FRIM

FOREST PARK SELANGOR

Candidate World Heritage Site

Volume 1: Nomination Dossier

FOREWORD

On the 7th of December 1988, Malaysia in recognition of its profound commitment to preserving our shared cultural and natural heritage, ratified the 1972 UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage. This endorsement underscored Malaysia's dedication to upholding the principles enshrined by UNESCO and safeguarding our nation's treasures.

Understanding the global imperative of collaborative efforts to preserve heritage, Malaysia acknowledges the crucial role played by UNESCO in this endeavour. One significant stride towards ensuring the meticulous preservation of heritage sites is to achieve their inclusion in the UNESCO's List of World Heritage Sites.

One of these special places in Malaysia is the FRIM Forest Park Selangor (FRIM FPS) or known as Forest Research Institute Malaysia (FRIM), adjacent to the Bukit Lagong Forest Reserve in Kepong, Selangor.

It is an exceptional example of a man-made tropical rainforest that is as rich in biodiversity as a mature natural forest. A century ago, FRIM FPS was initiated through the reforestation of trees, marking an innovative endeavor that defied the prevailing norms of the time, particularly within tropical rainforests. The site's historical narrative extends beyond its lush landscapes, embodying a cultural exchange between the British and the local community. The architectural marvels and meticulously preserved landscapes stand as a testament to this rich history.

Recognising the profound historical significance of FRIM FPS in the history of world forestry, the Department of National Heritage, Ministry of Tourism, Arts and Culture, and the Forestry Research Institute Malaysia (FRIM), Ministry of Natural Resources and Environmental Sustainability, are working together to achieve FRIM FPS's inclusion into the List of World Heritage Sites. Doing so would do much to ensure that this site is well-protected into the future.

In conclusion, this nomination holds paramount importance for Malaysia to empower the protection and preservation of FRIM FPS for future generations.

DATO SRI TIONG KING SING
MINISTER OF TOURISM, ARTS AND CULTURE
MALAYSIA

FOREWORD

Malaysia is firmly committed to upholding the vital principals of safeguarding our heritage, be it on a national or international scale by utilising legal mechanisms or recognition. UNESCO recognition not only bestows prestige but also represents a globally endorsed standard of conservation recognised by experts in heritage worldwide.

The Ministry of Tourism, Arts and Culture, working through the National Heritage Department, is keen to contribute to global initiatives in safeguarding heritage. This involves seeking recognition under the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage of 1972.

The nomination process for the Forest Research Institute Malaysia Forest Park Selangor (FRIM FPS) commenced in 2017 with the submission of the Tentative List to UNESCO on 23 February 2017. The commitment to protect and preserve this site predates the nomination, with legal safeguards under the National Heritage Act 2005 (Act 645), Forest Research Institute Malaysia Act 2016 (Act 782), Wildlife Conservation Act 2010 (Act 716), International Trade in Endangered Species Act 2008 (Act 686), and Town and Country Planning Act 1976 (Act 172).

It is anticipated that the successful listing of this site on the World Heritage List will significantly enhance its global recognition and appreciation.

DATO' ROSLAN TAN SRI ABDUL RAHMAN
SECRETARY GENERAL
MINISTRY OF TOURISM, ARTS AND CULTURE
MALAYSIA

ACKNOWLEDGEMENTS

The Nomination Dossier was prepared by the Nomination Dossier Committee, on behalf of the Forest Research Institute Malaysia (FRIM). The preparation of the Nomination Dossier was assisted by the representatives of:

- Department of National Heritage (DNH)
- Department of Town and Country Planning (PLANMalaysia)
- Forestry Department of Peninsular Malaysia (JPSM)
- Selangor Forestry Department (JPS)
- Selayang Municipal Council (MPS)
- Kuala Lumpur City Hall (DBKL)
- Gombak Land and District Office

Thanks are also due to the individuals and members of the various divisions in FRIM approached during the preparation of this Nomination Dossier.

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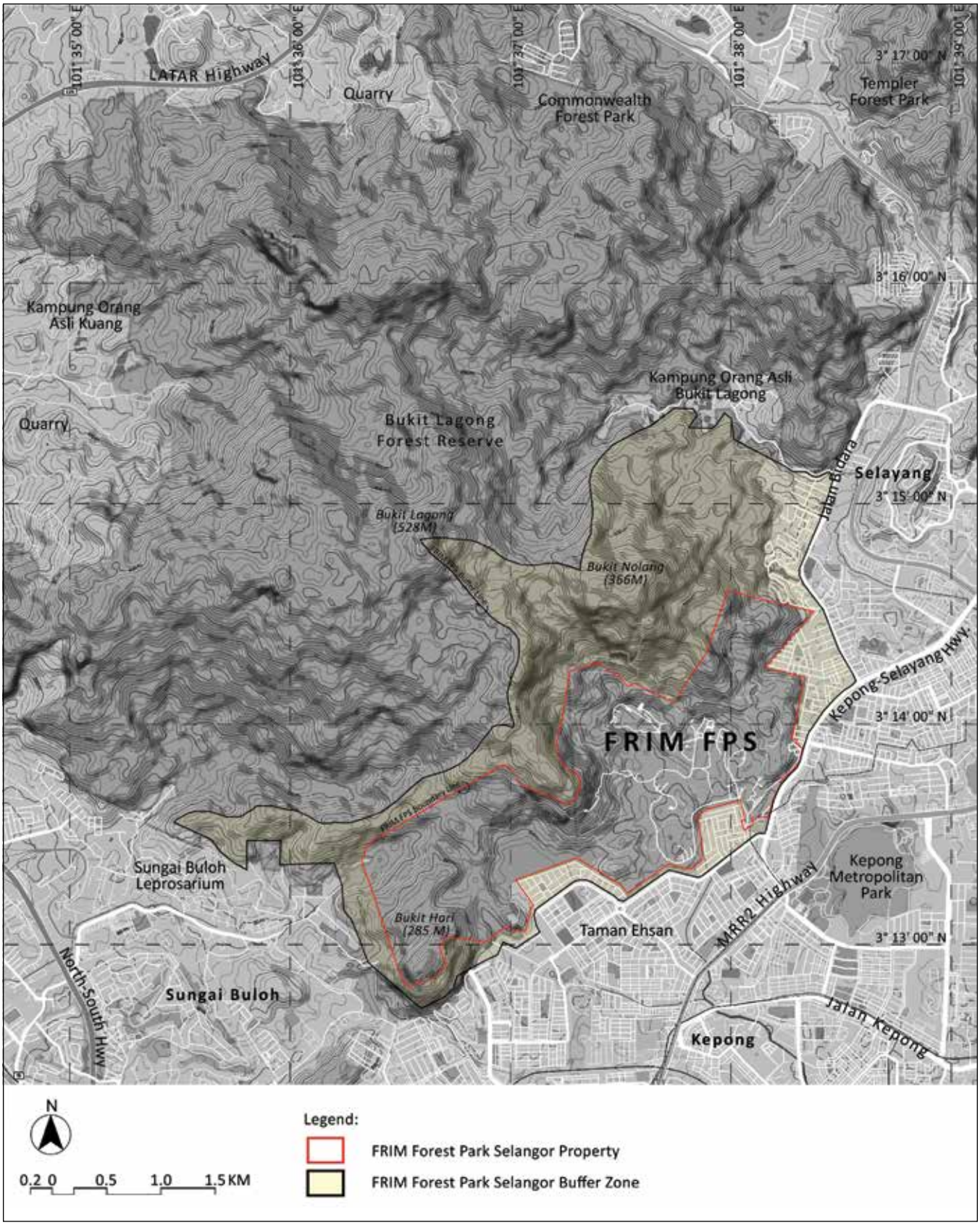
EXECUTIVE SUMMARY



Map of the nominated property and buffer zone

EXECUTIVE SUMMARY

STATE PARTY
Malaysia

STATE, PROVINCE OR REGION
The nominated property is located in the district of Gombak in the state of Selangor.

NAME OF NOMINATED PROPERTY
Forest Research Institute Malaysia Forest Park Selangor (FRIM FPS)

GEOGRAPHICAL COORDINATES TO THE NEAREST SECOND
The geographical location of the site's approximate centre point is:
Latitude N 3° 14' 07"
Longitude E 101° 38' 03"

TEXTUAL DESCRIPTION OF THE BOUNDARY OF THE NOMINATED PROPERTY
The nominated property is 589-ha in size and elongated in shape, with its long axis orientated in a northeast-southwest alignment. The nominated property itself is mature and stable. The buffer zone in the north, covering several forest compartments of the Bukit Lagong Forest Reserve, contributes to the biodiversity of the nominated property by providing a larger range for wildlife. The southern buffer, a narrow strip of housing settlement on lower ground, is of lesser importance because it does not contribute to the biodiversity nor to the cultural landscape of the nominated property. The buffer zone surrounding the nominated property is protected by several legal instruments.

MAP OF THE NOMINATED PROPERTY, SHOWING BOUNDARIES AND BUFFER ZONE
See facing page.

CRITERIA UNDER WHICH PROPERTY IS NOMINATED
The nominated property uses Criteria (II) and (V).

CULTURAL LANDSCAPE

This is a cultural landscape nomination.

DRAFT STATEMENT OF OUTSTANDING UNIVERSAL VALUE

Brief Synthesis—Located on the outskirts of the capital city of Kuala Lumpur, Malaysia, FRIM FPS is a 589-ha nominated property dominated by a man-made tropical rain forest with the multi-storied structure and the rich biodiversity of a matured natural forest. FRIM FPS conserves a cultural landscape that reflects a fusion of British and local knowledge and cultural values in the creation of an extraordinary scientific feat in tropical reforestation, initiated about 100 years ago, on land that had been made barren through tin mining. This is the first ever documented initiative in the world of the rehabilitation of mined land back to a lush and productive tropical rain forest. This site had been deliberately selected to provide a challenge for tropical rain forest research which was then at a rudimentary level. The implementation of the pioneers' extraordinary vision of creating a forest was carried out simultaneously with the establishment of a forest research institute, its infrastructure, and a community of live-in staff and their families. This resulted in a cultural landscape reminiscent of a British-Malay plantation estate, made up of a community working and living in the forested environment they were creating, embedded with buildings, water bodies, and narrow roads that followed the natural contours of the land. The structure of this cultural landscape has remained intact. It is a living monument and an exceptional testimony of the combined works of man and nature, exhibiting an interchange of human values.

Criterion (ii)—The man-made forest conserves a cultural landscape created around the late 1920s when its historic buildings, avenues, and water bodies were designed. This landscape shows an interchange of ideas between British colonial and local elements, seen in the architectural style and landscape design modified and implanted in a local Malay setting. This site is reminiscent of a British-Malay rubber estate where living spaces were carved out in the deep forested parts of the country. In the case of FRIM FPS, its living spaces were implanted amidst a growing man-made forest. They shared values of the period in their layout design, architecture, and meaning. However, while the rubber estates have all been subjected to redevelopment, FRIM FPS has remained intact and true to its original design. This forested landscape integrates working and living facilities such as offices, laboratories, and housing quarters, making FRIM FPS the only

tropical forest research institute with its staff and office on site. This created close interaction among employees, especially between foreign and local staff, resulting in an informal social structure that paralleled the formal organisational structure. This living-working forest environment has inspired tropical landscape design aimed at living close to nature.

Criterion (v)—FRIM FPS bears an exceptional testimony to a mature tropical rain forest created on land that had been irreversibly changed by the effects of mining. This man-made forest was created at a time when reforestation was not a norm and there was no knowledge on tropical rain forest restoration. This 100-year-old site stands out as the earliest reforestation of a tropical rain forest on totally devastated mined land. It was human scientific intervention that achieved maximum forest structure and biodiversity carrying capacity within a short time. This man-made forest was created through experimentation over a period of several decades. There were neither machinery nor chemicals—only human effort against a very inhospitable environment in which success was uncertain. This restoration or reforestation effort resulted in a double feat. It was a successful benchmark restoration of a natural tropical rain forest before there was any interest in such endeavours. It was achieved on the most degraded of mining lands before there was any environmental pressure to heal such land, thus raising the level of knowledge on tropical forestry from rudimentary to advanced in just a few decades.

Integrity—The man-made forest in FRIM FPS has matured and is able to reproduce and regenerate like a natural forest. The size of the nominated property (589-ha) is sufficient to minimize the intrusion of detrimental effects from its edges. The cultural landscape comprising the man-made forest, historic estate layout of the artery of roads and avenues, ponds, and lakes as remnants of tin mining activities, and buildings for offices, laboratories, and housing quarters are all intact and have been maintained to preserve the original ambience of the nominated property. The key spirit and ambience of the site derived from the presence of the community, and its role in nurturing environmental awareness and its social hierarchy that paralleled the organisational hierarchy is still observed. The live-in staff has been maintained at 100-200 families, ensuring that the carrying capacity, sustainability, and ambience of the nominated site are maintained. The nominated property has always been managed by the same organisation, i.e. FRIM, and this has ensured its continuity, sustainability, and protection.

Authenticity—The characteristic form and design of a natural tropical rain forest is clearly visible in FRIM FPS's man-made mature forest, making it an authentic tropical rain forest. This is evidenced by its evergreen habit, dominance of broad-leaved plants, structural-stratification into five strata consisting of emergent, main canopy, understorey, shrub, and ground strata. FRIM FPS is further distinguished by its ability to sustain a wide diversity of indigenous wildlife and to provide the full ecosystem services of a tropical rain forest. Its use and function as a forest research institute with a mission to create a man-made forest has continued from its inception without interruption and in less than a hundred years, FRIM FPS has clearly succeeded in becoming equivalent to a natural forest. The historic estate layout with its narrow roads, historic buildings embedded in the man-made forest, and mining ponds and lakes as well as its live-in community tradition are all still present and provides an ambience of the past, that upon entering the nominated property it feels like entering into a well-conserved and continuing cultural achievement.

Protection and Management Requirements—The values of the FRIM FPS nominated property have been protected and managed without any deviation from its original mission for almost one hundred years. The boundaries of the nominated property are stable and it is protected sufficiently well by a secure buffer that guards its biodiversity and its site values. Protection has been made possible by forest research institute having control of the nominated property following the official Gazette Notification No. 5449 in October 1926. This status has remained until today, and it has been further strengthened by more legal instruments, thereby allowing the pioneers' mission to continue unhindered to the present. Many committees at various levels are in place to ascertain that the cultural landscape of trees, forest, roads, avenues, historic buildings, and housing quarters are protected and maintained. Currently, all physical development plans have to be submitted for careful consideration by a top level committee of FRIM and the Department of National Heritage, Malaysia. Challenges such as environmental pressures, human threats, and physical infrastructure are not major issues and are dealt with in the conservation management plan (CMP) to ensure that the site is managed well with sustainable guidelines.

NAME AND CONTACT INFORMATION OF OFFICIAL LOCAL INSTITUTION/AGENCY/ORGANISATION

Institution/Agency/Organisation	:	Department of National Heritage
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CHAPTER 1

IDENTIFICATION OF THE NOMINATED PROPERTY

1.a Country

1.b State, Province or Region

1.c Name of Nominated Property

1.d Geographical Coordinates to the Nearest Second

1.e Maps and Plans, Showing the Boundaries of the Nominated Property and Buffer Zone

1.f Area of Nominated Property (ha.) and Proposed Buffer Zone (ha.)

1.a COUNTRY

Malaysia

1.b STATE, PROVINCE OR REGION

The Nominated Property is located in the district of Gombak in the state of Selangor.

1.c NAME OF NOMINATED PROPERTY

The Property nominated for inscription on the List of World Heritage Sites will be known as: Forest Research Institute Malaysia Forest Park Selangor (FRIM FPS)*.

1.d GEOGRAPHICAL COORDINATES TO THE NEAREST SECOND

The geographical location of the site's approximate centre point is:
Latitude N 3° 14' 07"
Longitude E 101° 38' 03"

1.e MAPS AND PLANS, SHOWING THE BOUNDARIES OF THE NOMINATED PROPERTY AND BUFFER ZONE

1.f AREA OF NOMINATED PROPERTY AND PROPOSED BUFFER ZONE

Area of nominated property: 589 hectares
Area of buffer zone: 767 hectares
Total: 1,356 hectares

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* The nominated property is referred throughout the text as "Forest Research Institute Malaysia Forest Park Selangor" or "FRIM FPS" or "nominated property".

Figure 1.1: Location of Malaysia in Southeast Asia

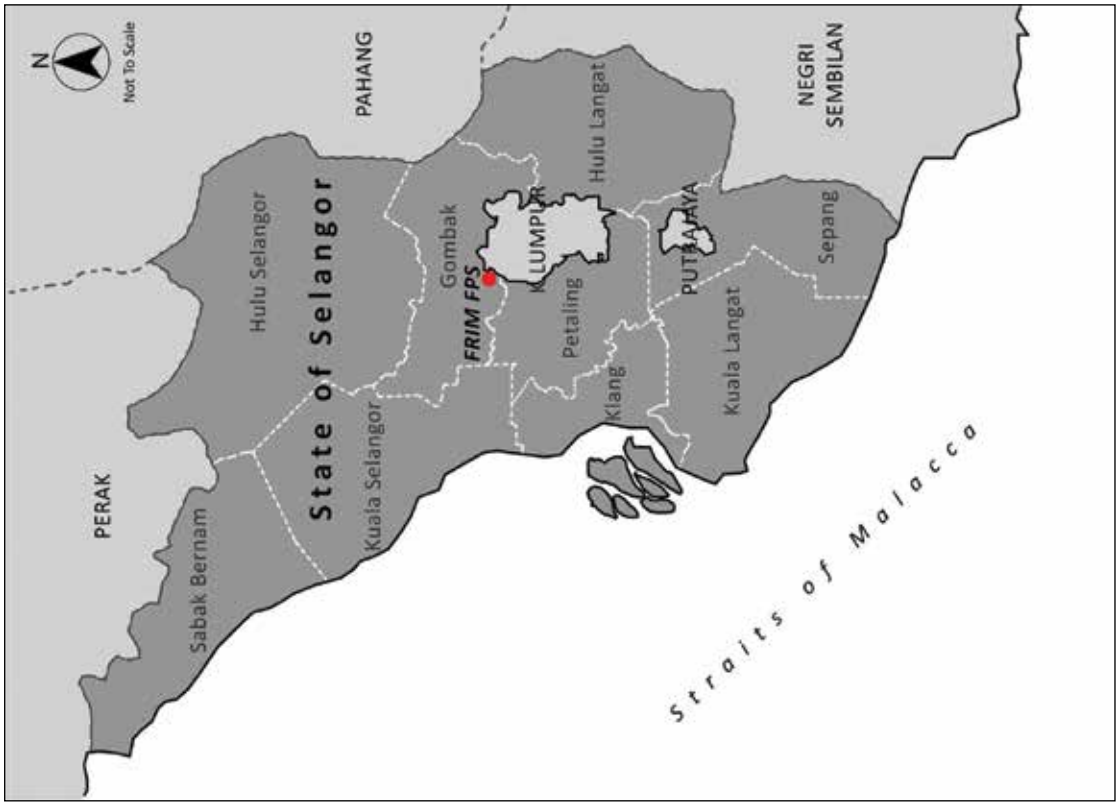
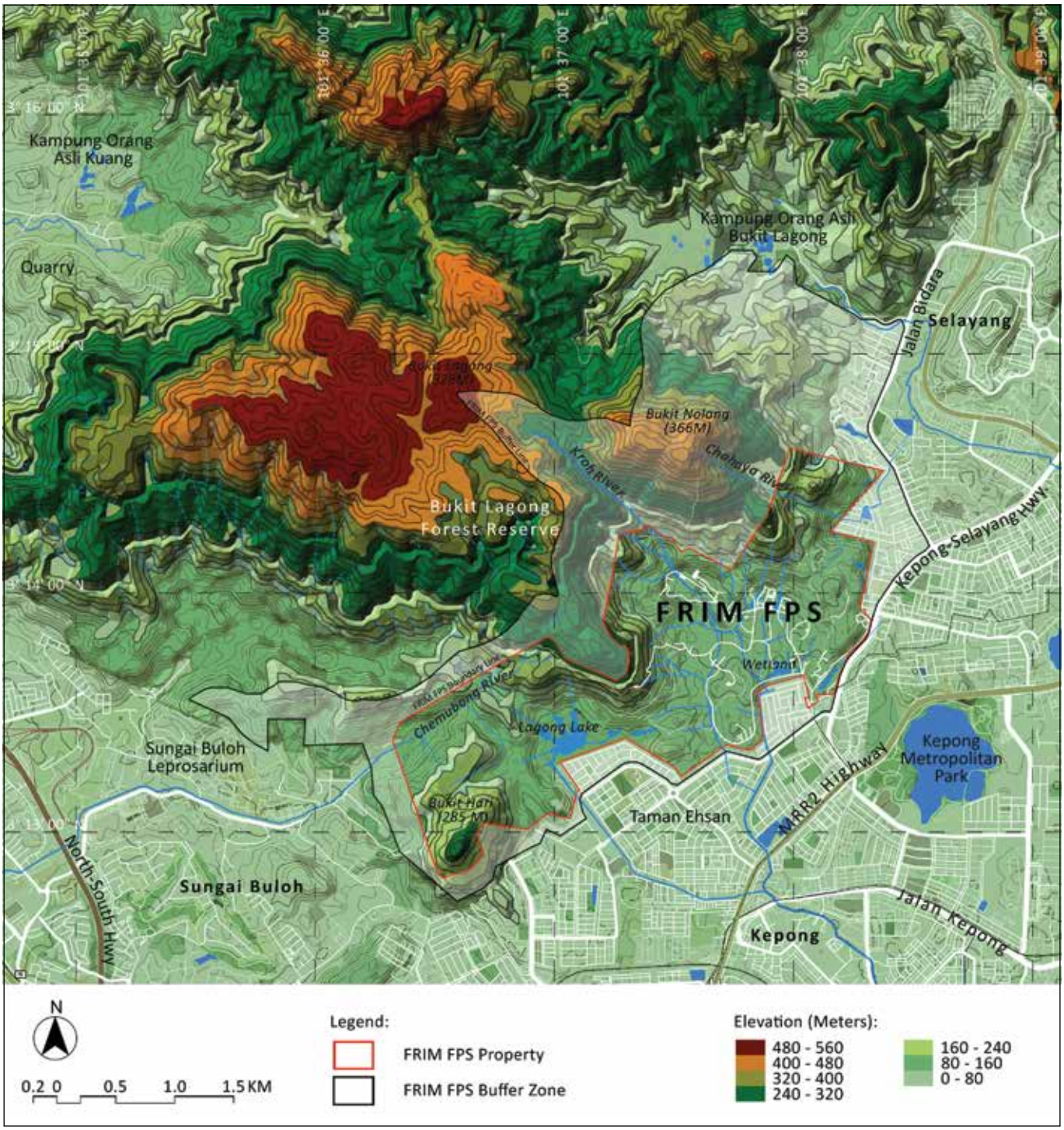


Figure 1.3: Location of the nominated property in the State of Selangor

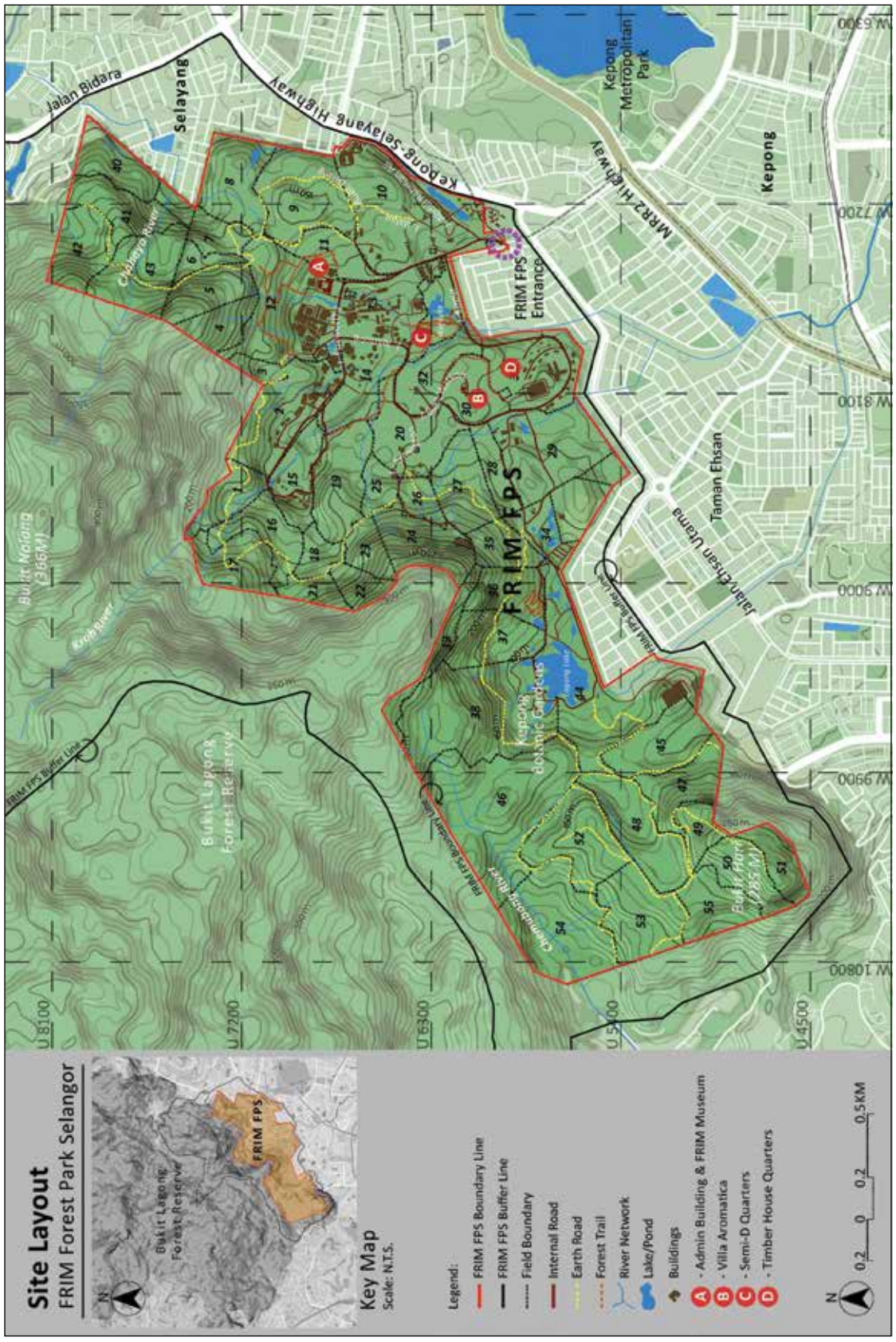
Figure 1.2: Location of the State of Selangor in Peninsular Malaysia

Figure 1.4: FRIM FPS in relation to the city of Kuala Lumpur



Source: Department of Survey and Mapping Malaysia

Figure 1.5: Topographic map of nominated property and its surroundings



Source: *Department of Survey and Mapping Malaysia*

Figure 1.6: Historic estate landscape of FRIM FPS with its roads, avenues, buildings and water bodies

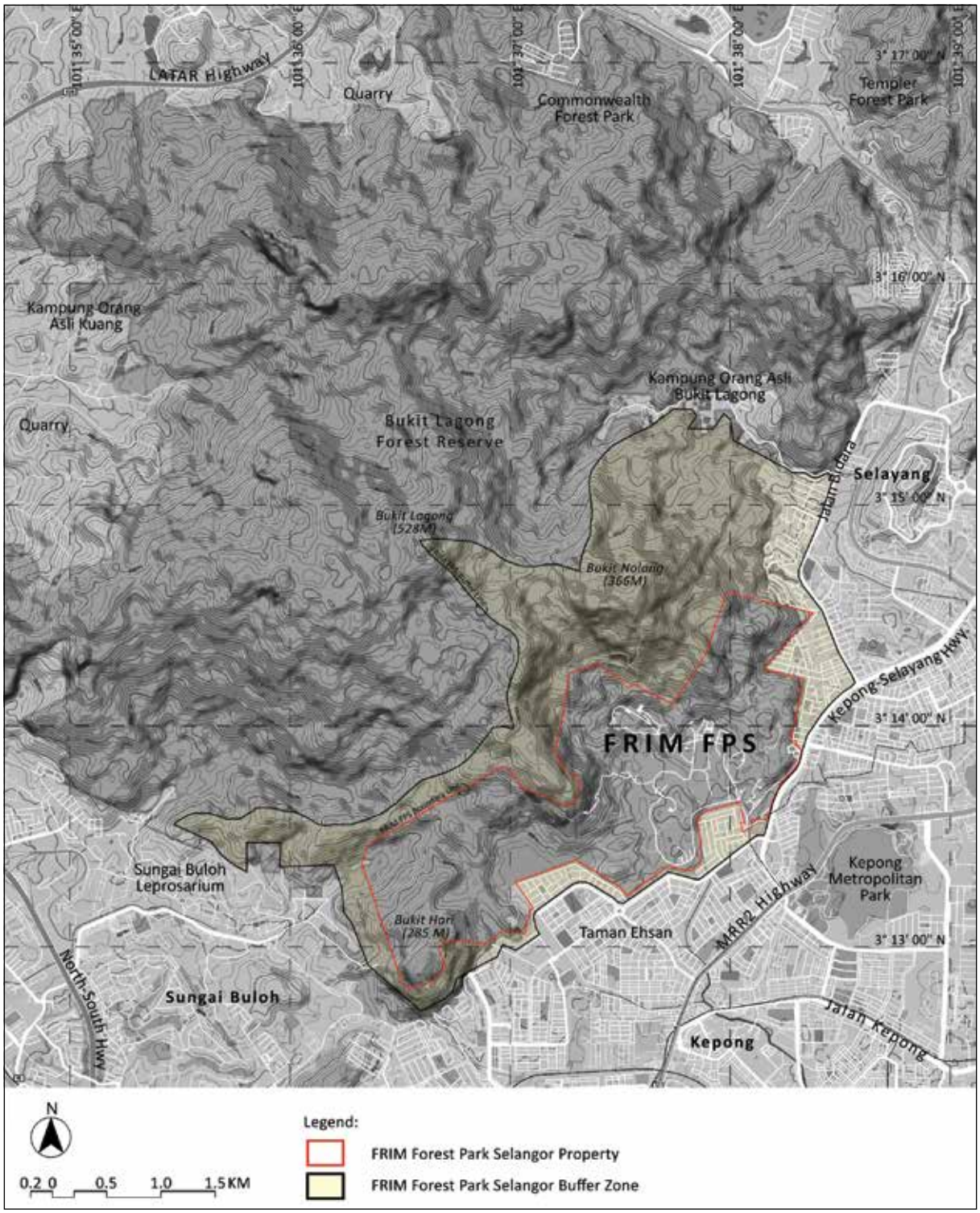
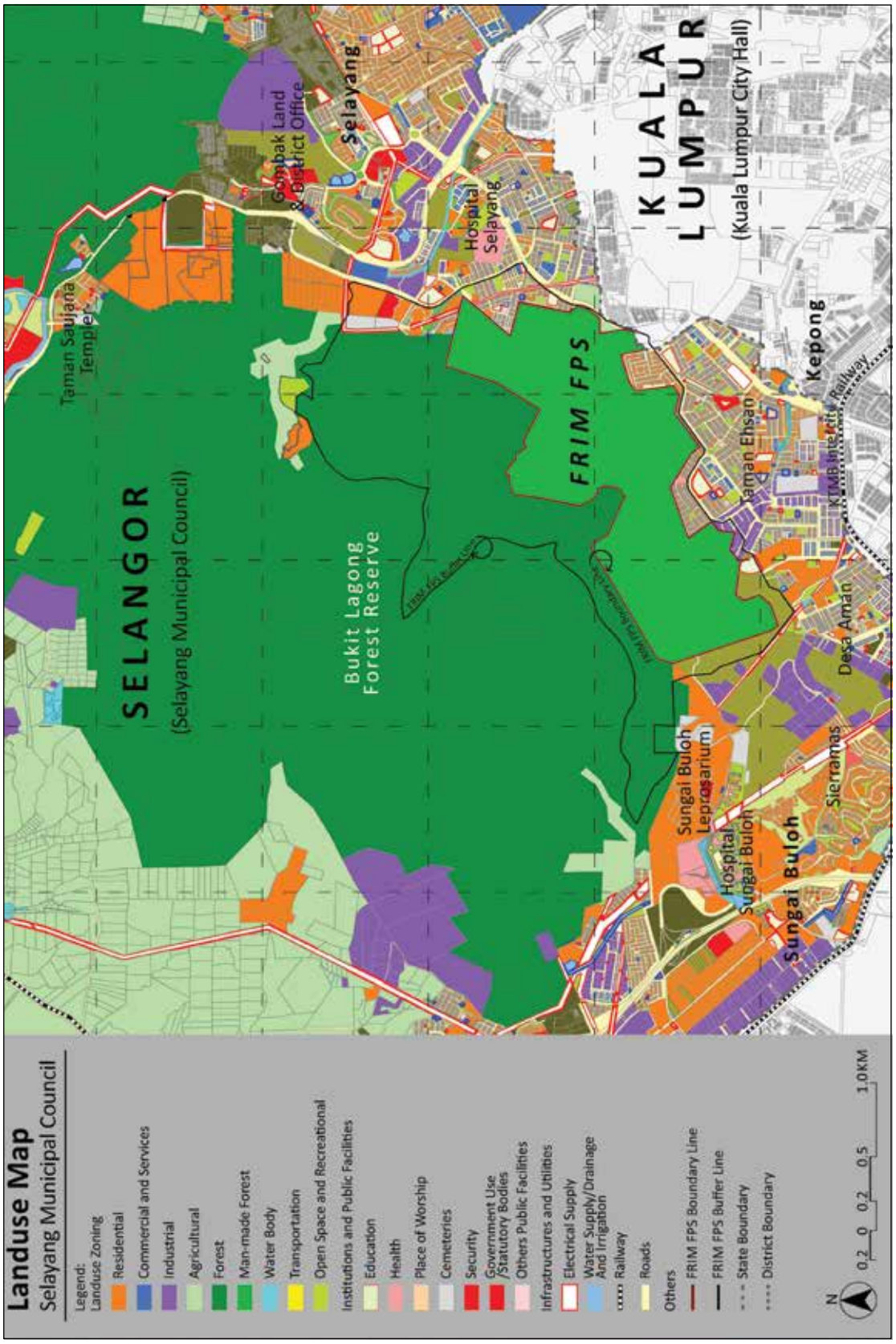


Figure 1.7: Nominated property and its buffer zone



Source: Department of Survey and Mapping Malaysia

Figure 1.8: Land use surrounding the nominated property

CHAPTER 2

DESCRIPTION

2.a Description of Nominated Property

2.b History and Development

2.a DESCRIPTION OF NOMINATED PROPERTY

Located on the outskirts of the city of Kuala Lumpur, in the state of Selangor, is a prominent man-made tropical lowland rain forest, a National Heritage Site, that was created on devastated mining land. This nominated property, 589-ha in size and known as the Forest Research Institute Malaysia Forest Park Selangor (FRIM FPS), is testimony to a pioneering effort in tropical reforestation that began in the 1920s, in which a mature tropical rain forest was, against all expectations, successfully created and sustained through extraordinary interaction between foreign and local cultures and between man and nature.

This feat was planned and initiated at a time when scientific knowledge of tropical trees and forests was rudimentary and mined land was considered impossible to restore to its original forested condition (**Figure 2.1; Figure 2.2**). It was accomplished by a multicultural community living, working, and bonding together on-site within a 20th century colonial estate setting. The man-made forest (**Figure 2.3**), the historic estate layout, and the live-in community are the attributes of the nominated property (**Figure 2.4**).

Figure 2.1: Aerial view of mined land in the immediate vicinity of the nominated property (c. 1960)

Figure 2.2: Aerial view from the nominated property (c. 1960) showing the extent of tin mining in the area

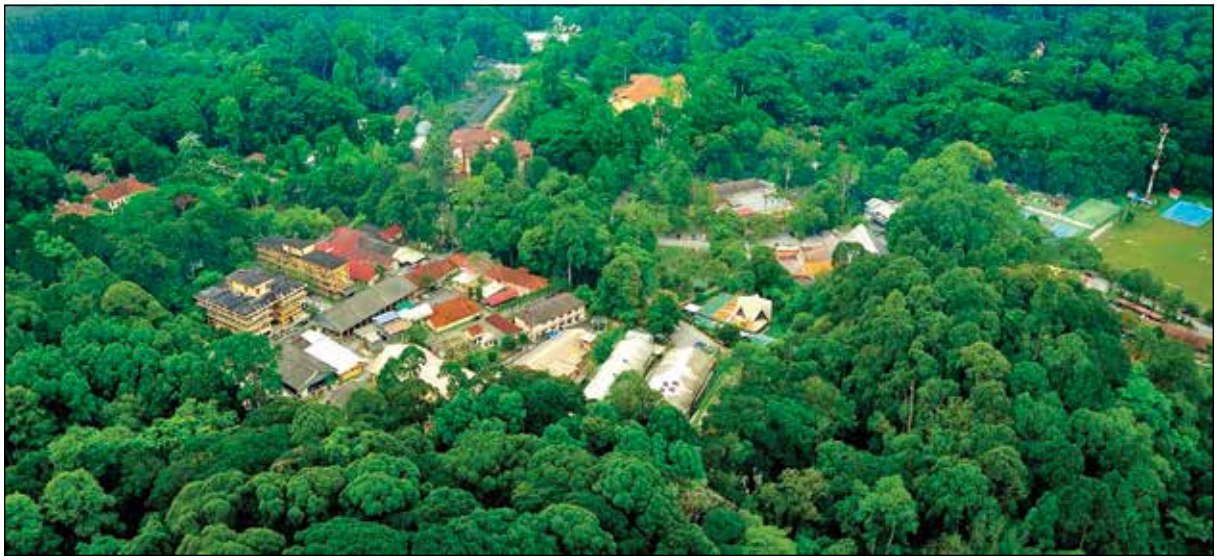


Figure 2.3: Aerial photo of FRIM FPS (2013)

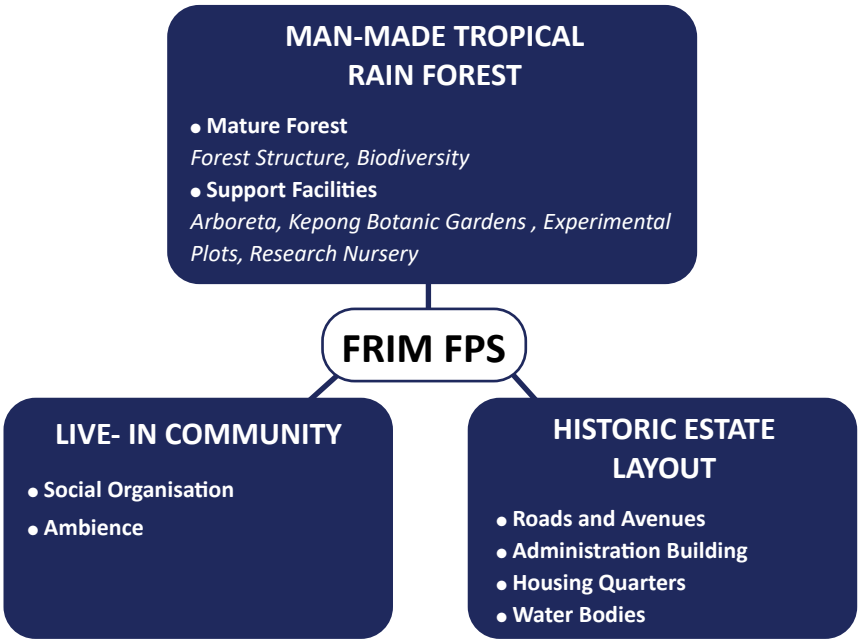


Figure 2.4: The attributes of FRIM FPS

2.a (i) MAN-MADE TROPICAL RAIN FOREST

The scientific leader of this effort was Dr. F. W. Foxworthy who was Forest Research Officer in 1918–1932, fully supported by his superior, G. E. S. Cubitt, who was Chief Forest Officer in 1915–1929 of what was then British Malaya, and J. G. Watson who was Foxworthy's deputy and eventual successor.

As the world's largest producer of tin, a significant proportion of natural tropical rain forests in the country had to be felled and cleared for tin mining, the aftermath of which was an infertile landscape of sand, silt, and water-logged depressions. This inspired Foxworthy, a Cornell-trained American botanist/forester, to plan a bold and massive effort in reforestation in 1925, in what was at that time a scientifically unexplored territory.

Foxworthy's small team of Western-trained scientists were familiar with temperate reforestation on relatively fertile land but not tropical reforestation on land devastated by mining. Through scientific experiments combined with indigenous knowledge of trees from local staff, this East-West interaction resulted in a vibrant environment that created a biodiversity-rich high forest. Continuity of management of the nominated property by FRIM made it feasible for the pioneering mission, the first scientific effort on tropical reforestation in the world, to continue uninterrupted for close to a century. FRIM FPS is a successful effort in combining the works of man and nature to recreate a tropical rain forest that had disappeared through mining activity. This success has to be seen especially in the light of the global significance of tropical rain forests, because although such forests occupy only 10% of the world's land area, they hold more than 50% of the world's biodiversity.

Looking back, what was it that could have inspired Foxworthy to take on such an impossible task while being cognisant of its high probability of failure? A peek at the global state of knowledge on forestry and reforestation in the late 19th and early 20th century would suggest that Foxworthy would have been exposed to the conservation mood of reforestation prevalent at the turn of the century in North America and Europe. The Society of American Foresters was formed, and the World Congress of Foresters convened in Rome. Forest conservation gained coherence and the conservation movement emerged in the United States of America, influenced by names such as Gifford Pinchot, a student of Dietrich Brandis, to whose works Foxworthy would have been exposed. After a century of forest exploitation for railroads, ships, cantonments, housing crates and boxes for war, fuel, and other needs of a rapidly industrialising world, reforestation of temperate forests afforded a correction for the felled or logged areas. Foxworthy would have seen a parallel situation here in Kuala Lumpur—a need to reforest large areas of barren land caused by tin mining.

However, there was no example of reforestation of tropical rain forest in the world, let alone the growing of tropical trees on depleted soil. Foxworthy pursued this interest with determination and open eyes as he saw that if he succeeded, he would have contributed immensely to the knowledge of tropical forests and proved that devastated tin mining land could be reforested. In a few decades, Foxworthy and the pioneers successfully created a forest, thus bringing knowledge of reforestation in the humid tropics to the forefront, on par with knowledge of temperate reforestation. However, this resounding achievement was not publicised at that time because it did not fit the then-prevailing paradigm of tropical economic development.

For almost 100 years, this forest has grown without interruption and is now equivalent to a natural tropical lowland rain forest in its multi-storied structure and rich biodiversity. On a global scale, the maximum level of biodiversity (measured by the total of biological species living in a particular habitat) is found in mature tropical lowland rain forest, and the lowest level is found on mined land, deserts, and ice-covered habitats. The creation of a tropical rain forest in FRIM FPS was unique in that nursery-raised seedlings of rain forest species were planted directly on mined land bypassing the normal process of ecological plant succession. The forest was created without going through the normal intermediate stages of plant succession. This jump in biodiversity carrying capacity required bold scientific effort and dedicated labour.

The major components of this man-made tropical rain forest are:

- Mature Forest (Forest Structure & Biodiversity)
- Support Facilities (Arboreta, Kepong Botanic Gardens, Experimental Plots & Research Nursery)

- **MATURE FOREST**

A hundred years into its existence, FRIM FPS is clearly identifiable as a mature forest equivalent to a natural forest based on its form, design, and biodiversity. This man-made tropical lowland rain forest has grown without interruption and flourished into a typical multi-storied **FOREST STRUCTURE** with the rich biodiversity of a natural lowland forest. The equivalence of the forest in FRIM FPS as a natural tropical rain forest can be confirmed by comparison with the forest form, structure, and biodiversity of the natural tropical rain forests of Malaysia from sea level to about 1,200 meters elevation.

Tropical rain forests have a specific form and design such as evergreen habit, dominance of broad-leaved plants, and structural stratification into five strata consisting of an emergent layer, a main canopy contributed by tall trees, an understorey of smaller trees, a shrub layer, and a ground layer. The main canopy is clearly defined in the nominated property. The emergent layer is made up of individual trees that emerge above the main canopy. Only a few trees are emergent at present, but as the forest continues to mature, more and more trees will become emergent.

The crowns that make up the canopy layer are seen to be like islands sharply separated from each other by clear space. This phenomenon, known as crown shyness, was first discovered in this nominated property (Ng, 1977). Since publication in 1977, it has become evident from aerial observations by helicopters, drones, and cable cars, that the crowns of mature canopy trees in all tropical rain forests are distinct from each other. This had previously gone unrecognised because dense understorey layers obscure the view of the canopy from the ground, creating the impression that the crowns of canopy trees grow into each other's space (**Figure 2.5; Figure 2.6**).

Figure 2.5: Crown shyness phenomenon seen from below

Figure 2.6: Crown shyness phenomenon seen from above

The rain forests of Malaysia are unique among tropical rain forests because they are dominated by members of one plant family, the Dipterocarpaceae. Their architecture and their great height, reaching 50 meters or more, give Malaysian tropical rain forests their characteristic appearance of tall straight trunks with very little taper (about 2.5 cm for every in 3m of height or about 1 inch per 10 feet of height) (Foxworthy in Ng, 2018: 190–198). The architecture and height of Malaysian tropical rain forests distinguish them from other rain forests in the world (**Figure 2.7a & b**).

Figure 2.7a & b: Profiles of man-made forest in FRIM FPS

The age of trees in the nominated property ranges from 30 to about 100 years old based on Field Planting Records. Fields are compartments into which the land was divided. The trees are still growing and are expected to live for about 300 years. The age of trees in Malaysia cannot be determined by annual growth rings because such rings do not develop in the Malaysian climate. Hence, the trees of known age in FRIM FPS will eventually provide science with the first direct measurements of the natural life span of trees in the humid tropics of Malaysia.

The number of tree species in FRIM, based on the Field Planting Records and lists of trees in the arboreta, botanic gardens, and roadsides, is about 800 species. The total number of species of vascular plants including ferns, herbs, shrubs and epiphytes is not known, but is about 2,300 species (Kerishnan & Siba, 2018). The lower plants such as mosses and fungi have not been comprehensively documented. However, FRIM FPS is rich in diversity of fungi because dipterocarp trees have been planted throughout the area and dipterocarps have an obligatory symbiotic relationship with ectomycorrhizal fungi. Overall, about 200 species of macrofungi have been recorded in FRIM FPS (**Figure 2.8; Figure 2.9**) (FRIM Fungi Database, 2019).

Figure 2.8: *Microporus xanthopus*, an important fungus for recycling wood

Figure 2.9: *Russula virescens*, one of the mycorrhizal fungi important for the nutrition and survival of dipterocarp trees

Comparing FRIM FPS and other natural lowland rain forests in Peninsular Malaysia—notably those at Taman Negara (National Park), Endau-Rompin National Park (Johor), Pasoh Forest Reserve (Negeri Sembilan), Ulu Muda Forest Reserve (Kedah), and Rompin State Park (Pahang)—in terms of the forest stratification as well as the number and taxonomic composition of different categories of plant diversity, it becomes apparent that those of FRIM FPS are very similar to that of a natural lowland rain forest (Latiff, 1996; Shamsul, et al., 2004).

Tropical rain forests are distinguished by their ability to sustain a wide range of **BIODIVERSITY** of indigenous wildlife. The successful establishment of a multi-species community of mainly indigenous trees on the previously mined land created the conditions for indigenous fauna to colonise the area. These conditions include multiple food resources and a growing range of microhabitats. Wildlife has been able to move into the area from the neighbouring areas, especially the Bukit Lagong Forest Reserve in the north of FRIM FPS, accelerating the process of biodiversity enrichment. Crown shyness provides an explanation for the wealth of diversity in flying, swinging, leaping, and gliding animals in the Asian tropics. Among these, the 'flying' lemurs, 'flying' squirrels as well as primates are found in the nominated property.

The fauna in FRIM FPS is documented in the Compendium of Facts and Figures: Forest Research Institute Malaysia (FRIM) (Kerishnan & Siba, 2018). FRIM FPS serves as a refuge for 13 Critically Endangered (CR), 25 Endangered (EN), and 35 Vulnerable (VU) species (Yong et al., 2011). FRIM FPS has 233 species of birds, which is about a quarter of the total birds recorded in Peninsular Malaysia (Shahfiz et al., 2021). Of mammals, 62 species have been recorded (Shahfiz et al., 2021). Several mammal species found in FRIM FPS are fully protected under the Wildlife Conservation Act 2010. The nominated property is home to about 82 species of reptiles and about 34 species of frogs and toads. A total of 21 species of freshwater fish live in the streams, lakes, and wetlands of the nominated property. FRIM FPS also has high diversity of insects. In particular, there are more than 324 species of butterflies such as the golden birdwing and lime butterfly (Phon & Khoo, 2023), 11 species of fireflies, 18 species of dung beetles, 92 species of ants and 10 species of termites (FRIM Insect Database, 2019). Dragonflies and damselflies are commonly found in the wetland areas. (**Figure 2.11 – Figure 2.20**)

Taxa	Number of Families	Number of Species
Birds	58	233
Mammals	18	62
Reptiles	15	82
Amphibians	6	34
Freshwater fishes	13	21

Source: Kerishnan & Siba, 2018

Figure 2.10: Total number of animal taxa in the nominated property

Figure 2.11: Pig-Tailed Macaque
(Macaca nemestrina)

Figure 2.12: Garden Lizard
(Calostes versicolor)

Figure 2.13: Larut Sucker Frog
(Amolops larutensis)

Figure 2.14: Short-Nosed Fruit Bat
(Cynopterus brachyotis)

Figure 2.15: Rufous-Collared Kingfisher
(Actenoides concretus)

Figure 2.16: Crested Serpent Eagle
(Spilornis cheela)

Figure 2.17: Chocolate Demon
(Ancistroides nigrita)

Figure 2.18: Common Birdwing
(Troides helena)

Figure 2.19: Giant Ant
(Dinomyrmex gigas)

Figure 2.20: Firefly
(Diaphanes sp.*)*

When compared with natural lowland forests in Peninsular Malaysia, FRIM FPS's number and categories of fauna, especially those of small mammals, avifauna, herpetofauna, and insects fauna, are very similar to those found in natural lowland rain forest (Quah & Sah, 2018). The only exception is that FRIM FPS being a small area of about 590 hectares lacks medium and big mammals.

In brief, this high diversity of flora and fauna in the nominated property enhances the value of the man-made forest which revived the "lost" biodiversity caused by felling and mining activities in the past. Mature tropical rain forests are the most stable of biological communities in the tropics and this mature man-made forest in FRIM FPS has reached this level of stability and is now equivalent to a natural tropical rain forest.

• SUPPORT FACILITIES

Scientific research to replant a tropical rain forest on land that had become infertile resulted in several support facilities being developed—arboreta, botanic gardens, experimental plots and research nursery.

ARBORETA are places that house special collections of living trees grown to facilitate research, *ex-situ* conservation of trees, and environmental education. Complementing the forest are four main arboreta that occupy a total of 23.6-ha (Kerishnan & Siba, 2018). Watson established the Dipterocarp Arboretum and the Non-Dipterocarp Arboretum in the late 1920s. The Coniferetum (Gymnosperm Garden) was established in 1949 while the Fruit Tree Arboretum was established in the 1970s. The trees have been spaced out uniformly in rows, on lawns that

have no undergrowth to obscure the view of the individual specimen tree. Each species is represented by a small number of individuals so that many species can be packed into a small area. Each specimen tree is individually labeled. Like the forest, the trees in the arboreta were part of the research and these trees too have now reached maturity.

These arboreta are conveniently located for easy viewing along the major arteries. Their majestic beauty contributes towards the aesthetic value of the scenery. The arboreta have functioned the way they were meant to, i.e. for research and education on trees, and the shape and structure of the trees are clearly visible in their neat rows, thus facilitating study.

Arboretum	Year of Establishment	Number of Species	Significance
Dipterocarp	1928	120	Dedicated to the Dipterocarpaceae, which is the dominant family of timber trees in Southeast Asia
Non-Dipterocarp	1928	169	Other timber families collectively known as Non-Dipterocarps
Coniferetum	1949	23	Tropical gymnosperms
Fruit Tree	1979	89	Tropical fruit trees

Figure 2.21: Number of planted species and year of establishment of the arboreta in nominated property

The arboreta are consistently enriched by additions of new living specimens from many localities in Malaysia. The Dipterocarp Arboretum is the most outstanding arboretum as it has the largest collection of *ex-situ* dipterocarp trees in the world while also functioning as a reference site.

- ***Dipterocarp Arboretum*** covers an area of about 6.5-ha and contains trees of more than 120 species of dipterocarps (Dipterocarpaceae) of genera such as *Anisoptera, Cotylelobium, Dipterocarpus, Dryobalanops, Neobalanocarpus, Parashorea, Shorea, Upuna,* and *Vatica* (Kerishnan & Siba, 2018). This is the largest collection of *ex-situ* dipterocarp trees in the world, representing the family upon on which the timber industry of Malaysia and Southeast Asia is largely based.

- ***Non-Dipterocarp Arboretum*** comprises more than 169 species of trees belonging to 43 families in an area of ca. 14-ha (Kerishnan & Siba, 2018). Important species of tropical tree families such as Apocynaceae, Annonaceae, Anacardiaceae, Combretaceae, Ebenaceae, Leguminosae, Fagaceae, Euphorbiaceae, Myristicaceae, Myrsinaceae, Sapotaceae, Sapindaceae, Moraceae, Lauraceae, Meliaceae, and Rutaceae. These are the common families of trees in the forests of Malaysia.

- ***Coniferetum*** or Gymnosperm Arboretum covers an area of about 2.5-ha and contains more than 23 species of non-flowering trees including those of *Podocarpus, Agathis, Gnetum, Pinus, Araucaria, Dacrydium* and *Cycas* (Kerishnan & Siba, 2018).

- ***Fruit Tree Arboretum*** is established in two different areas, housing more than 89 species of trees bearing edible fruits (Kerishnan & Siba, 2018). Among the important fruit trees are Mangosteen, Jackfruit, Petai, Rambutan, Mango, and Cashew Nut. These are some of the common fruit tree species in Malaysia and Southeast Asia.

Figure 2.22: Dipterocarp Arboretum in 1934 with *Paraserianthes falcataria* as nurse trees to provide shade for the young forest trees

Figure 2.23: The Dipterocarp Arboretum in 2020

Figure 2.24: Non-Dipterocarp Arboretum, 2022

Figure 2.25: Fruit Tree Arboretum, 2020

Figure 2.26: Coniferetum, 2022

The **KEPONG BOTANIC GARDENS (KBG)** was established in 1995 to promote botany, horticulture, garden landscaping, and plant conservation (Adnan et al., 2018). Plants were grown as part of an *ex-situ* conservation effort. KBG focuses on *ex-situ* plant conservation by the continuous introduction and planting of species. Currently there are two Critically Endangered (CR) species, five Endangered (EN) species, and four Vulnerable (VU) species (Yong et al., 2011). Thematic collections such as those of monocots—namely palms, gingers, bamboos, orchids, vines, bananas, ferns, and aquatic plants—were added. Plans for the future include an expansion of the number of species to be introduced and maintained in the thematic gardens for education and research.

KBG occupies about 80-ha and is dominated by the 4-ha Lagong Lake which was formerly within a wetland area, the remnants of tin mining activities (Abd. Latif et al., 2013). This lake was created by defining and hardening the edges of the wetland. There are six small ponds in the surrounding area created in the same manner. Lagong Lake's ornamental clear water provides a panoramic mirror image of the surrounding landscape. The Kepong Botanic Gardens was also created to cater to the increasing number of visitors using the nominated property for recreation. It was necessary to disperse the visitor load to reduce soil compaction and erosion in the old forests.

Figure 2.27: Aerial photo of Kepong Botanic Gardens

Figure 2.28: Place for recreational activities

Figure 2.29: Pergola and lawn

Figure 2.30: Ornamental shrubs

EXPERIMENTAL PLOTS were located in Bukit Hari, an area of 75-ha at the western end of the nominated property. During World War II, this area was cleared for growing vegetables. After the war, it was covered with the tall weedy grass *Imperata cylindrica*. In the 1960s to 1980s, the area was planted with the

Caribbean Pine *Pinus caribaea* under an FAO/UNDP project to test this tropical pine as a reforestation species to support the paper industry. This project was ended in the late 1980s and the area was replanted with selected indigenous species of plantation interest. These trial plots are now 30–40 years old. These include *Dyera costulata, Endospermum diadenum, Hopea odorata, Aquilaria malaccensis,* and several dipterocarp and other non-dipterocarp species. The Bukit Hari Experimental Plots will continue to conduct experiments on and testing of new clones of forest species (Ahmad Zuhaidi & Amir Saaiffudin, 2021).

Figure 2.31: Bukit Hari with pine forests in 1965

Figure 2.32: Bukit Hari replanted with indigenous species in 2001

Figure 2.33: *Aquilaria malaccensis* grown for experimental production of the very highly valued perfumed agarwood, 2020

The **RESEARCH NURSERY** was established by the pioneers in 1926 in order to raise the hundreds of thousands of seedlings and saplings needed as planting materials for reforestation within the nominated property. The first seeds were planted in July 1926, immediately after the land was acquired. A nursery of 1.5-ha containing 330 nursery beds was prepared, and by the end of the year, more than 25,000 seedlings of 100 tree species had been raised and field planting had begun (Anon, 2019, 2020, 2022). Over the years, additional nurseries were established to support the Kepong Botanic Gardens and to cater for botanical conservation as well external demand for trees in greening programmes in the country. The plant nursery, which was important in the early reforestation of the man-made forest, has now diversified into a research nursery as well as commercial nursery, supplying seedlings and saplings for government agencies and the private sector in their greening programme while also continuing to serve the replacement planting needs for the nominated property.

Figure 2.34: One of the nurseries in FRIM FPS, 2020

2.a (ii) HISTORIC ESTATE LAYOUT

The key elements in the design layout of the nominated property are its roads and avenues, Administration Building, housing quarters, and water bodies. These were the features included in planning the spatial arrangement of the site while

the experimental forest planting was being done all over the nominated property. This basic design layout has remained intact over the years despite inevitable changes due to institutional growth over time, as seen in new additions of offices and laboratories, and periodic replacement of temporary wooden housing due to wear and tear.

The historic estate layout of the nominated property is reminiscent of rubber estates when the country was one of the world's largest producers of rubber. The dramatic rubber boom in the first decade of the 20th century saw rubber estates dominate the rural landscape during this British-ruled era. These estates were large areas of land cleared of lowland forests and planted with rubber trees and segmented by internal roads and paths into compartments to facilitate access by the workers and managerial staff. The management of rubber estates was usually organised in a three-tiered hierarchy: the managerial level, usually British; the support staff, usually educated locals; and the labourers, almost always immigrant workers known as 'coolies'. This hierarchy is further entrenched in the organisation, as seen in their quarters which varied in size, typology, and location, based on rank or position (Chang, 2012). Thus, the estate manager would live in a large bungalow with quarters for servants and driver, within a big compound of lawns, gardens, and a grand driveway located prominently on a hill. The support staff would be given medium-sized detached cottages. The labourers would live in what was known as a 'coolie line' or a row of small single storey terrace houses, usually within walking distance to their community amenities centre and workplace. Other facilities like school, clinic, places of worship, and common playing fields were also provided for the workers' welfare. Architecturally, all the housing types were designed in response to tropical environmental conditions, resulting in a climate-responsive/friendly architecture. Most of these estates have now been replanted with oil palm or developed into townships and new housing areas.

The planning of the FRIM FPS during the colonial period was no different from the layout planning of a rubber estate during this colonial period. A highly probable source of inspiration to plan FRIM FPS like a rubber estate was RH Whitty, an ex-rubber planter (Watson, 1950) who joined Foxworthy in 1921. The layout of roads, the location and size of houses based on one's position, the arrangement of office and laboratories, as well as community facilities are all reminiscent of a rubber estate. In FRIM FPS, the land was similarly divided into compartments called fields, and there were 55 fields altogether in FRIM FPS. Instead of rubber, forest trees were planted. The work place was represented by an administration

building that housed offices and laboratories. Like an estate, FRIM FPS also comprised a multi-ethnic community of Malays, Chinese, and Indians, who together with a team of foreign scientists and their families resided at the site. The foreign scientists, like the foreign rubber estate managers, were provided with large bungalows, surrounded by well-maintained gardens.

Just like in an estate, the provision for type of housing quarters in FRIM FPS was based on the organisational hierarchy of the research institute, which can be seen to be typologically reflected in bungalows, semi-detached houses and small single storey terrace houses or flats. The head of FRIM FPS was housed in a large bungalow, with quarters for servants and driver separated from the main house and surrounded by spacious lawn and garden, and located on a hill. The scientists too occupied bungalows, albeit smaller ones. The clerks occupied semi-detached houses. The support staff were housed in terrace houses or wooden Malay *kampung* (village) houses. Like in a colonial rubber estate, FRIM FPS also provided communal facilities like clinic, school, recreation grounds, and a place of worship. Like the paths in an estate that provided access to the different compartments in an estate, there are in FRIM FPS forest trails or rover tracks, which facilitated access for planting and monitoring of the planted trees. The rover tracks and forest walking trails served as the field boundaries and some of them have been upgraded and now function as walking trails for visitors. There are six such trails, namely Keruing Trail, Sebasah Trail, Engkabang Trail, Salleh Trail, Latif Trail, and Razak Walk.

Figure 2.35a: Keruing Trail

Figure 2.35b: Razak Walk

Figure 2.35c: Latif Trail

Figure 2.35: Development of forest trail from forest floor (2.35a) to cement rendered (2.35b) and to Fiber Reinforced Polymer (FRP) boardwalk (2.35c)

The most important old **ROADS AND AVENUES** are Jalan Foxworthy and Jalan Jelutong. Both roads planted with trees in 1928 are now impressive avenues. Jalan Foxworthy leads from the Main Gate, past the Administration Building (formerly known as the Main Building) completed in 1929 and continues to the playing field and to the waterfall area in Kampung Jawa where it makes a loop. It is lined by large trees such as Mahogany (*Swietenia macrophylla*), Tembusu (*Cyrtophyllum fragrans*), and Merawan Siput Jantan (*Hopea odorata*), which provide visitors with the memorable entrance experience of driving through a tree-lined tunnel until the Administration Building comes suddenly into view. The frontage of the building is lined by tall Royal Palms. Beyond the Administration Building, trees of many other species line the roads, including a row of Sealing Wax Palms with reddish stems. After the palms is a major junction from which

Jalan Jelutong branches off. This is lined on both sides by giant trees of Jelutong (*Dyera costulata*). Jalan Jelutong continues across the stream Sungai Kroh, and on to the Dipterocarp and Non-Dipterocarp Arboreta. Jalan Foxworthy and Jalan Jelutong connect the historic buildings, nursery, and old community facilities. In the 1960s, a new road, Jalan Kapur, was constructed, branching off from the end of Jalan Jelutong and making a big loop southwards and eastwards until it meets Jalan Foxworthy. All the roads are narrow and winding because they follow the natural land contours, and their width is fixed by the trees planted along their sides. Minor roads lead to specific buildings and rover tracks run into the man-made forests. The roads and tracks have been well maintained and they contribute greatly to the conservation of the original estate ambience of the nominated property.

Figure 2.36: Jalan Foxworthy

Figure 2.37a: Jalan Kapur

Figure 2.37b: Jalan Jelutong

Beginning at the entrance of FRIM FPS, Jalan Foxworthy winds its way to the **ADMINISTRATION BUILDING**, the hub of activity in the centre of the nominated property. The Administration Building, originally comprising office and laboratories (The Straits Times, January 30, 1928), was the first important building that was constructed. It currently houses the Office of the Director General, the administration and finance offices, and a research gallery. As a National Heritage

Site, any physical intervention to this building will have to be approved by the Department of National Heritage, Malaysia. Built of brick and lime, it was completed in 1929, one of the earliest of modern Art-Deco buildings of that size. It was constructed by the government, with Malay vernacular architectural elements, such as an overhang roof, veranda, extended window with louvre panel above, and high-ceilinged interiors, an adaptation to the hot and humid local climate. A veranda prevents direct sunlight and heat onto the internal walls and it is a typical feature of Malay houses in the tropics. The building has remained intact, although its function and interior spatial use has changed over the decades due to programme activity expansion. After the post-war period from the 1960s onwards, additional new blocks of offices and support facilities were constructed around the Administration Building. This was in keeping with expansion of the research institute to cater for new departments. In the vicinity of the Administration Building is the research nursery that was established in 1926.

Figure 2.38: FRIM FPS Administration Building completed in 1929, surrounded by deforested slopes and pools of water created by tin-mining

Figure 2.39: Administration Building in 1951

Figure 2.40: Administration Building in 2022

Figure 2.41: Art-Deco elements on the façade of the Administration Building

The foreign scientists and local staff required **HOUSING QUARTERS** as the pioneers had planned that they all should live together as a community within the site that they were working on as an experiment in reforestation. The design layout of the nominated property made room for housing quarters which were of different typologies, size, and location. Like the housing in the rubber estates of the period, these reflected the management hierarchy. The high-ranking pioneer scientists lived in **bungalows**, with the largest bungalow being that of the head of the management or organisation. As a pioneer head of the organisation, Foxworthy was the first to occupy Villa Aromatica, the largest of the bungalows.

Villa Aromatica (**JKR501**), a secluded two-storey Art-Deco style bungalow built on a hill in 1927 before the completion of the Administrative Building, was the house for the head of the institute. It had an annex as quarters for domestic staff, namely servants and drivers. A square layout plan, with a central staircase leads to the upper floor arriving at a family area and two large bedroom suites, both of which have attached bathrooms. The living hall occupies half of the ground floor space and the other half is shared between the dining room and kitchen. A wide veranda surrounds all sides of the building and leads to the staff quarters which was added not long after its completion. The roof coverings of the original building and the new addition are of the same material type: Guichard Carvin & Co Marseilles tiles from St. Andre, France, which suggest the additions were carried out within the same era. The second and major renovation took place after World

War II where the whole ground floor platform was raised and new concrete floor was constructed on the first floor due to severe termite infestation on the original timber beams and floor boards. The 1930s Art-Deco period was also the era of new technology inventions and this was evidenced in Villa Aromatica. Imported "Crittall" steel windows with glass panels were used instead of timber shutter windows. During World War II, the original steel double casement windows and transom lights were damaged but due to material discontinuation and sourcing challenges, they were replaced with new aluminium casement windows while the transom lights were closed up. Another renovation took place in the 1970s where the first-floor timber structure was changed to reinforced concrete and finished with new timber board. The ground floor was raised and new terrazzo flooring was added during that same renovation.

Figure 2.42: Villa Aromatica front porch

Figure 2.43: Villa Aromatica verandah

Figure 2.44: The front elevation of Villa Aromatica with a grand porte-cochere and big lawn dated 2021

Figure 2.45: The covered walkway linking the main house to the servants quarters where the French Marseille tiles is visible from the roof soffit

Besides bungalows, the other types of housing quarters are the single storey semi-detached houses located along the historical Jalan Jelutong as seen in **Figure 2.46**, and temporary wooden houses on stilts built in local *kampung* (village) style for the support staff at the bottom of the hierarchy. The **semi-detached houses** came in pairs, meaning two units in a block where the party-wall is shared and each of the houses has an internal courtyard in the center court. They were built of brick and lime in the early 1930s, not long after the Administrative Building and Villa Aromatica. The main living hall and dining room are located at the front portion of the house, while the bedrooms are tucked in the side of the courtyard and the kitchen is at the rear of the house. The servant's quarters are attached behind the kitchen and it has its own access. The roof is covered with Indian Marseilles tiles and the façade is accented with large Diocletian windows and surrounded with clay faced bricks. However, all these bricks are now covered with modern paint, which will be very difficult to reverse. The building base is lined with faced brick and decorative pointing, a unique building feature in that era which is no longer found in the country. All these semi-detached quarters have been adapted into office space since 2000s. The office of Wisma APAFRI (Asia-Pacific Association of Forestry Research Institutions) currently occupies one of the semi-detached units.

Figure 2.46: Semi-detached brick house as seen in Wisma APAFRI (JKR 503)

The **wooden houses on stilts** were mostly built with lower grade timber. The pre-war ones were scattered along different parts of the nominated property, mostly along Jalan Abdul Rahman Ali, while the post-war ones built in 1960s were distributed in Kampung Jawa, Lorong Kapur, and Bukit Baru. The post-war timber houses were the result of more than three decades of research and testing with local timber that would survive for six decades. The first batch was built in Lorong Kapur and subsequently in the Jalan Abdul Rahman Ali vicinity. There were three design types, all with a rectangular layout and ranging from two to three bedrooms, elevated from the ground and with a six feet wide veranda at the entrance. The first two-bedroom style built at the junction of Jalan Kapur and Lorong Kapur was designed by the Forest Department engineer himself, Patrick Campbell, in 1960 (The Straits Times, January 14, 1961) and these houses are still occupied by FRIM FPS staff. Following that, other government departments in the country also built timber quarters taking advantage of their lower cost and shorter construction period. However, these quarters are now only seen in FRIM FPS, where they are still intact and occupied.

Figure 2.47: Wooden house on stilts built in local *kampung* (village) style

The **WATER BODIES** consist of streams, lakes, ponds, and natural wetlands. Three streams were important factors in the choice of this site for the establishment of the forest research institute. The availability of water from streams and ponds was pivotal to daily life as well as for the plant nursery. A 4-ha lake, Lagong Lake, provides a panoramic mirror image of the surrounding landscape and is the central feature of the Kepong Botanic Gardens (KBG). The wetland areas are irregular depressions created by past mining activities in which rain water accumulates. The Office Pond was created by deepening a wetland depression and stabilising its banks to make the Central Garden. Other wetland areas have dried up by natural siltation and drainage when the road system with side drains was established. One remaining area, next to the Fruit Tree Arboretum, attracts water birds.

Figure 2.48: Office Pond

Figure 2.49: Lagong Lake, provides a panoramic mirror image of the surrounding landscape

In brief, FRIM FPS today is a lush tropical forest that surrounds offices, laboratories, houses, water bodies, and narrow roads lined with Tembusu, Mahagony, and other big trees. Buildings have integrated with the developing forest, making FRIM FPS grow into a unique forest estate setting, reminiscent of the layout of a rubber estate that was a dominant feature of the country as the world's largest exporter of rubber. This man-made forest landscape has remained intact and has preserved its historic setting which sets it apart from all other government institutions in the country.

2.a (iii) LIVE-IN COMMUNITY

In 1925, the head of the Forestry Department G.E.S. Cubitt's request for financial provision for all the staff and their families to live within the research grounds, was approved. This meant that the Forest Research Officer, Foxworthy, would live together with eight or nine other senior staff and 200 workers on the site. This had never been done before by any other forest research institute and even today, FRIM FPS remains the only forest research institute in the world that

has its staff live and work on the site. It was an expensive proposition but this was granted because it was a time of rubber boom and British Malaya was the biggest producer of rubber. This concept of live-in community, from its beginnings in 1920s, also generated the need for social facilities to cater to their welfare especially because the site was at that time isolated and considered far from Kuala Lumpur which was about an hour's drive along small country roads. Just as in the rubber estates, physical entities such as accommodation based on position or rank, school, clinic, place of worship, and recreation facilities had to be built so that the site was a self-sufficient entity catering to the needs of those living in the site. This concept of live-in community has survived in FRIM FPS until today.

The implementation of this live-in community concept began in the 1920s. The pioneers' decision to live within the site and establish a live-in community allowed foreign and local staff to mix and share a sense of belonging to the organisation and its aims. This allowed them to bond over the mission/vision to create a man-made forest. The pioneers' decision to live within the site and establish a live-in community generated the maximum level of interaction between scientific methodology and indigenous knowledge. This harmonious mix of Western scientific enquiry and local knowledge contributed to the success of the mission to plant trees on the devastated mined land. Living within the site and sharing the same mission also meant that the local staff felt a sense of responsibility to monitor the experiments. FRIM FPS was the only tropical reforestation site where the staff lived within a growing forest that they had created. The Western scientists, who never exceeded eight or nine at any one time, interacted with about 200 local staff that included Malays, Chinese, and Indians, in a multi-cultural environment of mutual trust and respect. This interest and assimilation in local culture by the foreign scientists further bonded the live-in population as a community that worked and lived harmoniously together.

Of particular interest is the **SOCIAL ORGANISATION** arising out of the foreign and local staff living together as a community and bonded by the same mission to reforest the site. It was a hierarchical social organisation reflecting the work hierarchy. The administrative hierarchy was transplanted into the social hierarchy and so the head of forest research institute was also regarded as the head of the community and involved himself in social events and celebrations such as annual festivals, sports events, weddings, and funerals. The head of FRIM also took on the role of "headman" of the community whose responsibility would include all after office matters, from family squabbles to emergencies such as illnesses.

The local staff took pride in the man-made forest project and safeguarded the nominated property at all times, in particular when British rule collapsed and Malaya came under Japanese Occupation during World War II. By this time the experiment was in its Second Phase or Transition Phase (1942–1945), when the saplings had grown to become poles, about 20–30 m tall, with tall straight trunks and slender lateral branches, changing from juvenile to mature form. When the British left, there was a breakdown of authority. The buildings were looted, and the Herbarium was in a disastrous condition. In the absence of the British, it was the live-in local community that had to regroup to save the nominated property. The local live-in community reorganised itself with its most senior technician acting as head of the organisation, until the war ended with the Japanese surrender in 1945. When the British returned, they found the local organisation intact. The damage to the nominated property was limited because the live-in community and their families had stayed and safeguarded the nominated property by their presence.

The social organisation of the community also followed a hierarchical order in its housing quarters which mirrored one's rank in the organisation. The size, spatial design, architectural trend, and location reflected a three-tier architectural design hierarchy. Here in the nominated property, the design hierarchy could be seen in bungalows, semi-detached houses, and wooden houses. Typical of estates, the head of the nominated property was given the largest bungalow located on a hill or higher ground that was deemed to be away from malaria and away from the rest of the quarters. An offshoot of a red laterite road that ran through the nominated property led to a gate beyond which were large lawns fronting a double storey brick bungalow that used to be called JKR501 but has been renamed Villa Aromatica after the Kapur tree *Dryobalanops aromatica*. Then there were single storey semi-detached houses for local officers, built along Jalan Jelutong. These housing quarters continued to be occupied as quarters until the 1990s. After that, the bungalows and semi-detached houses went through adaptive reuse. Continuous occupation even as adaptive reuse requires maintenance and encourages building conservation.

The support staff at the bottom of the hierarchy were accommodated in small wooden houses that were not built to last. In the pre-war days, the support staff lived in temporary wooden houses along Jalan Abdul Rahman Ali. After the war, the workers were relocated to a village environment in Bukit Baru, east of Jalan Foxworthy in another part of the nominated property and also in Lorong Kapur. Over the years, more local style wooden houses were built to replace the

dilapidated wooden houses that could not survive time. In the early 1960s, FRIM developed simple, economical, prefabricated wooden houses for the country and for its own use as housing quarters along Lorong Kapur, Jalan Bukit Baru, Jalan Abdul Rahman Ali, and Kampung Jawa.

The colonial brick bungalows, lawns, ornamental ponds, and Malay wooden houses against a backdrop of forest gives the nominated property a unique **AMBIENCE** not found anywhere else. This unique ambience of a living experimental site with social and cultural elements embedded in its community is not seen in any other reforestation site in the world to this day. Community amenities that include a primary school, mosque, clubhouse, and sporting facilities continue to maintain and sustain the original ambience of the nominated property as a living community within a forested environment. This community of people of various ages from young children to adults gives the nominated property a vibrant ambience that has been present for almost a century, a living environment within the forest, a meeting of man and nature.

Figure 2.50: Football field

The social organisation and that special ambience of the site present during the pre-war and post-war periods—i.e. up to 1960s when the foreign scientists were in charge—continued even after Malayan Independence in 1957, when the foreign scientists were phased out and replaced by Malaysian scientists who continued the live-in tradition. Since then, the concept of a live-in community of multi-ethnic Malaysians has continued. Its size has been maintained at the level of 100–200 families at approximately 400–800 people. This was made possible with the availability of housing loans, which halted any increase in the population of the live-in community. Any increase could have necessitated a reduction in forest land on the nominated property. Thus, for over almost a century, the carrying capacity of the nominated property has been maintained, as the live-in population and nominated property size have remained constant.

Modifications to the role of the live-in community are adaptations to present needs of the forest and its conservation. While the community remains the eyes and ears of the happenings in the forest property, they no longer need to watch over the planting of trees as they did in the early years, because the trees have matured. With planting completed, the emphasis has shifted to conservation of the forest and other areas of forestry research. However, the community still monitors the forest for any threats from man or nature. This original role has continued till today, despite a change in configuration of the live-in staff, where in the last few decades, the head of FRIM FPS and scientists or senior staff live outside the nominated property. However, the head of FRIM FPS still plays his role as the “headman” of those who live in the nominated property, and his wife heads the women’s organisation called PUSPANITA. The senior staff continue to officiate social and religious functions, thereby holding the community together. The vacated living quarters of the head and senior staff have been put to good use as function and office spaces, thus reducing new development on the land. So too with the live-in housing—modern apartment blocks located at the edge of the nominated property have replaced many of the wooden houses of the past that could no longer be rehabilitated.

Also in line with previous roles of the live-in community are activities such as planting that have taken on a new slant fitting in with current conservation awareness and greening effort. The Green Community Programme run by the Green Community Centre (GCC) has developed interest groups such as Junior BioD Rangers and Go Green FRIM who continue the planting of trees (as the 1920s community did) through its seed collection and planting project. The

forests are now mature and abundant seeds are shed; these are gathered and prepared for planting. The mature forest also lends itself to *kelulut* (stingless bee) honey production. It is planned that the live-in community activities such as these will be expanded to the larger population, making them a catalyst for conservation awareness, just like FRIM FPS's reforestation mission in the 1920s was also a precursor to conservation interests in the country.

Figure 2.51: Green Community Centre

In brief, social changes are inevitable especially over a period of 100 years. In the case of FRIM FPS, these changes reflect an adjustment to current needs. This flexibility has kept the live-in community as relevant as before, but in different ways. Thus, the live-in community has remained an integral part of the original landscape. This live-in community tradition has continued over the years with changes that fitted with the times while still maintaining the spirit of their role in the on-going mission that was established by the pioneers.

2.b HISTORY AND DEVELOPMENT

2.b (i) SELECTION OF SITE

The site of the nominated property was selected as an extreme challenge in reforestation by F. W. Foxworthy who had been appointed Forest Research Officer in 1918 to initiate forestry research. Based on his diary of recorded activities, it was Foxworthy who examined various potential sites and selected this site for its dependable supply of water and proximity to a forest reserve. Thus the site for FRIM FPS was established near the village of Kepong, 16 km from the centre of Kuala Lumpur, adjoining a hilly forest reserve at its northern boundary—the Bukit Lagong Forest Reserve, with its three streams flowing through the nominated property (**Figure 2.52**). This dependable source of water supply was an important

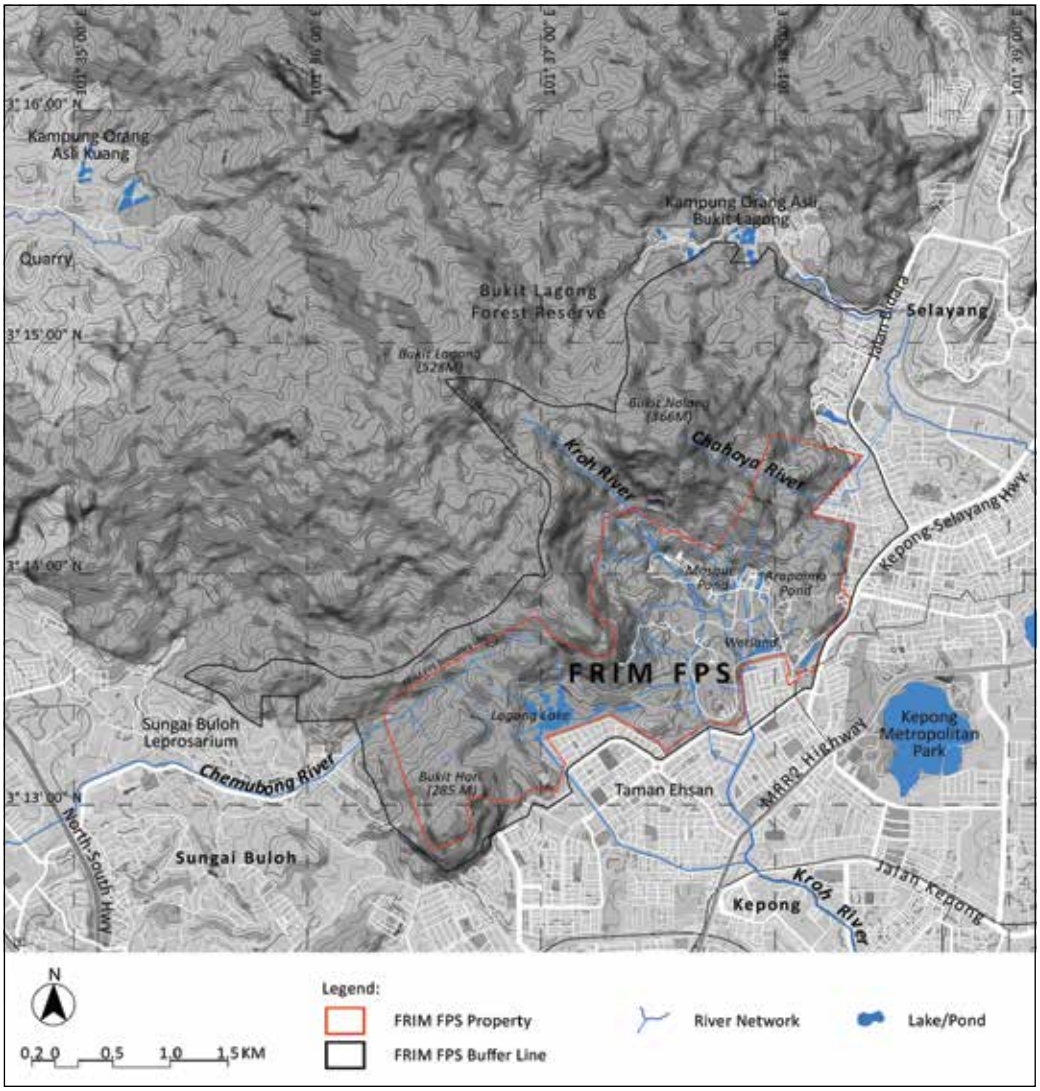


Figure 2.52: Source of water from the three main rivers, Chahaya River, Kroh River and Chemubong River, that determined site selection

criterion in site selection for Foxworthy (Foxworthy in Ng, 2018:163). The FRIM FPS nominated property was approved by the State of Selangor in December 1925 and officially declared a Reserve for "forest education and research" by Government Gazette notification No. 5449 dated 1 October 1926 (**Appendix 1**).

Foxworthy's deputy and eventual successor J.G. Watson described the nominated property as follows:

> *"The areas available for planting consisted of abandoned mining land that had first been of forest, then mined by Chinese open-cast and gravel pumps methods, resulting in portions of it being covered with the overburden and refuse removed from the mines, then grazed by cattle, cultivated by Chinese vegetable gardeners, and abandoned and grazed again until whatever merit the surface soil may have had was leached well out of it. The worst places of all were covered with lalang (Imperata cylindrica) encouraged by frequent burning…"* (Watson, 1935: 110)

Foxworthy's intentions were explained in his annual report of 1927:

> *"The object of planting experiments at this stage is primarily to find out which of the many hundred possible species are worth planting up on a large scale. Bearing in mind the fact that the area was deliberately chosen with a view to providing a severe test and that the conditions are, therefore, abnormal and infinitely more severe than any that would be likely to arise in the trees' natural habitat, it is clear that failures must be the rule rather than the exception, and that there can be no question of regular plantations until the trees have proved their hardiness."* (Anon, 2019, 2020, 2022)

Foxworthy launched a bold and massive exploration of scientifically unexplored territory and was prepared to accept that "failure would be the rule rather than the exception" (Anon, 2019, 2020, 2022).

Mining causes extreme soil damage and destruction, making it extremely difficult to rehabilitate. Nothing is more damaging than the mining of alluvial tin in Malaysia. To obtain the ore, the original forest is felled and cleared, and the soil is dug up and washed with water. Soil and sand particles are washed away leaving behind the heavy particles of tin ore. Originally this was done manually in

small pockets but as demand grew for tin, especially for food canning, and as the country became the top tin producer in the world until 1960s, vast areas of forest were cleared and tin was extracted using pumps and big dredging machines. As the forests were felled and the land systematically gouged up and washed for tin, the rivers ran thick with mud. Kuala Lumpur, the capital of Malaysia, situated in the rich tin fields of the Klang Valley at the confluence of two rivers, was the capital of the tin industry. Its name *Kuala* (= river confluence) and *Lumpur* (= mud) describes what it looked like.

After mining, natural ecological succession takes place, with small weedy plants colonising the land. Areas may also get covered with coarse *Imperata cylindrica* grass, or coarse *Dicranopteris linearis* ferns. The original tropical rain forest trees with majestic columnar trunks, do not return. Even after 70 years, such lands in Malaysia have been found to remain poorly vegetated.

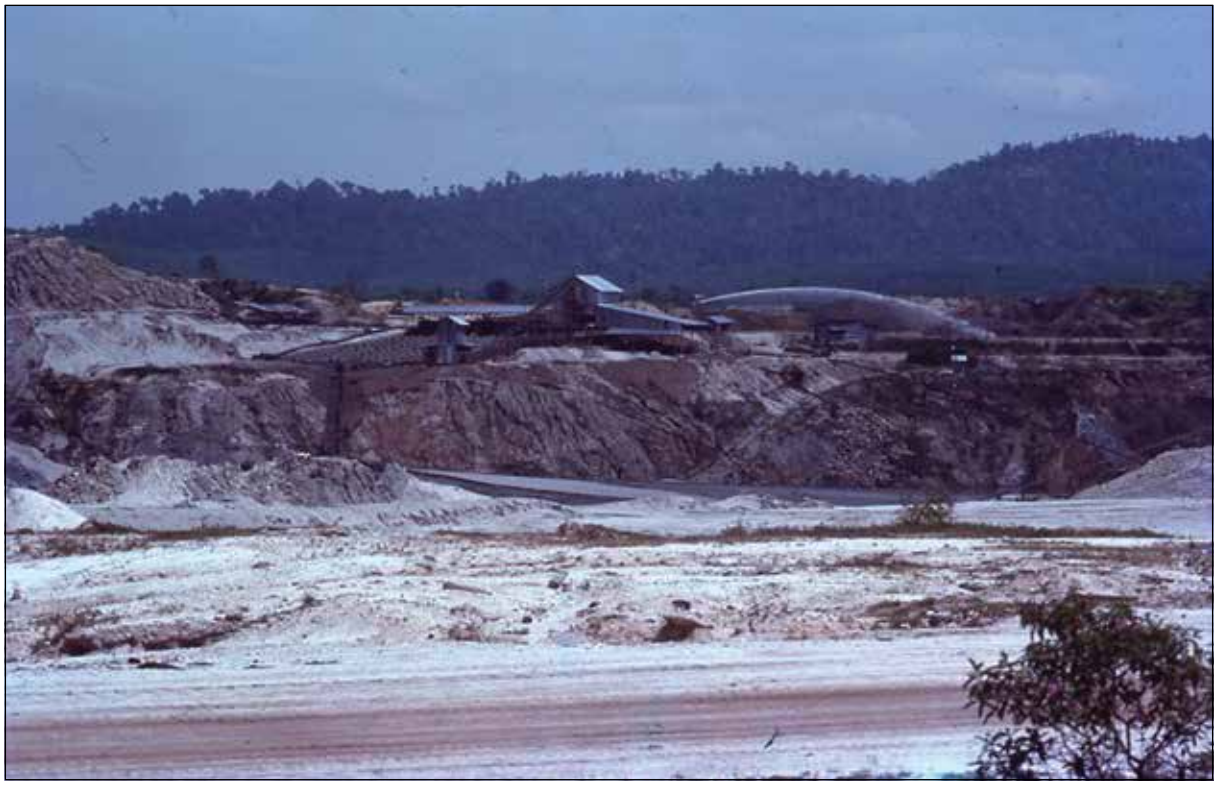


Figure 2.53: Gravel pump mining to extract tin resulting in massive loss of soil

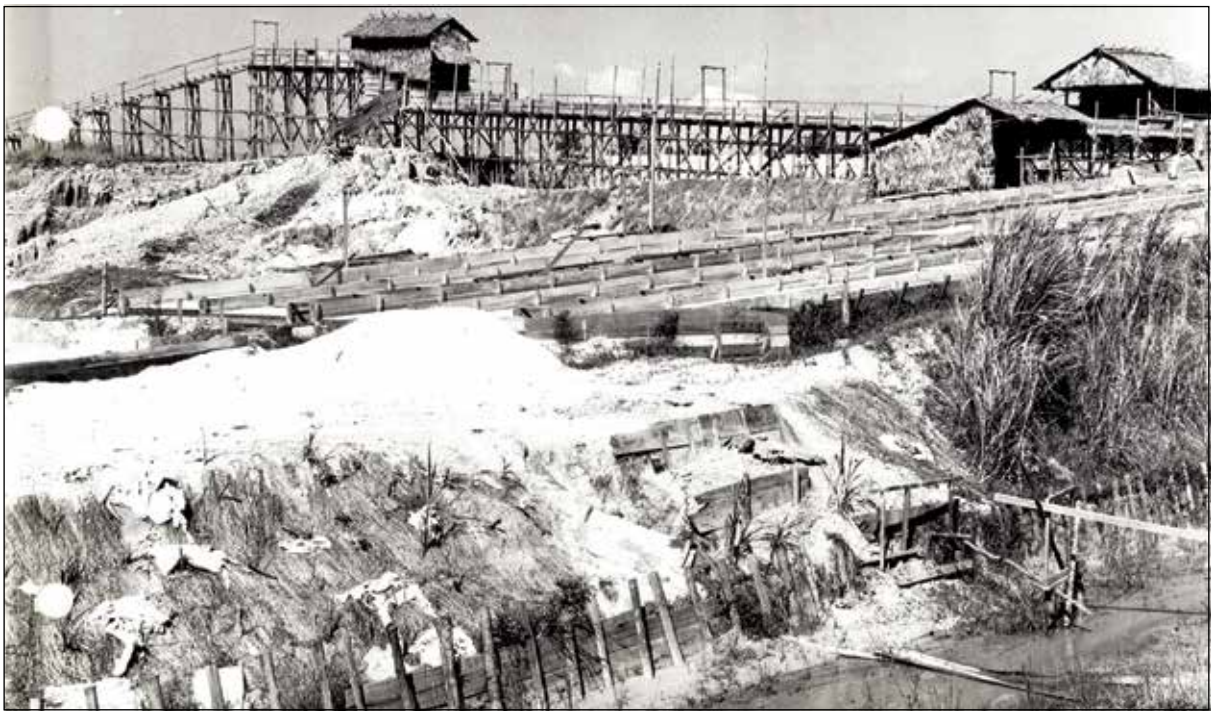


Figure 2.54: An area being mined for tin. The wooden structure in the background is the "Palong". A slurry of soil with tin ore particles is pumped to the roofed structure at the top and allowed to run down a long inclined slope designed to trap the tin ore particles while allowing the water and soil to flow down

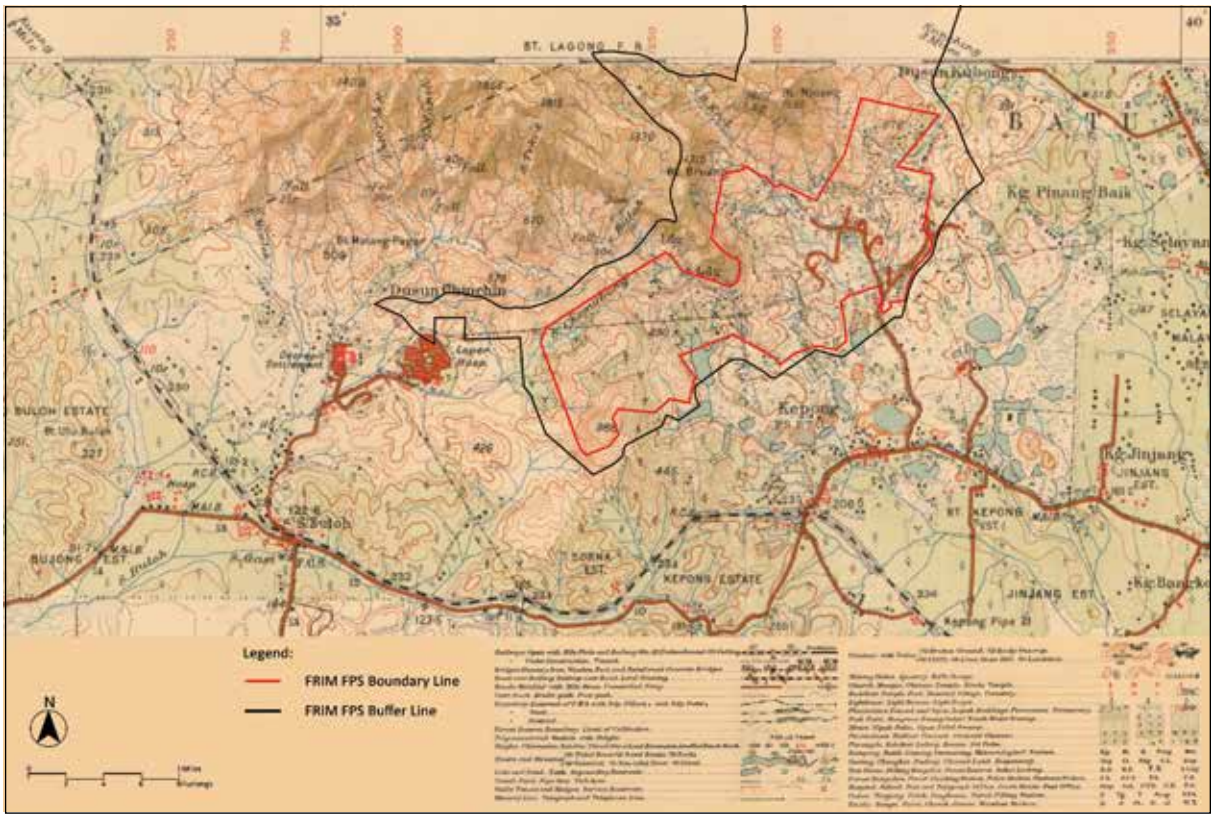


Figure 2.55: FRIM FPS superimposed on a 1930s map showing major roads and mining ponds in and around the nominated property

2.b (ii) HISTORY OF PLANTING

Foxworthy was working in the Philippines when he was identified by G. E. S. Cubitt the then head of the Forest Department, as someone who could help him establish a research unit to create a forest on the most devastated site chosen.

The appointment of Foxworthy was announced by Cubitt in the Annual Report of the Forest Administration of 1918 as follows:

> *Towards the end of the year the appointment of Forest Research Officer was offered to Foxworthy, for several years the head of the Forest School and Investigations Division of the Forestry in the Philippines. It is hardly too much to say that this is the most important step taken by the Government since the founding of the department, which is to be congratulated in securing the services of an officer whose knowledge of the timbers of the Indo-Malayan Region is probably unrivalled.*

Almost all of the area in and around Kuala Lumpur was heavily mined and this included FRIM FPS located north-west of Kuala Lumpur. The nominated property went through three major phases of development (**Figure 2.56**) that covered the:

- Pre-War Planting Period (1926–1941)
- World War II Transition Period (1942–1945)
- Forest Maturation Period (1946–to date)

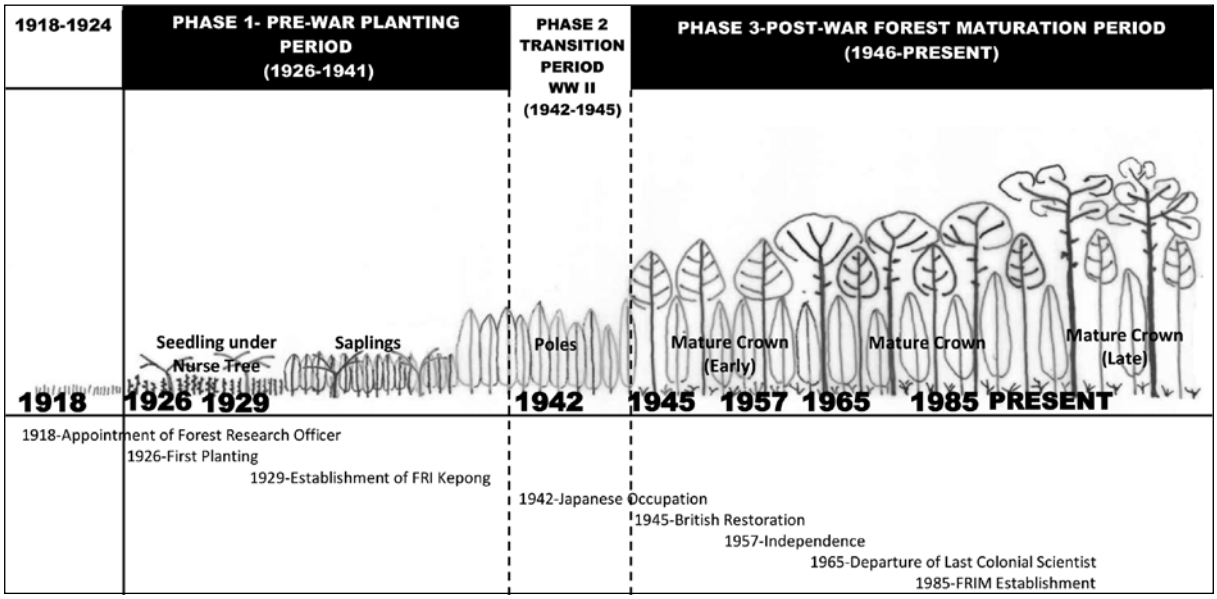


Figure 2.56: Major phases of development in the nominated property

Phase 1: Pre-War Planting Period (**1926–1941**): The small team of pioneer scientists in forest research institute, trained in Europe and North America, had to innovate a whole new system of forest establishment to overcome problems that were peculiar to tropical climates. For example, in temperate climates, trees flower and fruit at fixed times of the year so seed harvesting can be planned in advance. In the humid tropics, there are no seasons, and seed production times are completely unpredictable. Years of abundance are few compared to years of scarcity. Furthermore, rain forest seeds respire and die quickly if prevented from growing, so seeds have to be germinated as soon as they are collected. The local staff contributed towards the creation of this tropical rain forest with their intimate knowledge of the trees and animals.

The pioneers began planting in 1926 (Watson, 1950: 63):

> *The year 1926 witnessed the initiating of experimental plantations at Kepong under the enthusiastic guidance of Foxworthy, ably helped by the late R. H. Whitty, an ex-rubber-planter who had originally joined the Department during the 1921 depression when a dozen or so men were given temporary employment in forest reconnaissance work.*

From the Annual Report for 1926 (Anon, 2019, 2020, 2022), the creation of the man-made forests began with the planting of 161 species of trees in 1926 by intensive manual effort under harsh open conditions. A nursery of 1.5-ha containing 330 nursery beds was prepared and by the end of the year, 25,000 seedlings of 100 species had been raised and field planting had begun. By the end of 1927, the number of species planted had reached 161. The mortality rate was extremely high but every seedling that died was replaced by another seedling of a different species as often as necessary. With a wide range of species to use, every planting spot was eventually filled with a plant that was adapted to the micro-site. Fast-growing nurse trees were used to provide overhead shade. Planting was carried out from dawn to 10 am to avoid the midday heat. As much as possible, planting was carried out on rainy days. Weeding was carried out every month, at least during the first year, to remove competing vegetation. There was no machinery of any kind, no irrigation, and no pesticides. All the work was done manually by an efficient and willing work force. In this way, a full stocking of planted seedlings was established.

Figure 2.57: Nursery beds with seedlings in veneer tubes placed on concrete slabs to prevent root penetration in the ground

Figure 2.58: Potting seedlings in veneer tubes invented in FRIM FPS and manufactured by its timber research laboratory

In temperate climates, the transfer of nursery-raised seedlings to the field is done when the seedlings are in a dormant state induced by winter. In the humid tropics, seedlings are metabolically active all the time and are easily killed by root damage or sudden exposure to sun when planted out in the field. The pioneers learnt to establish nurse trees to provide initial shade. In general, work in the tropics, could not be planned by calendar. The institute had to be organised to collect and germinate seeds and plant the seedlings throughout the year. Tropical reforestation required a whole new way of thinking involving the interaction of Western ideas with indigenous forest landscape.

Foxworthy's 'impossible quest' could have failed and been quietly forgotten, but Foxworthy and J. G. Watson spent the rest of their working lives on it, providing the leadership that inspired all their staff, which consisted of a small number of colonial forest scientists, never more than eight or nine at a time, and a force of 200 locally recruited workers. All the staff and their families were housed within the site on which they had to create a forest and establish a forest research institute. As a result of their effort, FRIM FPS is a spectacular man-made tropical rain forest with an embedded forest research institute and a self-sustaining live-in community.

Figure 2.59: F. W. Foxworthy

Figure 2.60: J. G. Watson

As the planted seedlings grew into saplings and pole-sized trees, the soil regained its fertility. It has been found that the foliage of trees captures nutrient-bearing dust in the air which is then washed down to the ground by rain. As the trees grew, indigenous wildlife moved in and carried with them seeds from elsewhere, making the flora more diverse. The diversity of indigenous plants produced the diversity of food resources needed to support heterogenous indigenous wildlife.

Because there was no restriction on species and there were well over 100 species to use, all the planted fields were eventually filled with plants that were individually well-suited to their respective sites. By the time Foxworthy retired at the end of 1932 (Anon., 1950), there was a mixture of many species in each field. Incredibly, the earliest planted fields were crammed with pole-sized young trees 6 m tall with foliage touching each other laterally. Foxworthy wrote an account of what was undoubtedly his greatest achievement before he retired, but due to the global Great Depression that hit the country in 1931, there was no money to print his report in 1932 nor in the years following. Foxworthy's closing report disappeared when the Institute was looted during the Japanese invasion in 1941. Foxworthy would have passed into obscurity except that his experimental forests kept developing until what they are today.

Phase 2: World War II Transition Period (**1942–1945**): By the 1940s, the trees had grown to 20–30 m tall, with tall straight trunks and slender subordinate lateral branches (**Figure 2.61**). At this height, the trees change from juvenile to mature form. New branches are no longer subordinate and lateral. Instead they grow upwards and act as competing leaders, to form a rounded crown. The subordinate lateral branches of the juvenile stage are shed to reveal tall, straight, branchless trunks. With the shedding of the juvenile branches, space is created below the mature crowns, which get filled with understory trees, shrubs, seedlings, and ground vegetation, thus making the forest appear as a five-layered structure.

During this period, British Malaya came under Japanese Occupation from 1942 to 1945. The Japanese authorities did not station any Japanese staff at the Institute and only made day visits from Kuala Lumpur but the local staff remained on duty. The only trees planted were a stand of the camphor tree *Cinnamomum camphora* at the end of the Coniferetum and one tree at the side of Office Pond beside a small ornamental bridge.

The war ended with the Japanese surrender in August 1945. When the British returned, they found the local organisation intact. Damage to the nominated property was limited because the live-in community of staff and their families safeguarded the nominated property with their presence. However, some planted areas especially around Bukit Hari at the western end of the nominated property had been cleared for food cultivation due to acute shortage of food. After the war, the area was colonised by the tall grass *Imperata cylindrica*, then cleared and planted with exotic pine species in the 1960s. After the termination of the pine experiments in the 1990s, the areas were re-used for new planting of indigenous species as part of continuing research to test new ideas and materials in forest establishment.

Figure 2.61: Photo taken in 1949 of forest planted in 1927 in Field 12C of FRIM FPS at age 22 years, average height 90 feet and average diameter about 10 inches (the undergrowth in the foreground has been cleared to provide more light for the seedlings on the ground resulting from heavy fruit fall in 1947)

Phase 3: Forest Maturation Period (**1946–to date**): After the war, despite a severe shortage of scientists, all the research units disrupted by the war were revived. Independence was proclaimed on 31 August 1957, after which the British scientists were phased out gradually until the last two left in 1965. All research units and the reforestation mission established earlier by the British were continued and maintained by Malaysian scientists who had been trained overseas, mostly in the United Kingdom and Australia.

Figure 2.62: The British staff of the institute in 1954

Figure 2.63: The Malaysian staff of the institute together with the Director General and Deputy Director General of the Forestry Department in 1969

After World War II, a new global paradigm in forestry was promoted by the World Bank, the Food and Agriculture Organisation of the United Nations (FAO), and other development agencies. These organisations did not favour indigenous forests which they regarded as impediments to economic development. Instead, they promoted monocultures of selected 'miracle trees' to produce 'industrial wood' on short rotations. For nearly half a century, from the end of World War II to the 1990s, tropical rain forests were so lowly regarded that they were exploited or eliminated with no regard for environmental consequences.

Tropical forestry research went through a period of uniformisation in the belief that this would be the most effective use of scientific man power. It was predicted that there would be a crippling shortage of paper for the books, newspapers, and writing materials that all literate societies depend upon. Tropical pines were considered the best species to grow for making paper. The FRIM FPS experimental research plot in Bukit Hari then began the growing of pines from imported seeds of tropical pine, *Pinus caribaea* in the 1960s and 1970s. It was soon apparent that pines in Malaysia could not regenerate naturally in the tropics and so seeds had to be continuously imported. Meanwhile, the technology for making paper from mixed tropical hardwoods had improved until there was no economic basis for growing pine trees. Interest in pines died down and by the mid-1980s, no more pines were planted and the projected crippling shortage of paper did not materialise.

Research on tropical trees between 1972 and 1990 covering more than 600 species in 300 genera and 86 botanical families resulted in the introduction of many more species to nominated property. This research was published in the two volume Manual of Forest Fruits, Seeds, and Seedlings (Ng, 1990; 1991) which became the reference manual for a new industry in raising trees for urban planting. This project also provided scientific support for the growth of urban greening using tropical forest trees.

2.b (iii) DEVELOPMENT OF THE FRIM FPS LANDSCAPE

In 1921, Foxworthy examined various potential devastated sites and deliberately selected the Kepong mined site with its severe soil conditions as a challenge for reforestation at a time when knowledge on tropical rain forest was rudimentary. Cubitt, the head of the Forestry Department, sent a memorandum to the colonial government dated 2 November 1925 requesting a generous financial allocation to start experimental plantations and to build a forest research institute, with room for offices, laboratories and on-site housing for the Forest Research Officer, eight or nine other senior staff and 200 workers and their families, something that had never been done before in a forest research institute anywhere else in the world. Cubitt's request coincided with a boom in world demand for rubber and British Malaya was then the biggest producer of rubber. It was a time of great financial optimism, and Cubitt was granted the total allocation he asked for. Thus, a forest research institute, now known as Forest Research Institute Malaysia (FRIM) was established on a strategically selected site with all its staff and their families housed at the site as a live-in community.

The pioneers' decision for all staff to live within the site and establish a live-in community of Western scientists and local staff and their families generated requirements for community living needs or facilities, above and beyond research and administration. This required physical entities such as accommodation for staff of all ranks, school, clinic, and place of worship to be built within the research site so that the site would be a self-sufficient entity. This unique pioneering decision to house families within the site on which they had to create a forest and establish a forest research institute, was a brilliant move as the foreign and local staff were bonded by shared knowledge and responsibility which contributed to the success of the mission. This success in turn contributed to a sudden increase in knowledge on tropical forestry, in particular on how man can recreate the mixed indigenous species composition, multi-layered structure, and vast biodiversity of a mature tropical rain forest equivalent to a natural lowland forest even on a totally devastated land, as had never been done before. This was a first not just in tropical reforestation but also in replanting on a thick sandy infertile land, at a time when there were no chemical fertilisers and no labour-saving machinery.

The development of this barren land which was the original state of the nominated property in the 1920s involved spatial planning of the site for forest experimentation. This involved a design layout of the roads and trails, as well as the location of buildings and housing to be constructed. An examination and analysis of the above features in the nominated property clearly show that they resonate with the features of contemporaneous rubber estates that dominated the rural landscape of Malaya at a time when it was the biggest exporter of rubber in the world. These estates had a design layout of roads and paths and a hierarchical living and working arrangement that reflected a three-tiered management organisation as evidenced by location, house type, and size. Instead of growing rubber, this “estate”, the FRIM FPS nominated property, grew forest trees.

Thus, the various features such as the man-made forest, buildings, houses, roads, ponds, and lakes, morphed into a cultural landscape of the site that reflects the interaction of man with his environment, as well as an interchange of human values between foreign and local, over many decades and several changes of government from the 1920s till today. The people, the forest, and the buildings together contributed to the cultural landscape of FRIM FPS.

With the original barren mining land as its blank canvas, the pioneers first set about cutting narrow laterite roads, paths and forest trails that weaved through the nominated property linking the experimental plots to nurseries, offices, laboratories, and housing quarters. The landscape was designed by J. G. Watson (Anon., Obituary 1950). He integrated the pools of water left by mining into a landscape of avenues, lawns, and water bodies carved into a sandy environment. Lawns were a special design element for important buildings such as the Administration Building. It was also a feature of Villa Aromatica, the house of the head of forest research institute which enjoyed a prime location on a hill and was surrounded by spacious lawns and a long driveway. The Administration Building, which as with other buildings carried a mixture of Art-Deco and local Malay architectural elements such as the veranda, was completed in 1929. Beyond its spacious lawns used for special occasions were remnants of mining pools designed as a water feature in the landscape. There were two main avenues, first constructed in 1927, namely Jalan Foxworthy, which ran from the main entrance to the Administration Building, and Jalan Jelutong which led to Villa Aromatica, the earliest bungalow.

The surrounding landscape of sandy land changed as planting began with the growing of nurse trees for the seedlings. The first tree was planted in 1926 in Field 12. Nurse trees were planted to protect seedlings which grew from saplings to pole-sized trees with juvenile crowns. The site was also busy with the construction of trails or paths, more staff housing, and community facilities. The lowest level of staff that were involved in planting were housed in wooden houses. Within 20 years, the trees that were closely planted had grown 20 m in height and together with the buildings along tarred roads, the young forest was becoming a visible feature in the sandy landscape.

Just before World War II erupted, the first trees planted had grown to about 30 m tall, with straight trunks and slender subordinate lateral branches. At this height, the trees change from juvenile to mature and the new branches are no longer subordinate and lateral but instead grow upwards and act as competing leaders to form a rounded crown. Between 1926 and 1944, 372.2-ha or 63.2% of the nominated property were planted (FRIM Plant Database, 2022) (**Figure 2.64a**). The war years allowed the trees to mature, while the local community living in the nominated property regrouped to protect the site in the absence of the foreign scientists. The war ended in 1945 when the Japanese surrendered. Overall the damage to the landscape was controlled because it was safeguarded by the live-in community.

Planting continued after World War II and by 1969, a large portion of the nominated property—440.6-ha or 74.8%—was forested (FRIM Plant Database, 2022) (**Figure 2.64b**). The nominated property was enriched not just by a larger forested area but also by the development of a 80-ha botanic gardens surrounding a 4-ha clear water lake with a special panoramic mirror image of the surrounding landscape (**Figure 2.64c**). Approximately 11 fields or 75-ha in the Bukit Hari experimental area previously planted with pine was replanted with indigenous species. This completed the reforestation of the nominated property. Bukit Hari resumed its tropical rain forest research and successfully added in more species, adding to its plant diversity. This reforestation of the site continued even after the British left in the 1960s, until the whole nominated property was forested, with the youngest trees in FRIM FPS—currently more than 30 years old—coming from this Bukit Hari area.

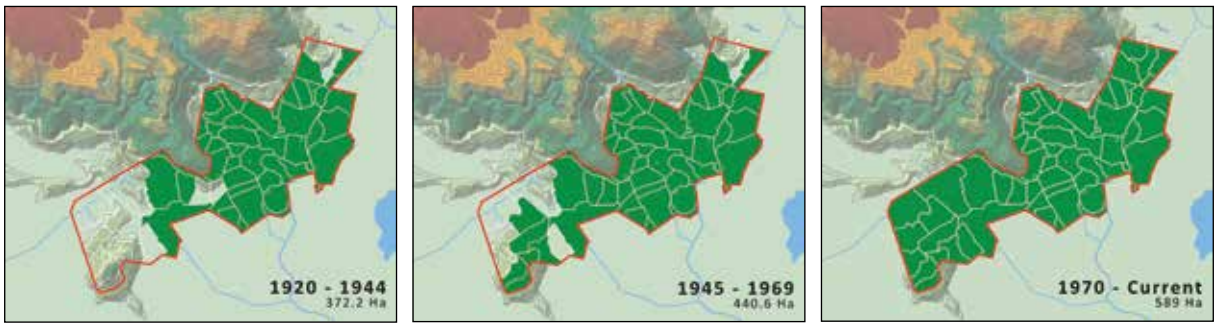


Figure 2.64a: Phase 1 Figure 2.64b: Phase 2 Figure 2.64c: Phase 3

Figure 2.64: Planting phases of reforestation based on Field Planting Records

The uninterrupted creation of the forest from the 1920s has resulted in a tropical rain forest with the rich biodiversity of a natural forest. The cultural landscape of the British era with its forests, roads and avenues, water bodies, and buildings are basically intact, although more buildings for offices and laboratories as well as community facilities were added in the 1980s, which saw a surge in construction activities due to the growth of the institution. Despite these additional buildings, the historic buildings remain outstanding and the overall forest estate setting has been conserved to maintain the original ambience of the nominated property. The trees have grown to become a thick forest that hugs the buildings and make them seem like the forest carved out spaces for the buildings. Trees lining the main roads have grown mature forming shady avenues.

FRIM FPS has maintained its dominant feature as a man-made forest, embedded with elements reminiscent of a British-Malay rubber estate common in the pre-war years of the 20th century. In FRIM FPS, indigenous forest species were planted instead of rubber trees, but they shared a similar layout of accommodation based on hierarchy, where size, location, and construction material reflected one's rank in the organisation. Communal facilities and the "factory"—or in the case of FRIM FPS, its offices and—were close to staff quarters and small roads linked the area together as an estate entity. This estate landscape design now exists intact only in FRIM FPS, giving FRIM FPS landscape a historic value, important in our national heritage.

FRIM FPS remains a spectacular man-made tropical rain forest within which is a forest research institute, and a live-in community residing in a landscape resembling the old estate landscape of the early 20th century. Although social change is an inevitable part of cultural development, it has not had a negative impact on the integrity of the landscape of the nominated property. There is little room for new planting, and consequently emphasis has shifted to conservation of the current man-made forest and other areas of forestry research. The size of the live-in community has been maintained at the level of about 100–200 families, ensuring that the carrying capacity of the nominated property is maintained while protecting the living ambience and ensuring that all communal facilities are used and sustained. Green awareness programmes, more in line with current interests in environmental protection, have been developed to promote social interaction within the community as well as between this community and others outside. The original wooden houses on stilts had been renewed from time to time but the high cost of doing so has seen a shift to apartment blocks, with the freed land area to be utilised for tree planting and park development. While updating the site to current interests and needs, FRIM has not lost the direction and mission set by the pioneers. The original mission to create a tropical rain forest has materialised and it needs to be monitored and protected as the forest grows for several centuries more, as the evolutionary process of growing is still in progress.

After 100 years, FRIM FPS is now equivalent to a tropical natural lowland rain forest, with a landscape designed and created intentionally by man. Stepping out of any of its buildings today would lead almost directly into a tropical rain forest, making these buildings seem as if they were carved out of a natural rain forest when in reality they are contemporaneous. The man-made forest of FRIM FPS conserves a cultural landscape of man-made tropical rain forest embedded with offices, laboratories, houses, community facilities, lawns, tree-lined avenues, and water bodies, that matured by the 1980s and has remained true until today. Thus, FRIM FPS is a manifestation of the interaction between humankind and its natural environment, that created a distinct cultural landscape, which recognised cultural diversity in humankind and biodiversity for nature, while overcoming physical constraints of devastated mined land and a dearth of knowledge in tropical reforestation.

Figure 2.65: FRIM FPS Administration Building in its present man-made forest setting

CHAPTER 3

JUSTIFICATION FOR INSCRIPTION

3.1.a BRIEF SYNTHESIS

The FRIM Forest Park Selangor (FRIM FPS), located in the north-western outskirts of Kuala Lumpur 16km from the capital in the state of Selangor, is a 589-ha man-made tropical lowland rain forest. It was created in the 1920s and has since remained an important part of the research and mission of the Forest Research Institute Malaysia (FRIM). The amazing feature of this man-made forest is that it is the result of the pioneers' extraordinary vision to rehabilitate land that had been totally devastated by tin mining. This was 100 years ago, a time when knowledge on tropical rain forest was rudimentary, with no tropical reforestation example to follow; when tropical forests were regarded as abundant and of low economic value; and when conservation and reforestation were in their infancies.

The experiment of creating this forest was therefore a vision ahead of its time. It was carried out simultaneously with the establishment of a forest research entity and its concomitant infrastructure of office, laboratories, a system of roads and trails, and housing quarters for a community of staff and their families working and living in the forest they were helping to build. It was an exceptional testimony of the combined works of man and nature in the successful creation of a mature tropical rain forest on severely devastated mining land, an effort which resulted in a distinct cultural landscape reflecting a fusion of British and local Malay knowledge and cultural values.

Today, stepping out of any of these buildings would lead almost immediately into the man-made tropical rain forest, making it appear as if the buildings were constructed into the forest, when in fact they are contemporaneous. In the process, the site developed its distinct cultural landscape illustrating the essential and elements of this geo-cultural region. It is also a continuing forest landscape representing the conservation and evolutionary process of trees whose growth is still in progress. The structure and design of this cultural landscape, the result of interaction between man and nature, has remained intact.

This site was deliberately selected by Malaysia's first Forest Research Officer, F. W. Foxworthy, an American, in the early 1920s to provide a challenge for forestry research. This was a time of intellectual growth in temperate forestry and a rise in global awareness on the importance of temperate reforestation due to forest exploitation in Europe and America. However, the rehabilitation of tropical rain forests was not on the global radar then, because pristine tropical rain forests dominated the humid tropical landscape and appeared inexhaustible. However,

Foxworthy, familiar with temperate zone forest exploitation, must have seen a parallel if not a worse situation here where tin mining was not just depleting our tropical forests but leaving behind infertile land. Tropical rain forests contain more than 50% of the world's biodiversity while occupying only 10% of the world's forests (**Figure 3.1**). This makes it necessary for tropical rain forests to be conserved and restored wherever possible. Thus, FRIM FPS's success is especially notable because it succeeded long before there was any interest in such restoration or any environmental pressure to heal the land.

The resulting cultural landscape of FRIM FPS is a combination of British colonial and local Malay elements in architecture and design layout, reminiscent of a 20th century rubber estate in its layout of roads, paths, and buildings as well as housing quarters which echo the hierarchy of the organisation in its typology, location, and size. The architecture reflects an adaptation to the wet and humid tropics through the adoption of Malay vernacular elements featured in buildings of Anglo-Indian style and Art-Deco style. The substantive and important impact of a harmonious mix of cultures seen in architectural style is especially clear in the nominated property which has a collection of government buildings that records a stylistic evolution, materials, interchange of cultures in design elements, and spatial layout. These buildings are intact in form and continue to function within their original built purpose or adapted to new uses.

Thus, FRIM Forest Park Selangor bears exceptional testimony to the creation of a mature tropical rain forest on mined land that was inhospitable to almost all forms of vegetation. This man-made forest was created through scientific inquiry, with the benefit of local knowledge, and stands out as the earliest reforestation of a tropical rain forest. The Western scientists and local people together formed the live-in community with a shared mission of creating, monitoring, and maintaining the man-made forest. The nominated property conserves a cultural landscape that reflects a fusion of British and local Malay knowledge and cultural values in the creation of a mature tropical rain forest on severely devastated land, an exceptional testimony of the combined works of man and nature.

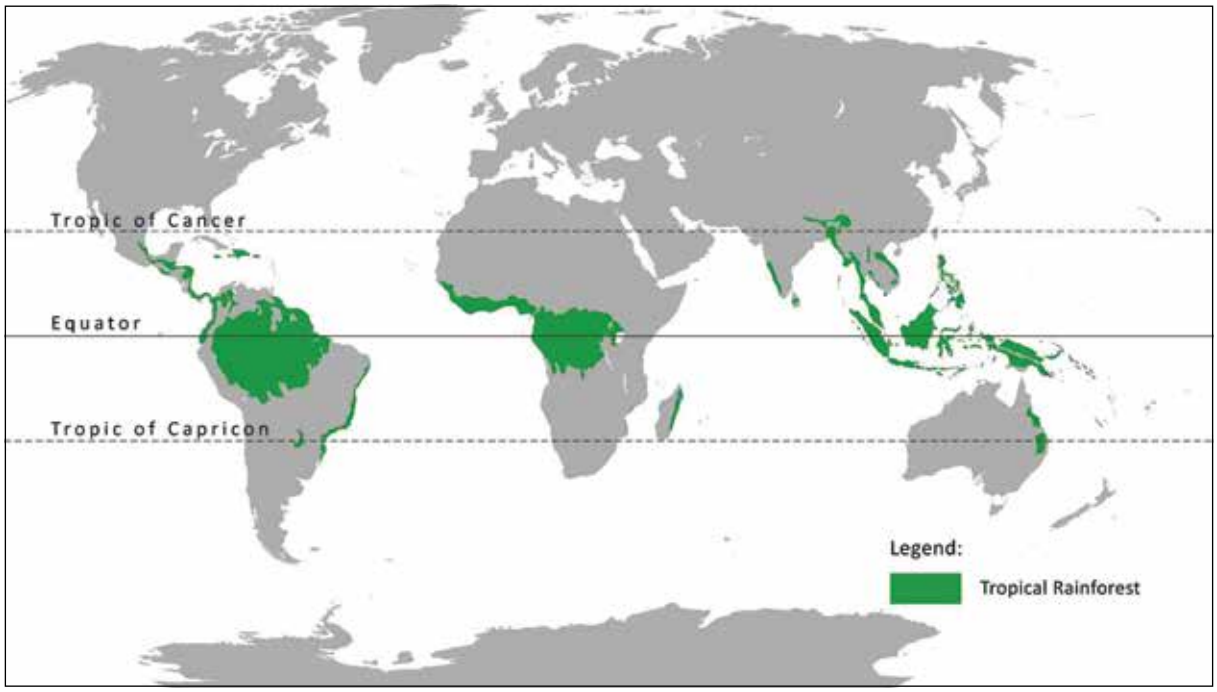


Figure 3.1: Global distribution of tropical rain forests

3.1.b CRITERIA UNDER WHICH INSCRIPTION IS PROPOSED

FRIM FPS, whose attributes are a) man-made forest, b) historic estate layout, and c) live-in community, is nominated for inscription on the World Heritage List under Criteria (ii) and (v) of the World Heritage Convention. The table below illustrates the Outstanding Universal Value of the nominated property and its supporting criteria (**Figure 3.2**). In the following pages, the Authenticity and Integrity as well as site Protection and Management will be discussed.

OUTSTANDING UNIVERSAL VALUE

A man-made forested landscape reflecting a fusion of British and local Malay knowledge and cultural values in the creation of a mature tropical rain forest on severely devastated land, an exceptional testimony of the combined works of man and nature.

Criterion (ii)

to exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning, or landscape design;

FRIM Forest Park Selangor conserves a landscape that is reminiscent of the design layout of 20th century rubber estate in colonial Malaya. It also reflects an interchange of values as seen in the architectural elements as well as through the cultural assimilation between the Western and local people who formed the live-in community.

Criterion (v)

to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;

FRIM Forest Park Selangor bears exceptional testimony to the creation of a mature tropical rain forest on mined land that was inhospitable to almost all forms of vegetation. The man-made forest was created through scientific inquiry and with the benefit of local knowledge and stands out as the earliest reforestation of a tropical rain forest on totally devastated mined land.

Attribute A **Man-Made Tropical Rain Forest**	***Attribute B*** **Historic Estate Layout**	***Attribute C*** **Live-In Community**	***Attribute A*** **Man-Made Tropical Rain Forest**	***Attribute C*** **Live-In Community**
• The cultural landscape is dominated by a man-made tropical rain forest that was created at the same time as its support facilities and infrastructure which include offices, research facilities, accommodation, and roads.	• A historic estate landscape that reflects an interchange of British and local elements in architectural and landscape design within a local tropical rain forest environment, reminiscent of a 20th century British-Malay rubber estate.	• Interaction among the live-in community resulted in cultural assimilation and an informal social organisation. This harmonious mix of cultures helped to bond the community in sharing the organisational mission on reforestation while also nurturing environmental awareness within the community.	• This man-made tropical rain forest has the characteristic forest structure and biodiversity composition of a mature natural tropical rain forest overcoming the infertile devastated mining land. This successful experimentation raised the level of knowledge on tropical forestry from a rudimentary to a relatively advanced level.	• The only tropical reforestation site in the world where the research institution as well as its staff live within the research grounds. Local knowledge on plants and planting as well as community commitment played a critical role in the successful creation of a man-made forest.

Figure 3.2: Summary of criteria and attributes of FRIM FPS

Criterion (ii) — ***"To exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design".***

The man-made forest of FRIM FPS is reminiscent of the layout design typical of British-Malay estates of the early 20th century. The nominated property also reflects an interchange of values as seen in the architectural elements, as well as in the cultural assimilation between the Western and local people who formed the live-in community. The rubber estates were carved out of the tropical jungles, but in FRIM FPS, indigenous forest species were planted instead of rubber trees. Embedded within the forest landscape are the offices, laboratories, housing quarters, and other support facilities. In a typical British-Malay estate, it would be divided into sections called compartments with access roads or trails for workers to plant and look after the trees and for managers to monitor progress. FRIM FPS was similarly divided into compartments known as fields, with access trails some of which are now used as adventure trails by visitors.

In a British-Malay estate design layout, the manager would occupy a large bungalow with a large garden on top of a hill. Other senior staff would occupy smaller bungalows with smaller gardens. The local staff would occupy small houses clustered around the factory, a clinic, a school, and places of worship. In FRIM FPS, the head of the institute was housed in a big isolated bungalow with a large lawn and garden on top of the hill. The factory was replaced by the main administration building and laboratories of the research institute. The pools of water left behind by mining were converted into ornamental ponds and lakes. The housing areas for the local staff (e.g. Lorong Kapur) were reminiscent of traditional Malay villages, while the tree-lined avenues, lawns, and water bodies are elements of British landscape design that prevailed in the bungalow houses where the foreign scientists lived and worked. The combination of British and Malay elements is also expressed in the architecture of its historic buildings. The old estate landscape design now exists intact only in FRIM FPS because the other estates have all been subjected to switching crop and re-development. FRIM FPS has remained true to its original design, which displays an interchange of ideas and values between British colonial and local elements.

The result of the founder's decision to have the staff and their families live together within its research property has had the effect of making FRIM FPS the only tropical reforestation site where the staff live and work within a growing forest of their own creation. The pioneer Western scientists, who never exceeded eight or nine at any one time, interacted with about 200 local staff of various ethnic groups, in an environment of mutual respect and trust. An informal social structure evolved in which the foreign pioneers who headed the organisation played the role of village heads just like in a typical Malay *kampung* (village), involving themselves in community events such as weddings and funerals. All were bonded together in a common 'impossible' mission. The official language was English but the common language was Malay. The relationship was sustained right to the end of the colonial period when the last of the British scientist left the country in the mid-1960s.

Important interchanges in values are demonstrated in the decades of evolution of architectural style in the built heritage. These early government-built buildings, from 1920s to 1960s, have preserved their original significant form through five decades of architectural evolution, from the British period till Independence. During this period, the buildings of British Anglo-Indian and Art-Deco architectural styles also incorporated some Malay vernacular elements into the design of the buildings. Thus, the early pioneering buildings incorporated vernacular elements such as veranda, overhang roof, porch, and high-ceilinged interiors as adaptations for the wet and humid tropics.

The birth of modern Malayan architecture in the post-war years was greatly influenced by the work of Danish architect, B. M. Iversen, who designed many governmental and corporate buildings in Malaya. His buildings were artfully designed and translated from international architectural trends to suit the local context and taste. His design emphasised the horizontality of the building façade to counterbalance the earlier verticality of Art-Deco. Examples of such building styles can be seen standing and occupied along Jalan Foxworthy, Jalan Jelutong, and Jalan Balau built in the 1950s.

The continuous use of those buildings encourage their conservation and preservation, therefore prolonging their lives and historical impact, not just from the point of view of FRIM FPS, but as a matter of national interest in the evolution of the architectural history and significance.

Criterion (v) — *"To be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change".*

FRIM Forest Park Selangor is an exceptional testimony to the creation of a mature tropical man-made forest on mined land that was inhospitable to almost all forms of vegetation. The man-made forest was created through scientific inquiry and with the benefit of local knowledge. This site stands out as the earliest reforestation of tropical rain forest on totally devastated mined land. In the 1920s, the reforestation of mined land was not considered a priority anywhere in the world. Mining was accepted as a necessary part of economic development, and deforestation was necessary before mining could take place. Once mined, the bare sandy landscape of the mined areas was left to nature to help it recover. Natural recovery was so slow that mined areas had the reputation of being the most irreversibly damaged of all landscapes. The original tropical rain forest with majestic columnar trunks do not return. Even after 70 years, such lands in Malaysia have been found to remain poorly vegetated.

The FRIM FPS effort in the 1920s was totally without precedents in the geocultural region, as well as anywhere else in the tropical world. The site chosen consisted mainly of abandoned mining land. Thick soil, in some places metres deep, was completely washed to extract the ore, leaving behind large pools of water and areas of sand and silt devoid of top soil. It was in this kind of seriously infertile soil that the planting experiments were conducted. Hence, it was expected that "failures must be the rule rather than the exception" (Anon, 2019, 2020, 2022). The aim was a scientific one, to find out which trees could be grown on a large scale under these severe conditions.

The Western-trained scientists, familiar with temperate reforestation, introduced the concept of planting with nursery-raised seedlings at close spacing to promote vertical growth, followed by thinning several years later to allow for lateral growth. At that time, this was the method applied to normal land but it had never been tested on totally devastated mining land. This was the first time such a method was attempted on devastated mining land. The scientists also introduced the concept of scientific experimentation and documentation. The local staff, especially a group of Malays recruited from Temerloh, Pahang were the first to be brought to the nominated property to contribute their

knowledge of trees and forests in the reforestation effort. They built storehouses for seeds and tools and started the preparation of the nursery (Anon, 2019, 2020, 2022). This East-West interaction resulted in a vibrant research environment. The scientists, unfamiliar with humid tropical forestry, had to innovate a whole new system of forest establishment to overcome problems that were particular to the climate of the wet and humid tropics, where there are no cold or dry seasons and seed production times are completely unpredictable. The pioneers did not know whether the reforestation project would materialise or how long it would take.

One hundred years on, the barren mined land has become a mature forest with a majestic height (30–40 m), five-layered structure (emergent, canopy, understorey, shrub, and ground layers), and biodiversity equivalent to that of a mature natural forest. The initial high rate of tree-mortality was countered by high rate of replanting with a rich diversity of nearly 200 species of indigenous trees; animals moved in from the Bukit Lagong Forest Reserve north of the nominated property and the animals brought in seeds from outside. Humus from leaf litter improved the texture of the soil, and nutrients were restored probably by atmospheric dust washed down by rain. The total number of species of all plants is about 2,300 (Kerishnan & Siba, 2018) of which the number of tree species based on the Field Records and lists of trees in the arboreta, Botanic Gardens, and roadsides, is about 800 species.

For animals, FRIM FPS has documented 233 species of birds, which is about a quarter of the total birds recorded in Peninsular Malaysia. Of mammals, 62 species have been documented including several that are fully protected under the Wildlife Conservation Act 2010. The nominated property is home to 82 species of reptiles, 34 species of amphibians, and 21 species of fresh water fish. FRIM FPS serves as a refuge for 13 Critically Endangered (CR), 25 Endangered (EN), and 35 Vulnerable (VU) species (Yong et al., 2011). The small mammals, birds, reptiles, amphibians, and insects have been in the man-made forest ever since the forest was maturing. They must have been dispersed from the adjacent Bukit Lagong Forest Reserve in search of food and places to rest, nest, and breed. Of particular importance are wild boars which came into the nominated property in search of food (worms) and thereby improved the soil fertility. The primates, notably the pig-tailed macaque (*Macaca nemestrina*) and dusky leaf monkey (*Trachypithecus obscurus*), have long been residents of the nominated property and have become part of the social life.

When seen in a global context, the pioneers' mission to reforest barren mined land in the 1920s was extraordinary and its success was beyond expectation. The only reforestation done during this period was for temperate forests in USA and Europe. There was a dearth of knowledge on tropical forests and the experimentation needed to consider local tropical plant behaviour which the foreign scientists researched with the help of local knowledge.

This successful effort to create a man-made tropical rain forest began in the 1920s with the pioneers' vision and mission that was far ahead of its time. The pioneers' decision to live within the site and establish a live-in community generated the maximum level of interaction between the scientific methodology of the foreign scientists and indigenous knowledge on tropical trees from the local staff. This close interaction together with inspirational leadership and bold pioneering vision contributed to the success of the mission. It increased the knowledge on tropical reforestation in the world.

3.1.c STATEMENT OF INTEGRITY

This nominated property, officially granted by Government in 1925 via Gazette Notification No. 5449 in October 1926, has always been managed by the same research entity currently known as FRIM that pioneered the creation of a man-made tropical rain forest 100 years ago. The resulting cultural landscape is an exceptional testimony to an interchange of human values and of human interaction with the environment. This was made possible by a continuity in mission and site management, the fundamental factors that ensured the protection of the integrity of the site.

The form and structure of the forest and its biodiversity was already apparent in the 1980s and its integrity has been sustained ever since, indicating that it is stable enough in size, structure, and biological composition to resist foreign invasive plants. Its integrity has been maintained over the years, and today the forest structure and biodiversity are equivalent to a natural tropical rain forest. It has attained full natural ecological stability further indicating that the site integrity has not been compromised, and that the 589-ha nominated property is of adequate size to convey its significance as a man-made tropical rain forest.

The nominated property is of adequate size to express its Outstanding Universal Value; has all the necessary attributes intact; has not suffered adverse effects of development; and has a comfortable buffer zone strategically located on the northern border allows for easy access of wildlife. In short, the integrity of the site is intact. The nominated property has been well-protected for almost 100 years. This is largely due to the fact that research and management have always been in the same hands. Thus, site protection has been a priority especially in the last decade during which the site was inscribed as a National Heritage Site. Driving into FRIM FPS today is like entering a different world, a forest with tree-lined avenues, historic buildings with lawns and water bodies. Its mature man-made tropical rain forest is large enough to contain the rich biodiversity of a natural forest, while its historic estate landscape, and its live-in community tradition have all maintained their integrity and will be further discussed in the section below.

3.1.d STATEMENT OF AUTHENTICITY

The forest in FRIM FPS is a man-made forest that without doubt conforms to the structure of a natural tropical lowland rain forest of the Indo-Malay Biogeographic Realm. Tropical rain forests have a specific form and design such as evergreen habit, dominance of broad-leaved plants, and structural stratification into five strata. FRIM FPS fulfils these characteristics of an authentic tropical rain forest. Its present fully restored forest condition is further confirmed by a comparison to existing pristine natural forests in the country, which are commonly known as dipterocarp forests, between sea level and 1,200 meters elevation. Tropical rain forests are further distinguished by their ability to sustain a wide diversity of indigenous wildlife. All these characteristics of a tropical rain forest are clearly visible in the nominated property. Thus, after a hundred years, FRIM FPS is clearly identifiable and equivalent to a natural tropical rain forest based on its form, design, biodiversity, and ecological functions. Like all other natural forests, the forest in FRIM FPS is capable of continuing its growth path with little human intervention.

The establishment of a forest research institute on this experimental site saw the development of buildings for laboratories, administration, accommodation, and community facilities, as well as infrastructure, embedded into the landscape. The entire nominated property was divided into 55 fields to facilitate access to all parts of the nominated property for planting, monitoring, and documentation and these divisions are respected until today as important markers or reference points. The field boundaries and internal roads and pathways have remained

unchanged. So too have the original buildings along tree-lined avenues, integrated with ornamental water bodies and lawns, and accommodation for the live-in staff. They are reminiscent of a pre-war colonial estate ambience that reflects an interchange of foreign and local elements in architecture and landscape design.

The British-Malay rubber estate design layout of the early 20th century has remained unchanged from its beginnings in the 1920s. The features include the tree-lined roads, Administration Building, housing quarters, and water bodies, all enveloped by forests. The main roads were of laterite in the first decade or so and were tarred in the early 1930s. The roads and names have not changed but the now-grown trees have turned the main arteries into shady avenues. The Administration Building, the earliest major building constructed, has its structure and form still intact, and its surrounding environment makes it prominent in the total landscape. The bungalow housing quarters reflect an interesting mixture of local and foreign architectural elements. Thus, the cultural landscape is structurally the same as it was during the pioneer's era, but richer as the forest has matured and there are more small roads branching from the original main roads, and additional buildings have been added to the landscape as the research institution expanded over a century.

The live-in community has continued until today and the internal population has been maintained at about 100–200 families. Also a number of the old houses in the nominated property, mostly wooden, were difficult and expensive to maintain, so they were replaced by apartments. The move from hard-to-maintain wooden houses to modern apartment-style housing began about 20 years ago. It was a move in the right direction as it freed land that could be utilised for planting purposes e.g. an arboretum. Thus, the carrying capacity of the nominated property is kept in equilibrium and the live-in community still plays a role in FRIM FPS in line with its current needs. As the forest is now matured, the role of the live-in community has shifted from one of guarding the site to monitoring and nurturing awareness, while maintaining the ambience of the site. The key spirit of the community's role in nurturing environmental awareness is still observed, and its social hierarchy continues to mirror the organisational hierarchy.

a) **Form and Design:** Tropical rain forests have a specific form and design seen in a suite of characteristics of which the principle ones are evergreen habit, dominance of broadleaved (Angiosperm) plants, structural stratification into five strata, and an ability to sustain a wide diversity of indigenous wildlife. The mature planted forests in FRIM FPS are evergreen and species-rich with broadleaved plants, with five strata structure and a diversity of wildlife. Hence the forests in FRIM FPS fulfill the form and design of tropical rain forest.

   True to its estate setting, the design layout of the nominated property comprised narrow roads, and buildings as workplace and housing. These elements have remained just as it was in the 1930s with the major roads, Jalan Foxworthy and Jalan Jelutong, as the major arteries. Later, other roads were built as extensions from these main roads. The buildings constructed reflect a mixture of foreign and local architectural elements that were sensitive to local wet and humid climate. Their form and design have remained intact. This is especially clear in the Administration Building and Villa Aromatica. The wooden quarters for the labourer level of staff were built as temporary houses in the 1920s and were demolished and rebuilt when necessary. Although the wooden labourer quarters were demolished, there are several well-built timber quarters of the 1960s for the clerical staff that are still in use as these were made of long-lasting wood. These are now 60 years old and may be termed built heritage.

b) **Material and Substance:** The rich species composition of FRIM FPS is equivalent to that of the best of natural tropical rain forests. FRIM FPS is refuge to 13 Critically Endangered (CR), 25 Endangered (EN), and 35 Vulnerable (VU) species of plants. The number of tree species in FRIM, based on the Field Records and lists of trees in the arboreta, Botanic Gardens, and roadsides is about 800 species. FRIM FPS is rich in diversity of microflora especially fungi that forms ectomycorrhiza. This is because dipterocarp trees have been planted throughout the area and dipterocarps have an obligatory symbiotic relationship with ectomycorrhizal fungi. Overall, about 200 species of fungi have been recorded in FRIM FPS.

   The landscape was reminiscent of an estate design layout of a forested area with narrow roads that form the major arteries into the nominated property along which were built heritage, mainly buildings for workplace and housing and some water bodies. The brick housing quarters were bungalows of sizes that reflected the organisational hierarchy. These buildings, built over many

decades beginning in the 1920s by the government arm of construction known as the Public Works Department, record a variety of styles over the century. They reflect a combination of local and foreign elements in architectural design that took the hot and humid climate into consideration.

c) **Use and Function:** In the 100 years since the establishment of FRIM FPS, Kuala Lumpur has grown up right up to FRIM FPS's southern boundary. FRIM FPS is now half surrounded by Greater Kuala Lumpur, making it a highly visible and accessible one-stop centre for a wide range of scientific, landscape, educational, and recreational services associated with trees and forests, in response to public demand. FRIM's core business of forest research has continued and it is currently the body that is monitoring forest health in the nominated property. As a result of its scientific mission, FRIM has a full complement of scientists and engineers available to support FRIM FPS.

   The addition of a Botanic Gardens in 1995 has made the nominated property an attractive place that is educational and much-visited by school children, while the general landscape is popular with joggers and cyclists. Its buildings along the major arteries of narrow roads have been utilised for the purposes they were meant for or as adaptive re-use. In the case of adaptive re-use, the old bungalows which were housing quarters are now used as offices, thereby reducing construction of new buildings. This has freed land area for planting and research purposes. A building kept in use, either its originally intended use or adaptive re-use, will help in conserving the building and extending its life. Generally there has been little change in use and function of the landscape.

d) **Traditions, Techniques and Management System:** At the beginning in the 1920s, the management of the nominated property focused on the experimentation of trees relevant for growing forests. The forests in the nominated property have successfully matured into being equivalent to a natural forest and are now self-sustaining. However, they continue to be monitored and maintained.

e) **Location and Setting:** Originally it took half a day to get from FRIM FPS to Kuala Lumpur by bicycle, which was then the typical mode of transport for most people. Over time, Greater Kuala Lumpur expanded to press against the southern boundary of FRIM FPS. Its visibility has made it more iconic than ever and this gives it an advantage in promoting responsibility for the

environment, respect for scientific inquiry, and an appreciation for its forest setting, sometimes dubbed a forest in the city. The tin mines surrounding the nominated property are no longer visible as the landscape has changed from mining ponds and sandy barren landscape of the pre-war years to one that is very urban with a network of highways, buildings, houses, shops, and hospitals. The nominated property now stands out as a high forest with its southern part bordering an urban housing area, making it appear like a forest in the city.

f) **Spirit and Feeling:** Upon entering the gate of the nominated property, the highways and city feel years away. The rich blend of colonial buildings with wooden Malay-style houses in a forest setting during the pioneers' period can still be seen today. The ambience of the nominated property's colonial past has been preserved. Visitors find it unbelievable when told the nominated property is a man-made forest. The live-in community adds a lively ambience to the site. FRIM FPS projects an attractive spirit and feeling because it has always been open to the public and its community is used to having visitors at all times. This interaction between FRIM FPS and the public at large is quite unusual for a research institution.

In summary, FRIM FPS is a man-made tropical rain forest created on devastated land in a historically unprecedented monumental tropical reforestation effort. It is a surviving example of a British-Malay plantation estate planning of the early 20th century. Little has changed since the pioneers period in the layout design of roads, the form and structure of the historic buildings, and the concept of live-in community. The forest has matured over the years to become the equivalent of a natural forest in its structure and biodiversity, and more buildings have been added as research grew and staff increased. It has remained one of a kind in its unique function as a centre for forestry research that reflects human interaction with the environment in the creation of a man-made forest.

3.1.e PROTECTION AND MANAGEMENT REQUIREMENTS

The FRIM FPS nominated property is owned by government and it has been protected and managed by FRIM, without any deviation from its original mission for almost one hundred years. The mission was to use the nominated property for experiments in reforestation of a devastated land by tin mining and there has never been any deviation from this mission. The Outstanding Universal Value

of the nominated property is the consequence of the success of this mission, carried out through the Great Depression of the 1930s, Japanese Occupation during World War II, post-war British Colonial Restoration, and finally Malaysian Independence. The spirit of scientific inquiry continues to this day and the planted forest has successfully matured to be equivalent to a natural lowland rain forest. This outstanding achievement is the pride of FRIM and of the nation. The boundaries of the nominated property are stable and they are protected sufficiently well by a secure buffer of Bukit Lagong Forest Reserve in the north and by the housing development in the south.

Site protection has been made possible via Gazette Notification No. 5449 in October 1926. More legal instruments have since been established and strengthened FRIM, thereby allowing the pioneers' mission to continue unhindered till today.

Control and management of the nominated property has been exercised effectively, efficiently, and continuously except for a short period during Japanese Occupation when some areas were damaged by wood-cutting and cultivation of food crops. The damaged areas were restored after the war. There has been no external pressure on the nominated property after an attempt in about year 2000 to get part of FRIM FPS excised for an exclusive property development was defeated and aborted. This event strengthened FRIM management even more as additional legal protection has since then been put into place by the grant of a permanent land title in April 2012.

The nominated property was declared a National Heritage on 23 January 2015 and as such it is further protected by the National Heritage Act 2005 (Act 645). The Integrated Conservation Management Plan (ICMP) of FRIM was prepared in fulfilment of the National Heritage Site requirement and came into force in 2020.

The buffer zone of FRIM FPS comes under the local authorities of *Majlis Perbandaran Selayang* (Selayang Municipal Council), and *Dewan Bandaraya Kuala Lumpur* (Kuala Lumpur City Hall), responsible for present and future developments for the area surrounding the nominated property, based on their Local Plans which protect the nominated property. Furthermore, the northern buffer zone, a forested area, is protected by the National Forest Policy 1978 (Amendment 1992) and subsequently the Malaysia Forest Policy 2021 and the

National Forestry Act 1984 (Amendment 1993). The Bukit Lagong Forest Reserve is managed according to the principles of sustainable forestry, which means that the area will remain a habitat for natural forest species and biodiversity, thus enhancing the protection for the Outstanding Universal Value of FRIM FPS.

The three streams that feed the nominated property with water arise in the northern buffer zone in the Bukit Lagong Forest Reserve and are securely protected. The largest stream, Sungai Kroh, feeds water to the municipal water supply of Kuala Lumpur, hence its protection is of great strategic importance to the city's water supply. The protection of the buffer zone also provides a larger territorial range for the wildlife in the nominated property. As for the flora, the existing trees have been producing seeds regularly to fill the ground with seedlings and saplings, hence the forest is self-regenerating and self-sustaining. Alien invasive species of weeds do not penetrate more than a few meters into the existing mature forest because indigenous species have effectively filled all available ecological niches there.

The man-made forest has become self-perpetuating and conserves a cultural landscape of people working and living within the forest they created. The structure of the forest estate layout with its artery of narrow roads linking access to buildings for office, laboratories and housing quarters, and old mining ponds have hardly changed over the years. Wooden houses were not lasting and had to be demolished and rebuilt when and where accommodation was needed. The bungalows and buildings for the work place are intact in their form and structure while some adaptive changes were made to the interior. As more office space was needed, the historic brick housing quarters went through adaptive re-use thereby saving the buildings from demolition and freeing up land space. As new quarters were needed to replace worn down wooden houses for the live-in community, flats were constructed, again saving land area for use as future arboreta. These are all located along narrow roads that have remained intact and not been widened. Instead, smaller roads branch off this old artery of roads adding access to other parts of the nominated property. Despite increase in traffic flow, FRIM has not widened these roads and does not plan to, as it exudes and maintains the old ambience of living and working in a forested area. Many committees are in place to ascertain that the cultural landscape of trees and forest, roads, historic buildings, and community housing are protected and maintained.

Currently, any renovation, building construction, or physical development plans for the nominated property will need to be submitted for careful consideration by a committee made up of the top level of FRIM organisation as well as the Department of National Heritage, Malaysia that inscribed the nominated property as a National Heritage Site. This highest level committee is called the Campus Development and Coordination Committee (*Jawatankuasa Pembangunan dan Penyelarasan Kampus*). The cutting of a tree requires permission from this committee chaired by the Director General of FRIM. The housing concerns of the live-in community that physically occupy the nominated property are looked after by the FRIM Housing Committee (*Jawatankuasa Perumahan FRIM*), while their role in the nominated property in encouraging social and heritage awareness is looked after by the FRIM FPS Heritage Community Committee (*Jawatankuasa Komuniti Warisan FRIM FPS*). Thus, controls are in place to protect the integrity of the nominated property.

The nominated property is protected from trespassers by a secure fence around its boundaries. Woodcutting does not exist in Kuala Lumpur and Selangor due to ample supply of electricity and gas for domestic consumption. Poaching of animals is practically non-existent. There have been cases of adventure-seeking groups cutting their way through the forest without permission but this does not happen often. Selangor is a modern industrial state and Kuala Lumpur is an affluent city. The forests are valued as recreational amenities by the public and this helps to ensure that the Outstanding Universal Value of the nominated property will be safeguarded.

The evolution of the nominated property into a heritage site and visitor destination was gradual and not pre-planned. It has survived well thus far, but the system may come under stress if the visitor load is increased beyond its present numbers and carrying capacity. Areas of concern include the following:

- Soil compaction along the forest trails which could result in the possible death of trees along the trails.
- Traffic congestion due to the narrowness of the historic tree-lined avenues that cannot be widened.
- Inconveniences for research, bearing in mind that the nominated property is the research campus of the national forest research institute of the country.

The construction of elevated walking trails or boardwalks, control of traffic, and restriction of numbers of visitors to sensitive areas will need to be implemented. The present management of the nominated property is in place and will be discussed in monitoring and maintenance (Chapter 6) and detailed in Chapter 5 (Management Strategies and Policies) of Conservation Management Plan (CMP). The draft of the Conservation Management Plan will outline the present system that will be detailed in the final CMP that will be submitted in 2025.

3.2 COMPARATIVE ANALYSIS

FRIM FPS is an outstanding global example of a man-made tropical rain forest. Created on devastated mining land in the early 20th century, it reflects a singular fusion of Western scientific methods with Malay local knowledge and cultural values. The pioneers of FRIM FPS took this transformation effort as a challenge to reforestation at a time when there was little knowledge on tropical rain forests. Much of the scientific knowledge of reforestation was based on temperate zone experiences. It was also a challenge to reforest land that had been devastated by mining, as it had never been done before in the world. Today, after almost 100 years, the mature man-made forest in FRIM FPS has grown to be equivalent to a natural tropical rain forest based on its structure and biodiversity. FRIM FPS is a unique man-made forest environment in which living and working conditions for its staff were established within the site. Living together as a community bonded the staff to a common mission and the sharing of knowledge in the experimentation of growing, monitoring, and maintaining a forest. The infrastructure planning of the site during the British period is reminiscent of a typical rubber estate during the early 20th century. This was seen in the design layout of roads, the location and size of housing quarters based on rank or position, and the arrangement of office and laboratories. This forested landscape is now made up of matured trees that hug the heritage buildings which are of foreign and vernacular styles reflecting an interchange of local and foreign architectural elements. FRIM FPS has influenced the greening of urban landscapes and its forest setting has provided inspiration for contemporary urban landscape design.

In short, the attributes of FRIM FPS that carry the Outstanding Universal Value fulfill the requirements of criteria (ii) and (v), integrity, authenticity, protection, and management of the nominated property. The nominated property can thus be summed up as:

- **A man-made forested landscape created in the early 20th century reflecting a fusion of British scientific methods with Malay local knowledge and cultural values.**

- **An exceptional testimony of the combined works of man and nature in the creation of a mature tropical rain forest on severely devastated mining land.**

The nominated property is a 100-year-old man-made tropical rain forest equivalent to a natural forest created on devastated mined land which also features a major artery of narrow roads for access to the workplace, housing quarters and other facilities, as well as a live-in community of staff that bonded to the mission and played a role in its success. In order to understand the position of the nominated property in the world, there is a need to compare this man-made tropical rain forest with other:

1. Tree plantation sites in the world
2. Man-made tropical rain forest on devastated land
3. Man-made tropical rain forest landscape of comparable cultural values

1. COMPARISON BETWEEN FRIM FPS AND OTHER TREE PLANTATION SITES IN THE WORLD

Globally, reforestation or tree planting activity has taken many forms. This chart (**Figure 3.3**) covers all the major types of global tree planting activities in the world besides man-made forests. These are monoculture tree plantations, major botanic gardens, and tree planting activities in forest research institutes. The nominated property is a man-made forest, different from all the other types of tree plantation site, i.e. monoculture tree plantations, botanic gardens, and tree planting activities in forest research institutes (FRI). However, this comparison is still made here so as to understand man-made forests in the larger context of tree plantation sites in the world.

Monoculture tree plantations are commercial in nature and found all over the world. For example, teak, rubber, eucalypt, acacia, poplar, and pine plantations. They are not man-made forests and do not contribute to the restoration of the natural forests. They are grown for commercial purposes following agricultural principles, one of which is intolerance of other species, which are regarded as weeds. **Botanic gardens** in the world contain *ex-situ* collections of trees and other plants in a garden setting for display and do not contribute to the restoration of natural forest. Such collections are not self-sustaining and self-generating like FRIM FPS. They are therefore not comparable to FRIM FPS, a mature man-made forest. The aim of **forest research institutes (FRIs)** in the tropics has always focused on forest research and management. Unlike FRIM FPS, other FRIs in the

world are not located within their forest experimental site and do not have a live-in community and therefore are not comparable to FRIM FPS. For these reasons, monoculture tree plantations, botanic gardens, and forest research institutes are not comparable to FRIM FPS, a self-sustainable and biodiversity rich man-made forest.

	Category	Site	Remarks
TREE PLANTING SITES	**Monoculture**	**All Over The World**	Countless economic monoculture plantations for the industrial production of economic commodities e.g. teak, rubber, eucalypt, acacia, poplar, and pine plantations. Unlike FRIM FPS that was created for environmental restoration.
	Botanic Garden	**Singapore Botanic Gardens** **Bogor Botanic Garden** **Royal Botanic Gardens, Peradeniya** **National Tropical Botanic Gardens, Hawaii** **Royal Botanic Gardens, Kew** **Arnold Arboretum**	These are among the botanic gardens in the world containing *ex-situ* collections. They are in a garden setting and are not self-sustaining and self-generating. They are therefore not comparable to FRIM FPS, a mature man-made forest that has become self-sustaining and self-generating.
	Forest Research Institutes (FRI)	**Philippine** **Indonesia** **Nigeria** **Malawi** **Tanzania** **Kenya** **Costa Rica** **Panama**	The aims of forest research institutes have always been to "improve" the forest for economic purposes by altering the composition of species to exclude non-economic species. It was never the aim of these FRIs to restore the natural forest. Therefore, it is not comparable to FRIM FPS.

Figure 3.3: FRIM FPS compared to other tree planting sites in the world

Thus, other tree planting sites—monoculture tree plantations, botanic gardens, and forest research institute (FRI)—are not within the scope of comparison to FRIM FPS. They are not mature man-made forests with high biodiversity that are self-sustaining and self-generating. No other tropical FRIs are located in their forest experimental site with their offices, laboratories, and live-in staff existing as a self-contained community in the site.

2. COMPARISON BETWEEN FRIM FPS AND OTHER MAN-MADE FORESTS ON DEVASTATED LAND

Within Malaysia, FRIM FPS is the only example of a man-made forest created on devastated land that has reached the equivalent of a natural forest. There is only one small site, namely FRIM Research Station in Bidor, Perak that is managed with expertise from FRIM since 1996. This site is a project of FRIM and is not comparable to the nominated property on the grounds that it is a relatively recent and minor follow up to FRIM FPS. Thus, FRIM FPS stands out as the only example in Malaysia of a man-made forest created on devastated land that has reached equivalent of a natural forest over a period of a hundred year with a record of scientific documentation.

A survey of all the UNESCO World Heritage Sites, as well as those on its Tentative List and not on the List, shows that there is no site with all the values of FRIM FPS. Tropical rain forests in the geo-cultural region that are inscribed on the World Heritage List are all Natural Sites. Among them are Ujung Kulon National Park, tropical rain forest heritage of Sumatra, Komodo National Park, and Lorentz National Park (Indonesia); Dong Phayayen-Khao Yai Forest Complex, Kalanga Krachan Forest Complex, and Thungyou-Huai Kho-Khaeng Wildlife Sanctuary (Thailand); Phong Nha-Ke Bang National Park, Ha Long Bay, and Trang An Landscape Complex (Vietnam); Mount Hamigutan Range Wildlife Sanctuary, Puerto Princessa Subterranean River National Park, and Tubba Reefs National Park (The Philippines); Sinharaja Forest Reserve and Central Highlands of Sri Lanka (Sri Lanka); Fanjingshan (China); and Kinabalu Park and Gunung Mulu National Park (Malaysia). Most of them are tropical natural forests, a few are limestone hills forest, one is a coral reef, and one an island of komodo dragons. These are all natural forests that exist and evolved in different vegetation types from sea level to the highest mountain in Southeast Asia. However, FRIM FPS is a man-made forest of about 100 years old, whose trees are planted and currently has the biodiversity composition, stand structure and ecological dynamics of a typical lowland natural tropical rain forest in Peninsular Malaysia.

A survey of man-made forest sites on devastated land in the geocultural region of tropical Southeast Asia indicates that there is only one site, the Man-Made Forest of Bilar and Loboc in the Philippines, that may be compared to the nominated property, while within the global tropics, comparison may be made with Tijuca Forest in Rio de Janeiro, Brazil. These two sites, like FRIM FPS, are efforts in the restoration of tropical rain forests. They are compared to FRIM FPS because they are the only other reforestation efforts in the humid tropics.

Out of interest, to place FRIM FPS in a larger global context of reforestation on devastated land that goes beyond the tropics, mention is made of the non-tropical Western Australia Jarrah Forest (Australia) and Saihanba National Forest Park (China), only because they are outstanding reforestation sites in the world. They are not tropical rain forests, and therefore are not comparable to the nominated property.

Category	Site	Degree of Land Devastation	Period	Reforestation Objective	Biogeographic Realm	Forest Type
TROPICAL MAN-MADE FOREST	FRIM FPS, Malaysia	TOTALLY DEVASTATED (Tin Mining)	1920s	Scientific Knowledge in Tropical Reforestation	Indo Malay	Malayan Dipterocarp Forest
	Man-Made Forest of Bilar and Loboc, the Philippines	Not devastated (Slash and Burn Farming)	1960s	Water Shed Restoration	Indo Malay	Philippine Mahogany Forest
	Tijuca Forest, Brazil	Not devastated (Ex-Coffee and Sugarcane Plantation)	1800s		Neotropic	Atlantic Rain Forest
NON-TROPICAL MAN-MADE FOREST	Western Australia Jarrah Forest, Australia	Bauxite Mining	1960s	Restoration of Original Vegetation	Australasia	Jarrah Forest (Dry Temperate)
	Saihanba National Forest Park, China	Desertified Land	1962	Reforestation to Combat Desertification	Palearctic	Temperate East Asia Forest

Figure 3.4: Man-made forests in the humid tropics and temperate zone on devastated land

• **FRIM FPS is an exceptional testimony of the combined works of man and nature in the creation of a mature tropical rain forest on severely devastated mining land.**

These are two sites in the world—namely Man-Made Forest of Bilar and Loboc and Tijuca Forest—which are comparable to FRIM FPS. There are both man-made tropical rain forests created on severely devastated land.

Man-Made Forest of Bilar and Loboc, Bohol (Philippines): Within the same geocultural region as FRIM FPS, located on the island of Bohol in the Philippines, is this man-made forest of 857-ha in size. The forest area covers the hilly land between the towns of Bilar and Loboc that had earlier been cleared for growing subsistence crops through slash-and-burn swidden farming. It was later planted with Philippine Mahogany which is the collective name for various indigenous species of *Shorea* of the plant family Dipterocarpaceae. The planting effort has paid off in terms of restoring the watershed functions of the hills and in improving the attractiveness of Bohol Island for residents and tourists.

Site	Degree of Land Devastation	Period	Reforestation Objective	Biogeographic Realm	Forest Type
FRIM FPS	Tin Mining	1920s till today	Scientific Knowledge in Tropical Reforestation	Indo Malay	Malayan Dipterocarp Forest
Man-Made Forest of Bilar and Loboc	Slash and Burn Farming	a one-off project in the 1960s	Water Shed Restoration	Indo Malay	Philippine Mahogany Forest

Figure 3.5: A comparison between the man-made forest of Bilar and Loboc and FRIM FPS

After 50-60 years, these trees have grown into a dense forest, and is beginning to look like a mature Philippine Mahogany Forest. Man-Made Forest of Bilar and Loboc is an extremely simplified version of tropical rain forest because the trees are all of one genus only and therefore cannot sustain a high level of biodiversity.

Man-Made Forest of Bilar and Loboc and FRIM FPS are located in the same Indo-Malay Biogeographic Realm and that is as far as their similarity goes. Although it is also a man-made tropical rain forest, the trees planted are all of one tree genus and is therefore not comparable to FRIM FPS which has 262 tree genera and a very high level of biodiversity (FRIM Plant Database, 2022).

Man-Made Forest of Bilar and Loboc was reforested on land that had undergone slash-and-burn swidden farming while FRIM FPS was reforested on severely devastated mining land. This makes FRIM FPS the only known reforestation example in the world that has covered the whole distance of biodiversity carrying capacity from mined land to mature tropical rain forest that is equivalent to a natural forest, with its very high level of biodiversity and an incomparable level of tree genera.

Man-Made Forest of Bilar and Loboc was planted on agricultural land that had not been as severely devastated as the mined land of FRIM FPS. The trees planted in Man-Made Forest of Bilar and Loboc are limited to the small number of Philippine Mahagony (*Shorea*) species, just one genus of dipterocarp tree, and some other tree genera available in Man-Made Forest of Bilar and Loboc, whereas FRIM FPS has access to 262 tree genera with hundreds of species of trees from all over Malaysia, thereby providing an extremely rich biodiversity equivalent to a natural tropical forest. Man-Made Forest of Bilar and Loboc and FRIM FPS were created for different purposes—Man-Made Forest of Bilar and Loboc, like Tijuca Forest, was created as a one-off project for watershed restoration while FRIM FPS is an on-going scientifically based research project on tropical reforestation that has a documented record of a hundred years work.

Tijuca Forest, Rio de Janeiro (Brazil):
This man-made forest is part of the World Heritage Site of *Rio de Janeiro Carioca Landscapes (2012)*. Tijuca Forest planting began in about 1844 under Major Manuel Gomez Archer in a watershed restoration project, on land that was relatively fertile and not devastated. By 1857, 100,000 seedlings had been planted with species of trees of the original Atlantic Forests. In 1874–1888 there was another planting effort under the botanist Auguste Glaziou.

Site	Degree of Land Devastation	Period	Reforestation Objective	Biogeographic Realm	Forest Type
FRIM FPS	Tin Mining	1920s till today	Scientific Knowledge in Tropical Reforestation	Indo Malay	Malayan Dipterocarp Forest
Tijuca Forest	Ex Coffee and Sugarcane Plantation	A one-off project in 1840s	Water Shed Restoration	Neotropic	Atlantic Rain Forest

Figure 3.6: A comparison between Tijuca Forest and FRIM FPS

Located in the humid tropics, Tijuca Forest, which covers about 3000-ha, is in the biogeographic realm of the Neotropics, a different biogeographic realm from the nominated property. Tijuca Forest replicates the Atlantic rain forests of the Neotropical Biogeographical Realm while FRIM FPS replicates the Malayan dipterocarp forest of the Indo-Malay Biogeographical Realm. The two biogeographical realms are totally different in its flora and fauna. There is no overlap of species at all.

This man-made forest, which was previously agricultural land, was grown specifically for watershed restoration. In order to safeguard water supplies, the hills of sugar cane and coffee were replaced with the planting of indigenous trees of the Atlantic rain forests—a relatively unchallenging reforestation effort. Tijuca Forest was created on agricultural land while FRIM FPS was created on the worst possible type of devastated land i.e. mining land. FRIM FPS is the only known reforestation example in the world that has covered the whole distance of biodiversity carrying capacity from mined land to mature tropical rain forest.

Tijuca Forest and FRIM FPS were created for different purposes. Tijuca was a one-off project for watershed restoration while FRIM FPS was created to consciously develop scientific knowledge in tropical rain forest reforestation, an effort that went against the current. At that time, forests were being exploited the world over, and only temperate reforestation was beginning to be attempted.

In conclusion, Tijuca Forest was created on agricultural land while FRIM FPS was created on devastated mined land. FRIM FPS is the only reforestation site in the world that has achieved a high biodiversity composition in the shortest time under severe infertile soil condition. Tijuca forest and FRIM FPS are from different biogeographic realms with no similarities in fauna and flora. Thus, FRIM FPS and Tijuca Forest each plays a significant and complementary role in protecting the biodiversity of the world. Also, Tijuca was planted specifically for a watershed project, while FRIM FPS was a long-term experiment in tropical reforestation which raised the level of knowledge on tropical reforestation. This made reforestation an option, a healing process at a time when the norm was to deforest and abandon. FRIM FPS successfully raised the level of knowledge on tropical reforestation from rudimentary in a matter of decades.

However, in order to place FRIM FPS in a global context of reforestation on devastated site, the Reforested Bauxite Land in Western Australia and Saihanba National Forest Park in China are briefly discussed below because they are significant reforestation sites in the world. Neither is currently on the World Heritage Sites List nor on the Tentative List.

Western Australia Jarrah Forest (Australia): NON-TROPICAL AND NOT A RAIN FOREST

After FRIM FPS, the next success story of reforestation of mined land took place almost half a century later in the 1960s, in Western Australia Jarrah Forest. This was land devastated by bauxite mining and planted with trees of *Eucalyptus marginata*, a temperate dry climate species, using modern deep soil ripping machinery. This site differs from FRIM FPS in that it is a dry temperate area and the forest is dominated by Jarrah (*Eucalyptus marginata*), a non-tropical forest species.

Saihanba National Forest Park (China): NON-TROPICAL AND NOT A RAIN FOREST

The Saihanba National Forest Park, a massive area of 200 square kilometres in north-eastern China, is an example of rehabilitation of land that had been degraded through desertification. The area is now reforested mainly with non-tropical (Paleoarctic) species of larch and birch. Although Saihanba National Forest Park is a man-made forest, it cannot be compared to FRIM FPS which is a tropical rain forest, while Saihanba National Forest Park is located in an arid temperate zone.

In conclusion, Man-Made Forest of Bilar and Loboc and Tijuca Forest are the only reforested tropical rain forest sites in the world comparable to FRIM FPS.

- **Man-Made Forest of Bilar and Loboc and Tijuca Forest were created for the immediate purpose of watershed restoration while FRIM FPS was created for scientific knowledge on tropical reforestation. Thus, while FRIM FPS had a long-term and continuing mission to create knowledge on tropical reforestation, Man-Made Forest of Bilar and Loboc and Tijuca Forest fulfilled their immediate functional objective for watershed restoration in a relatively short time.**

- **Man-Made Forest of Bilar and Loboc and Tijuca Forest were created on agricultural land. FRIM FPS on the other hand was created on the worst possible type of devastated land i.e. mined land.**

- **Although Man-Made Forest of Bilar and Loboc is in the same Indo-Malay Biogeographical Realm as FRIM FPS, it has a very much lower biodiversity than FRIM FPS. Tijuca Forest on the other hand is in the Neotropic Biogeographic Realm and has different fauna and flora. However, each plays a significant and complementary role in protecting the biodiversity of the world.**

Thus, FRIM FPS is an exceptional testimony as the only mature man-made tropical rain forest created on originally tropical rain forest land that had been irreversibly changed by mining.

3. COMPARISON BETWEEN FRIM FPS AND OTHER MAN-MADE TROPICAL RAIN FOREST LANDSCAPE OF COMPARABLE CULTURAL VALUES

We have seen that Man-Made Forest of Bilar and Loboc and Tijuca Forest are the only man-made tropical rain forest sites in the world that are comparable to FRIM FPS (**Figure 3.5, Figure 3.6**). However, the history of Man-Made Forest of Bilar and Loboc and Tijuca Forest shows there is no *in-situ* population involved in the planting of the trees for watershed protection. FRIM FPS on the other hand, is a living landscape of forests, man, and buildings that reflect an interchange of foreign and local values in architecture and landscape design.

Man-Made Forest of Bilar and Loboc and Tijuca Forest are forests but FRIM FPS is much more than a forest. It is a magnificent forest integrated with the community that creates and maintains it, within a historic British-Malay estate setting that has resulted from interchange of foreign and local values in architecture and landscape design.

- **A man-made forested landscape created in the early 20th century reflecting a fusion of British scientific with Malay local knowledge and cultural values.**

Site	Design Layout	Historic Buildings	Live-In Community
FRIM FPS	Forest estate	Foreign and local values in architecture	Harmonious mix of live-in community
Man-Made Forest of Bilar and Loboc	Watershed protection	No historic buildings	Not inhabited
Tijuca Forest	Watershed protection	No historic buildings	Not inhabited

Figure 3.7: Cultural landscape

The forest landscape of FRIM FPS is the result of the integration of a work environment (offices and laboratories) with a live-in community within a landscape that reflects an interchange of British colonial and local ideas as seen in the architecture and the layout avenues, buildings, and water bodies embedded in a man-made forest. This can be seen through the presence of British architecture and landscape design modified and implanted in a local Malay setting. Both Man-Made Forest of Bilar and Loboc and Tijuca Forest were planted as a project to cover a watershed area. The sites were then left to function as a watershed protection area, without need for permanent buildings and continuous occupation.

FRIM FPS is the only tropical reforestation site where it was a long-term project, a mission of forest research institute. The staff lived within the research site, allowing for close interaction between man and environment in their effort to create a forest. This live-in community feature encouraged cultural assimilation between Western scientists and local staff where the organisational hierarchy spilled into the social realm. An unusual informal social structure evolved, where the foreign pioneers who headed the organisation played the role of a village

head just like in a typical Malay *kampung* (village). This, together with the racial harmony present among the local staff, bound them together and helped towards realising the impossible mission.

Man-Made Forest of Bilar and Loboc and Tijuca Forests were watershed projects, while FRIM FPS was a long-term experiment in creating a tropical rain forest that resulted in a clearly defined landscape, designed and created intentionally by a live-in community of scientists and local staff, reflecting the combined works of man and nature.

CONCLUSION

The comparative study clearly shows that the values of FRIM FPS are totally without precedent in the country, region, and world. Thus, as the only mature man-made forest on devastated mining land, conserving a cultural landscape that reflected an interchange of values and cultural assimilation, the nominated property fills a gap in the World Heritage List. There is also no site representing a man-made tropical rain forest cultural landscape thus far.

Man-Made Forest of Bilar and Loboc and Tijuca Forest are similar to the nominated property only as far as they were reforestation efforts of tropical rain forest. They were one-off projects for watershed protection while FRIM FPS is an on-going long term experiment in the creation, protection, and maintenance of a forest on devastated land with an infrastructure for living and working on site. The estate layout of FRIM FPS is reminiscent of a British-Malay estate and this living-working environment with a colonial ambience has remained as it was.

FRIM FPS is the earliest successful effort in the world in the restoration of tropical rain forest on totally devastated land, demonstrating that such land anywhere can be rehabilitated to restore its original environmental value. FRIM FPS's reforestation success shows that the creation of a man-made forest to restore biodiversity and reduce the impact of climate change is possible even under the worst of circumstances.

3.3 DRAFT STATEMENT OF OUTSTANDING UNIVERSAL VALUE

Brief Synthesis—Located on the outskirts of the capital city of Kuala Lumpur, Malaysia, FRIM FPS is a 589-ha nominated property dominated by a man-made tropical rain forest with the multi-storied structure and the rich biodiversity of a matured natural forest. FRIM FPS conserves a cultural landscape that reflects a fusion of British and local knowledge and cultural values in the creation of an extraordinary scientific feat in tropical reforestation, initiated about 100 years ago, on land that had been made barren through tin mining. This is the first ever documented initiative in the world of the rehabilitation of mined land back to a lush and productive tropical rain forest.

This site had been deliberately selected to provide a challenge for tropical rain forest research which was then at a rudimentary level. The implementation of the pioneers' extraordinary vision of creating a forest was carried out simultaneously with the establishment of a forest research institute, its infrastructure, and a community of live-in staff and their families. This resulted in a cultural landscape reminiscent of a British-Malay plantation estate, made up of a community working and living in the forested environment they were creating, embedded with buildings, water bodies, and narrow roads that followed the natural contours of the land. The structure of this cultural landscape has remained intact. It is a living monument and an exceptional testimony of the combined works of man and nature, exhibiting an interchange of human values.

Criterion (ii)—The man-made forest conserves a cultural landscape created around the late 1920s when its historic buildings, avenues, and water bodies were designed. This landscape shows an interchange of ideas between British colonial and local elements, seen in the architectural style and landscape design modified and implanted in a local Malay setting. This site is reminiscent of a British-Malay estate where living spaces were carved out in the deep forested parts of the country. In the case of FRIM FPS, its living spaces were implanted amidst a growing man-made forest. They shared values of the period in their layout design, architecture, and meaning. However, the rubber estates have all been subjected to redevelopment, with FRIM FPS the only site that has remained intact and true to its original design.

This forested landscape integrates working and living facilities such as offices, laboratories and housing quarters, making FRIM FPS the only tropical forest research institute with its staff and office on site. This created close interaction

among staff especially between foreign and local staff, resulting in an informal social structure that paralleled the formal organisational structure. This living-working forest environment has inspired tropical landscape design aimed at living close to nature.

Criterion (v)—FRIM FPS bears an exceptional testimony to a mature tropical rain forest created on land that had been irreversibly changed by mining. This man-made forest was created at a time when reforestation was not a norm and there was no knowledge on tropical rain forest restoration. This 100-year-old site stands out as the earliest reforestation of a tropical rain forest on a totally devastated mined land, and it was human scientific intervention that achieved maximum forest structure and biodiversity carrying capacity within a short time.

This man-made forest was created through experimentation over a period of several decades. There were no machinery or chemicals, just human effort against a very inhospitable environment, the success of which was uncertain. This restoration or reforestation effort resulted in a double feat. It was a successful benchmark restoration of a natural tropical rain forest before there was any interest in such a reforestation. It was achieved on the most degraded of mining lands before there was any environmental pressure to heal such land, thus raising the level of knowledge on tropical forestry from rudimentary to advanced in just a few decades.

Integrity—The man-made forest in FRIM FPS has matured and is able to reproduce and regenerate like a natural forest. The size of the nominated property (589-ha) is sufficient to minimise the intrusion of detrimental effects from its edges. The cultural landscape comprising the man-made forest, historic estate layout of the artery of roads and avenues, ponds and lakes as remnants of tin mining activities, and buildings for offices, laboratories, and housing quarters are all intact and have been maintained to preserve the original ambience of the nominated property. The key spirit and ambience of the site has been derived from the presence of the community, and its role in nurturing environmental awareness and its social hierarchy that paralleled with the organisational hierarchy is still observed. The live-in staff has been maintained at 100–200 families, ensuring that the carrying capacity, sustainability, and ambience of the nominated site are maintained. The nominated property has always been managed by the same organisation, i.e. FRIM, and this has ensured its continuity, sustainability, and protection.

Authenticity—The characteristic form and design of a natural tropical rain forest is clearly visible in FRIM FPS's man-made forest, making it an authentic tropical rain forest. This is evidenced by its evergreen habit, dominance of broad-leaved plants, and structural stratification into five strata consisting of emergent, main canopy, understorey, shrub, and ground strata. FRIM FPS is further distinguished by its ability to sustain a wide diversity of indigenous wildlife and to provide the full ecosystem services of a tropical rain forest. Its use and function as a forest research institute with a mission to create a man-made forest has continued from the beginning without interruption and in less than a hundred years, FRIM FPS has clearly succeeded to be equivalent to a natural forest. The historic estate layout with its narrow roads, historic buildings embedded in the man-made forest, and mining ponds and lakes, as well as its live-in community tradition, are all still present. The authenticity of the nominated property has been well maintained although the city of Kuala Lumpur has expanded right up to its southern boundary. Upon entering the nominated property one experiences an abrupt change of ambience from a busy city to a placid forest estate. The Outstanding Universal Value of the nominated property will continue to grow because of its special significance and rarity in the modern world.

Protection and Management Requirements—The values of the FRIM FPS nominated property has been protected and managed without any deviation from its original mission for almost one hundred years. The boundaries of the nominated property are stable, and it is protected sufficiently by a secure buffer that guards its biodiversity and its site values. Protection has been made possible by forest research institute having control of the nominated property following the official Gazette Notification No. 5449 in October 1926. This status has remained until today, and it has been further strengthened by more legal instruments, thereby allowing the pioneers' mission to continue unhindered until the present.

Many committees at various levels are in place to ascertain that the cultural landscape of trees and forest, roads and avenues, historic buildings, and housing quarters are protected and maintained. Currently, all physical development plans have to be submitted for careful consideration by a top-level committee of FRIM and the Department of National Heritage, Malaysia. Challenges such as environmental pressures, human threats, and physical infrastructure are not major issues and are dealt with in the CMP to ensure that the site is managed well with sustainable guidelines.

CHAPTER 4

STATE OF CONSERVATION AND FACTORS AFFECTING THE NOMINATED PROPERTY

4.a Present State of Conservation

4.b Factors Affecting the Nominated Property

(i) Development Pressures and Management Response

(ii) Environmental Pressures, Natural Disasters and Risk Preparedness

(iii) Visitation, Other Human Activities and Sustainable Use

4.a PRESENT STATE OF CONSERVATION

This section discusses the present state of conservation of the nominated property of FRIM FPS and provides the baseline data necessary to monitor the state of protection and conservation of FRIM FPS in the future. Information is provided on the physical condition of the nominated property and any possible factors and potential threats to its Outstanding Universal Value.

The key attributes that give FRIM FPS its Outstanding Universal Value are the mature man-made tropical lowland rain forest, historic estate layout, and its live-in community (**Figure 4.1**). All these three attributes were established around the same time, circa 1926–1930. Hence, the historic estate layout is about the same age as the now mature man-made forests and the concept of the live-in community. After World War II, new buildings and research support facilities were fitted within the spaces in the maturing forests. The surroundings of the buildings were immediately planted with indigenous trees, giving the nominated property an evolving landscape manifesting the interaction of humankind and its natural environment. As the forest is still growing and the landscape is still evolving, it is to be expected that the physical appearance and the monitoring and conservation needs of the trees or forest would also change. However, it is important that the integrity and authenticity of the attributes remain and are preserved so that the Outstanding Universal Value is protected.

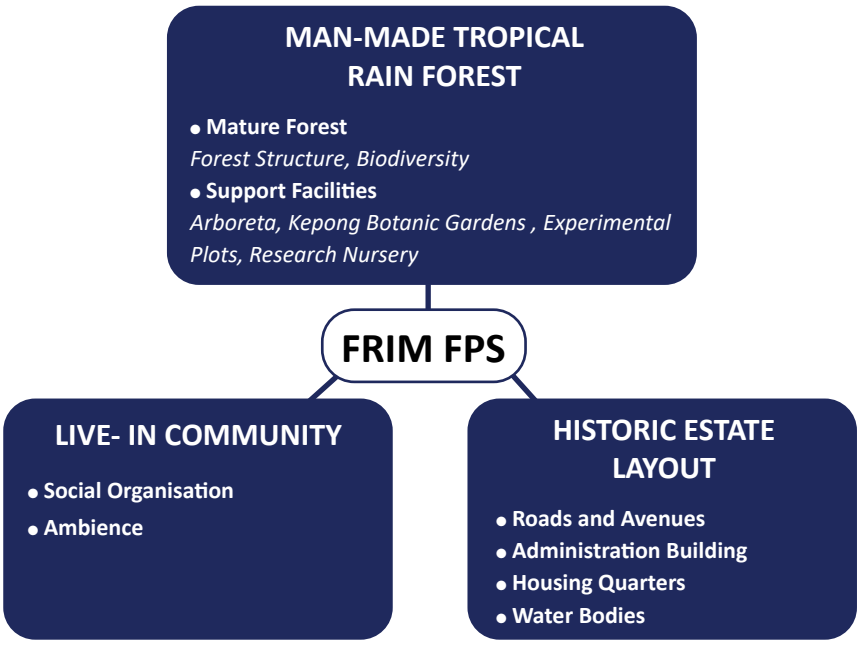


Figure 4.1: The FRIM FPS nominated property attributes

4.a (i) MAN-MADE TROPICAL RAIN FOREST

The man-made tropical rain forest of FRIM FPS has now reached a state of a **MATURE FOREST** that is self-sustaining and self-rejuvenating because the trees produce seeds regularly. Mature tropical rain forests are the most stable of biological communities in the tropics. After a seeding event, there are abundant seedlings and saplings on the forest floor that allow for the natural regeneration of the forest. This matured forest is a monument to FRIM FPS's historic feat in tropical reforestation on barren land, accomplished long before any other equivalent effort in the world.

Monitoring and maintenance of the forest is being conducted for research purposes. FRIM FPS has reached the stage of a natural forest, and like a natural forest, natural processes occur to maintain its health and stability. The creation of forest gaps is necessary for the growth of young trees. Gaps are created by lightning strikes and windthrows.

Tall trees have a higher probability of attracting lightning, and old trees are more likely to have hollow hearts that make them more susceptible to breakage in a storm. Cases of sudden destruction of trees are sporadic and randomly spaced, creating gaps for new seedlings and saplings to grow, thus creating a vigorous forest of trees of different ages.

Forest gaps are cleaned up by cutting and removing fallen tree trunks. Seedlings are planted if necessary to expedite gap-repair. This routine activity is managed by the ground staff. There is continuous natural culling of weak seedlings, saplings, and trees by fungi and insects which attract little attention because the great diversity of species of plants, fungi, and insects prevents any particular natural event from becoming dominant and unsightly.

However the forest needs to be protected from soil compaction caused by heavy visitor traffic, as seen in the FRIM Canopy Walkway and the Keruing Trail.

Among the **SUPPORT FACILITIES** associated with the man-made forest are the **Arboreta** established by the pioneers to serve as places for demonstration and education. In the arboreta, a large number of different species are concentrated for display within compact areas. Each species is represented by a small number of labelled specimens, planted in lines for easy location. The ground is kept free of undergrowth except for lawn grass, to facilitate viewing of the trees. The arboreta are enriched by specimens of new species as and when available. There are currently four major arboreta, for different types of trees: the Dipterocarp Arboretum and the Non-dipterocarp Arboretum established in the 1920s and 1930s by the pioneers; the Coniferetum established in 1949; and the Fruit Tree Arboretum in the 1970s. An arboretum needs to be actively rejuvenated by continuous introduction of young specimen trees.

Kepong Botanic Gardens complements the rest of the nominated property in which the focus of attention is on trees. This botanic gardens houses several thematic and specialised small gardens featuring the tropical plant families such as gingers, aroids, pitcher plants, and palms. Currently, Kepong Botanic Gardens showcases more than 580 species of plants (Kerishnan & Siba, 2018) including species that have been categorised by the International Union for Conservation of Nature (IUCN) Red Data List as rare, endemic, and vulnerable. The introduction of more non-trees, especially the monocotyledons, into the Kepong Botanic Gardens would enhance the scientific value of the nominated property.

The botanic gardens plays an important role in protecting the man-made old forest by channeling most visitors away from the historically important old forest. Activities in the Kepong Botanic Gardens area, such as the FRIM Forest Skywalk overlooking the city of Kuala Lumpur entice FRIM FPS visitors away from the mature forests and the research and administration area known as the main campus.

Experimental Plots are located in Bukit Hari, in about 75-ha area of the nominated property. Currently there are more than 30 tree species of economic importance planted in the area for research. Each plot contains between 53 to 800 individual trees. The plots may be recycled for new experiments. The experimental plots have been well-maintained and well-managed. The experiments are rotated in a cycle of 20–30 years depending on the tree species and objectives of the experiments.

The **Research Nursery** has grown from one nursery during the pre-war growing years to four nurseries now that cater to research and commercial needs. FRIM FPS's forest growing success has inspired government agencies, public universities, and property developers to reforest and green the environment of new townships and housing estates. Thus, the plant nursery has played a role in knowledge transfer of local indigenous tree species to local consumers for nearly a century.

Key Elements	Present State	Threats	Current Status
MATURE FOREST			
1) Forest Structure	The structure of the forest has attained the five-layered structure, with occasional emergent individuals, similar to the natural lowland forests of the country.	Tree deaths occur sporadically due to lightning strikes and storm damage. These gaps are random and they get filled by juvenile trees. Gap formation and regrowth are parts of the natural rejuvenation process by which natural forests are sustained in perpetuity.	Forest gaps are cleaned up promptly; the logs are removed, and saplings are planted if necessary to expedite filling of the gaps.
2) Biodiversity	The nominated property was initially planted with nearly 200 species of trees but since then, there has been natural influx of plants and animals from the adjoining Bukit Lagong Forest Reserve. The number of species of trees exceeds that of Bukit Lagong Forest Reserve because of deliberate introduction of trees from all over the country.	There is no systemic threat to any species. Individual trees may be threatened by soil compaction due to visitor traffic. Poaching of wildlife is almost unknown.	Records of species are maintained by the botanists and zoologists in the Forest Biodiversity Division of FRIM FPS. Any unusual threats observed would be acted upon.

Key Elements	Present State	Threats	Current Status
SUPPORT FACILITIES			
3) Arboreta	The specimen trees are mostly mature.	Unlike a forest, an arboretum does not rejuvenate itself. An active programme of replanting is needed.	Planting of young trees and increasing the range of species by targeted introductions.
4) Kepong Botanic Gardens	The botanic gardens complements the trees in the nominated property by catering for non-trees such as palms, gingers, climbing plants, flowering shrubs, and herbaceous plants. The gardens is important for dispersing visitors away from the historically important mature forests. The hugely popular skywalk overlooking the city of Kuala Lumpur is located in the botanic gardens.	The gardens can be improved by shaping and rejuvenating plants and introducing a greater variety of endangered, rare, and threatened species.	Maintaining standards of horticulture and display of plants.
5) Experimental Plots	The trials support research on species of special economic interest. The oldest plots are 40 years old.	There are no particular threats.	On-going experiments.
6) Research Nursery	Provides planting materials to cater for continued replacement planting within FRIM FPS as well as reforestation and greening of urban areas, and for research.	There are no particular threats.	Continuous restocking to meet research and urban planting demands.

Figure 4.2: State of conservation of man-made forests in the nominated property

4.a (ii) HISTORIC ESTATE LAYOUT

The pioneers' decision to establish a forest research institute where all the staff worked and lived as a community within the research site determined the infrastructure required in the spatial planning of the site, which took on an estate design layout that is reminiscent of the rubber estates of early 20th century British-Malaya. The key elements of this historic estate layout are its network of roads, forest trails and rover tracks, and the range of houses built over a period of 100 years that serve as a record of the history of housing architecture in the country. The estate layout of the nominated property also took into consideration the location of the water bodies such as ponds and lakes and the fields of forest trees being established all over the nominated property. The historic layout has remained intact over the years.

The **ROADS AND AVENUES** built in the 1920s linking the housing, administration, nursery, and community facilities have not changed over the years. There has been no road widening and the roadside trees along the major arteries of Jalan Foxworthy and Jalan Jelutong that were planted in 1928 have now turned the roads into shaded avenues. The trees along Jalan Foxworthy and Jalan Jelutong have matured over the decades, adding to the forest ambience of the nominated property. These trees define the width of the road as any road widening would necessarily involve tree-cutting, but FRIM FPS is averse to this and any changes to the colonial ambience of the site. The narrow, curved, and tree-lined avenues have to be protected and maintained. Trees along the avenues are kept under surveillance, especially to ensure the removal of hazardous branches. Young trees should be interplanted with the old trees in the future.

The **ADMINISTRATION BUILDING** currently houses the Office of the Director General, the administration and finance offices, and a Research Gallery. It is located at the heart of FRIM FPS on Jalan Foxworthy and has retained its imposing character, original footprint, proportions, and layout with minimum alteration to the historical character of the site. During the 1960s, a new office annex block was added to the rear of the main building. The roof profile and structure is intact and covered with Marseille tiles of various brands and ages, mostly from French and Indian manufacturers. The significant Art-Deco features on the building façade and entrance porch remain very much intact and well-preserved. The timber double casement windows and doors remain in their original locations, with some having been thoughtfully refurbished due to past decay and termite infestation. The internal layout of the major space has largely remained intact with minor expansion into the veranda space on the upper floor

during the 1980s. Rising damp and fungus stains are notable on the façade and there are areas where trees are encroaching on the building. These issues are currently being addressed and are in the process of rectification.

The pioneers planned that all the staff would work and live as a community within the site. They made room for housing quarters which were of different typologies, size, and location, just like the rubber estates of the period where size and location reflected the management hierarchy. These houses are intact except for the wooden houses for the workers which were not built to last and which have now been demolished. Today, all the historic bungalows and semi-detached houses are all still intact together with the newer stronger wooden houses that are currently occupied by the support staff. However, the historic brick houses have now been turned into offices and this adaptive reuse has reduced development while preserving these old buildings. Adapting to changes in the growth of the research institution and to government housing policies that began in the 1970s, the housing quarters went through some changes. Staff were allowed to take housing loans and live outside the site. Only a few bungalows and semi-detached houses are now used as quarters and apartments have become an option. The live-in population, however, has remained at 100–200 families thus maintaining the community strength.

Currently, there are three significant historic buildings that will be conserved as a record of the major types of **HOUSING QUARTERS.** These are Villa Aromatica, a bungalow, originally built for the head of the research institute; one of the semi-detached quarters; and a detached timber house that is representative of wooden quarters. New accommodation is now provided in the form of an apartment building, called Meranti Quarters, located at the north-eastern edge of the nominated property. There are many small wooden houses that are so worn out that they are inhabitable and ready to be demolished. The demolition of old houses will free up land for an arboretum.

Villa Aromatica (JKR501), located on a hill at the end of Jalan Watson, is the largest housing quarters. It was designated as a bungalow for the head of the institute and last occupied in 1995. The main building, servant and staff quarters, its compound, external features, and landscape are all well-maintained and remain in good condition. The roof structure and profile remain largely intact with French Marseilles tiles. During World War II, the building suffered substantial damage when it was unoccupied. Repair was made after the war (The

Straits Times, August 19, 1946) but the subsequent renovation did not change the architectural layout and form of the building. Today, the building caters for private functions and events by FRIM FPS.

Semi-Detached Quarters (JKR503), located along one of the earliest roads in FRIM FPS, Jalan Jelutong are the brick semi-detached quarters comprising a pair of houses where the party-wall is shared. The building roof profile remains in good condition and is covered with Marseilles tiles of various ages and manufacturers. The large feature window as well as other internal windows have remained intact. The semi-detached quarters have been adapted into office space with minimal intervention to the original wall structure. The original terracotta flooring has been covered with new modern tiles. The presence of rising damp on the building wall is rather severe due to an unattended drainage system, low ground platform, and damp proof course that has not worked over the years. However, these issues are currently being addressed. The general condition of the building is good.

The Detached Timber Quarters (FRIM328) are located along Lorong Kapur, off Jalan Kapur, which is an extension of the historic Jalan Jelutong. These timber quarters were the first commercial timber housing constructed with treated Malaysian timber. These houses are built on stilts of Balau and Kempas, with Meranti flooring, and louvre windows are among its features. In the last decade, some of the timber structures began to decay, and they have been replaced with reinforced concrete in order to prolong the life of the original building and also to avoid further timber decay. Currently, the overall condition of the timber quarters is good, with all the original windows and doors intact and well-maintained. Adjacent to this unit are many other units that are also intact and in good condition.

Interspersed in the landscape and of ornamental value are **WATER BODIES**, which include a lake, several small ponds and three natural streams, and some patches of wetland. The wetlands are remnants of the previous mining activities. The largest of these water bodies is the 4-ha lake in the Kepong Botanic Gardens. Currently, it is maintained and managed by the staff but it is minimally threatened by sedimentation and erosion at the edges. Efforts must be taken to address these continuous natural processes. The smaller ponds near the mosque and the Administration Building are threatened by sedimentation and contamination. There is a need to counter natural sedimentation and contamination.

The three main streams that originated at the ridges of Bukit Lagong Forest Reserve and flowed into the nominated property have also changed over time. Originally they were wider and deeper, and currently they are shallower and narrower depending on seasonal rainfall. They are also threatened by sedimentation and encroachment of low riparian vegetation. Steps have been taken to improve the water quality of all the existing water bodies and the surrounding landscape so as to retain the original ambience. There is only one small area of wetland left, next to the Fruit Tree Arboretum, and this attracts water birds. The wetland does not have a defined boundary. Its size varies with the amount of rainfall that flows into it. Wetlands serve as water retention areas in wet weather.

Thus, the historic estate layout of the forested nominated property, with its key elements of roads and avenues, Administration Building, housing quarters, and water bodies have remained intact in form, as the planted forest has grown all around them. This is a tangible representation of the living and working environment that was designed almost a century ago remaining basically intact, save for changes that are in line with the original mission i.e. a scientific experiment in reforestation, as well as environmental conservation, of which FRIM FPS was one of the earliest proponents in the country. The historic buildings have maintained their integrity in form despite several necessary post-war renovations, but they are in need of conservation and this will be addressed in the Conservation Management Plan (CMP).

The roads and avenues lined by matured trees have remained as they were. There have been no attempts to widen the roads. Thus, the historic estate layout comprising roads and avenues, the administration building, housing quarters, and water bodies that forms an important part of the cultural landscape of FRIM FPS has remained intact.

Key Elements	Present State	Threats	Current Status
1) Roads and Avenues	The main roads are tree-lined avenues that are well-maintained. The avenue trees define the width of the roads and provide a cool attractive environment for recreational walking and jogging. They are important components of the historic estate layout of the nominated property.	There has been a slow loss of avenue trees from year to year due to natural causes and these have been replaced.	These roads and avenues are still the main arteries leading to the main activity areas in the nominated property.
2) Administration Building	This imposing building continues to dominate the nominated property as a central building in FRIM FPS. It is an Art-Deco building with local Malay vernacular elements, a large front lawn, and surrounded by majestic trees.	Being in a humid tropical climate, there is a constant threat of dampness and the conservation issues related to humidity. However, the building is structurally sound and with good bones.	The building is fully utilised by the office of the Director General, the administrative division, and the Research Gallery. This building is currently undergoing conservation work.
3) Housing Quarters	Villa Aromatica (JKR501), the most prestigious residence in the nominated property, is currently used for social functions. Semi-detached house (JKR503): this was the originally the housing quarters of the intermediate local staff. It has gone through adaptive reuse and is now used as an office. Detached timber quarters (FRIM328): built in the 1960s for the support staff. It was built to promote the use of timber houses using local materials.	The housing quarters need regular maintenance as they faced normal threats of a humid tropical climate.	Villa Aromatica has not been used since the outbreak of COVID in March 2020. The semi-detached house used as an office is in good condition. FRIM328 is still occupied by support staff and remained in good condition.

Key Elements	Present State	Threats	Current Status
4) Water Bodies	The water bodies are three small streams that flow through the nominated property, ponds of various sizes, and a lake. The ponds and lake were originally wetlands created by removal of tin-bearing soils. The lake and ponds have been stabilised with well-defined and firm margins.	Recreational fishing, once tolerated, is no longer allowed. Sedimentation, algae and pollution of the ponds are issues that have to be constantly monitored.	The ponds are periodically cleaned up and refilled with water. The other water bodies are relatively free of problems.

Figure 4.3: State of conservation of historic estate layout—main artery of roads and avenues, Administration Building, selected housing quarters and water bodies

4.a (iii) LIVE-IN COMMUNITY

FRIM FPS's live-in community is a unique feature of the nominated property not found in any other tropical reforestation site in the world. The pioneers decided that all the staff and their families should live and work together on the site as a community. This resulted in an incredible degree of bonding among FRIM FPS staff towards its mission, while it created a harmonious living environment within the forest they were creating. Although the live-in community concept is close to 100 years old, it lives on with relevant modifications through the years till today.

The live-in community comprising local and foreign staff were housed in separate areas of the man-made forest and in houses that were built in different architectural styles. There were three housing typologies, namely bungalow, semi-detached, and vernacular style wooden houses representing the organisational hierarchy as reflected in housing quarters. Together with the Administration Building, they exhibit an interchange of foreign and local values in architecture. Today, the live-in community has remained the same in its population size, and most of them live in apartment blocks that have now freed precious land that could be used for arboreta.

The live-in community currently consists of staff of FRIM and a small number of staff from the water utility department, as well as staff of the Training Division of the Forestry Department. Although they are not from FRIM, they are all government staff and have integrated into the FRIM FPS community and together they form the 100–200 live-in families. Their presence helps provide security

for the nominated property which would otherwise have to employ an army of security guards to keep watch on everything. They keep alive all the community amenities that have been established including the primary school, the mosque, the clubhouse, kindergarten, cafeteria, and sporting facilities, thereby continuing the original ambience of the nominated property as a living community within a forested environment. This community of people of various ages from young children to adults gives the nominated property a vibrant ambience that had been present for almost a century, a living environment within the forest, a meeting of man and nature.

The current state of conservation of the live-in community are adaptations to the present needs of the forest at its present stage of growth. While the community remains the eyes and ears of the happenings in the forest property, they no longer need to watch over the planting of trees as they did in the early years because the trees have matured. With planting completed, the emphasis has shifted to conservation of the forest and other areas of forestry research. However, the community still monitors the forest for any threats from man or nature. This original role has continued until today, despite a change in configuration of the live-in staff, where in the last few decades, the head of FRIM FPS and some of the staff live outside the nominated property. However, the head of FRIM FPS still plays his role as the “headman” of those who live in the nominated property. He and the senior staff still continue to officiate social and religious functions of the community. The vacated living quarters have been put to good use as function and office space, thereby reducing new development on the land. Modern apartment blocks located on the edge of the nominated property have replaced many of the wooden houses of the past that could no longer be rehabilitated.

In line with the previous roles of the live-in community are activities such as planting that have now taken on a new slant fitting in with current conservation awareness and greening effort. The Green Community Programme has developed interest groups such as Junior BioD Rangers and Go Green FRIM who informally continue the planting of trees (as the 1920s community did) through its seed collection and planting project. The forests are now mature and abundant seeds are shed; these are gathered and prepared for planting. The mature forest also lends itself to *kelulut* (stingless bee) honey production. It is planned that the live-in community activities such as these will be expanded to the larger population, making them a catalyst for conservation awareness, just like FRIM FPS’s reforestation mission in the 1920s was also a precursor to conservation interests in the country.

In order to ensure that the live-in community maintains its integrity, several committees have been established. A heritage community committee known as *Jawatankuasa Komuniti Warisan FRIM FPS* oversees the needs of the community. Housing concerns of the live-in community that physically occupy the nominated property are looked after by the FRIM Housing Committee (*Jawatankuasa Perumahan FRIM*), Thus, controls are in place to protect the integrity of the site. Any modification made to the live-in community tradition is an adaptation to current needs of the forest.

Key Elements	Present State	Threats	Current Status
1) Social organisation	Social organisation of the community has not changed since its beginning. As before, the live-in community consists of government employees and their families. They are housed in quarters and provided with facilities built, owned, and maintained with government funds.	The community structure and organisation have been in place for close to 100 years, and is guided by long-established traditions. The main threats would be if the internal community changes drastically in size.	The facilities and amenities are optimised for its current size of about 100–200 families. There has not been any pressure to increase this number.
2) Ambience	They keep alive all the community amenities that have been established since the early beginnings and they have acted as the “eyes and ears” of the nominated property. Working and living in a forested environment allows the live-in community to continue protecting the site and maintaining the original ambience of the nominated property. This community of people of various ages from young children to adults gives the nominated property a vibrant ambience that has been present for almost a century, a living environment within the forest.	The main threat would be a sharp unregulated rise in the live-in community and visitors. This would upset the forest estate ambience of the nominated property.	The bulk of visitors are absorbed by the Botanic Gardens and its Skywalk overlooking the city of Kuala Lumpur. The number of live-in families has been capped at 100–200 families.

Figure 4.4: State of conservation of the live-in community

4.b FACTORS AFFECTING THE NOMINATED PROPERTY

This section provides information on the potential and possible factors which are likely to affect or threaten the Outstanding Universal Value of FRIM FPS. Living trees are ephemeral and the forest is a dynamic landscape or ecosystem in which change is inevitable and continuous. In order to do this, both the possible development pressures and environmental pressures which may affect the Outstanding Universal Value of the nominated property have to be monitored. FRIM FPS is managed by the Forest Research Institute Malaysia which continues the reforestation mission of its pioneers, thereby assuring the protection and conservation of the site by taking necessary steps to address the possible threats which may affect the nominated property.

4.b (i) DEVELOPMENT PRESSURES AND MANAGEMENT RESPONSE

The nominated property has been gazetted as a National Heritage Site in 2015. Any development in the nominated property currently has to adhere to the guidelines of the National Heritage Act 2005.

If FRIM FPS is inscribed as a UNESCO World Heritage site, then new development and construction will have to adhere to the policies and strategies in the Conservation Management Plan. New developments in the form of physical infrastructure as well as demolitions have to be planned so that they do not jeopardise the Outstanding Universal Value of this cultural landscape nominated property. Guidelines in the CMP pertaining to impacts on the Outstanding Universal Value will be outlined in terms of what is allowable and what is not. A Heritage Impact Assessment will be required for new developments where necessary.

Buildings and Development. Recently, the old forestry training school was rebuilt on site and its design had to be modified to fulfill the National Heritage guidelines. Any new development in the nominated property will be planned according to existing guidelines and stringent measures before being implemented.

Transportation Infrastructure. The tree-lined avenues and smaller roads that have been part of the historic estate infrastructure in the nominated property will continue to be maintained. These roads cannot be widened or straightened because of the heritage trees that define the arteries of historic roads which provide the colonial ambience, and also protect the integrity of the site. Trees that fulfill the criteria for heritage tree will be selected and conserved.

Utilities or Service Infrastructure. All the current utilities and service infrastructure will be maintained and managed as they are currently. There are no plans to add new utilities or service infrastructure in the nominated property.

Biological Resource Use/Modification. The introduction of exotic species has been minimal in the last nine decades and limited only to the ornamental plants notably shrubs and herbs to beautify the nominated property especially along the roadsides and existing research facilities and buildings. These ornamental plants are unlikely to disrupt the natural ecological processes therein. This is managed by the ground staff of FRIM. An increase in the presence of macaques and wild boars while minimal can be of nuisance value and will have to be managed.

Physical Resource Extraction. Mining, quarrying, oil and gas, and water extraction are not present in and around the nominated property.

4.b (ii) ENVIRONMENTAL PRESSURES, NATURAL DISASTERS, AND RISK PREPAREDNESS

FRIM FPS is located in the humid tropics and is thus subjected to high daily temperature, high humidity, high rainfall, occasional tropical storms, and dust. Its man-made forest is fully adapted to these natural phenomena. Major natural environmental disasters like volcanic eruptions, hurricanes/typhoons, and earthquakes do not occur in Peninsular Malaysia. Climate change and sudden ecological events have not been observed in FRIM FPS. The rich biological diversity in the nominated property will give it a good degree of resilience in facing the effects of climate change. The nominated property has never been flooded and is unlikely to flood given its land contour and location. From the meteorological records, the longest periods of continuous days without rain are 10–12 days at a stretch and this usually happens once a year but the trees have adapted to this. Thus, environmental pressures and natural disasters are not factors of concern.

The natural pressures that affect the forest include “natural culling” processes that remove weak plants and animals (natural selection), as well as the occasional lightning strikes and storm damage to trees. These are, however, natural phenomena that take place in all natural forests, as part of forest growth and renewal. Lightning and storms have sporadically damage the trees in the nominated property, but this “natural culling” make space for new plants

to grow, just as it would in any natural tropical forest. Hence, the nominated property does not experience environmental pressures and natural disasters.

Local conditions such as humidity, temperature, and rainfall could affect the infrastructure such as avenues, roads, and historic buildings in the nominated property where this asset has to be maintained. Of significant challenge is the conservation and maintenance of historic buildings subjected to tropical high humidity and rainfall, and encouraging the growth of fungi and roof leaks. Local climatic conditions have an impact on old wooden houses for the live-in community which make them often uneconomical to maintain.

Invasive/Alien Species. In island countries that are relatively isolated geographically, there are cases of alien species invading and displacing local wildlife. In the Malay Peninsula, some of our major crops for example rubber and oil palm are alien and many of our weeds are also alien. These species have been naturalised and are found at the forest fringes, roadsides, cultivated fields, monoculture plantations (rubber and oil palm), and open spaces. None of them have been able to invade mature natural forests. Their absence from the mature forests in FRIM FPS itself is a measure of the success of FRIM in creating a mature natural forest. In the case of fauna, the most troublesome aliens are the crows introduced from India but they are restricted to towns that generate the waste food. Alien fish released into our water bodies may threaten indigenous fish but this is not a problem in FRIM FPS.

Pests and Diseases in the forest have to be viewed as natural processes that are necessary to the health of the forest as a self-sustaining ecosystem. Trees produce thousands of seeds in a reproductive event and only one seed is needed to replace its parent. There is therefore intense competition in the forest and trees are continuously being culled by natural processes in which fungi and insects play vital roles. They are part of the recycling of resources by which the earth renews itself continuously. The concept of pests and diseases is a human-centric one applied to humans. This concept is extended to those animals and plants that are specially protected by humans from natural competition. Such protection will be applied to historic trees in the nominated property and those in the arboreta and along the avenues.

Air Pollution. The nominated property is now half-bordered by built-up areas and roads that have inevitably increased the amount of air pollution and dust, especially by vehicular traffic. However, there had been no visible detrimental effects on the trees and forests of nominated property.

4.b (iii) VISITATION, OTHER HUMAN ACTIVITIES AND SUSTAINABLE USE

FRIM is a government organisation that has evolved in a way totally different from all other government organisations or departments. It is a major scientific centre of national and global significance, and a unique visitor destination because it manages and conserves a biodiversity-rich and mature tropical lowland rain forest of its own creation, a property unique and valuable since the 1920s.

Prior to the COVID-19 pandemic, there were no limits to the number of visitors in the nominated property. However taking the advantage of the closing of the main campus during the pandemic in 2020 to 2022, no casual visitors including joggers are now allowed in the main campus, but constrained to the Kepong Botanic Gardens. The old forest can only be visited by appointment with fully accredited nature guides. It is necessary to limit the pressure in the main campus area where the Administration Building and Laboratories are concentrated. The CMP will look into the carrying capacity of the various attractions and to evaluate the impact of human activities such as soil compaction, theft, vandalism, and poaching.

Soil Compaction due to trampling by visitors can result in the decline and death of trees, as seen in the loss of stilt-rooted *Dillenia* tree (**Figure 4.5**). The Merbau tree that anchored the first canopy walkway also died after years of service due to the large crowds that used to gather around the tree. To avoid soil compaction, the major forest trails will gradually be provided with elevated boardwalks to avoid future soil compactions by visitors. It is the planned policy of FRIM FPS to have elevated boardwalks in all the major forest trails, which will be constructed using environmentally friendly materials i.e. fiber reinforced polymers (FRP) that can withstand the pressure of weight of visitors and climatic factors, which will be placed well above the ground (**Figure 4.6**). Furthermore, the number of visitors per specified distance of boardwalk will be determined. Currently, only one person is allowed per one metre trail, making it a total of 500 persons per trail at any one time. While tree death by soil compaction remains relatively rare, visitor conduct has to be continuously monitored.

Figure 4.5: A much photographed stilt-rooted *Dillenia* tree that died of soil compaction

Figure 4.6: Elevated boardwalk made of fiber reinforced polymer (FRP)

Theft, Vandalism, and Poaching. These human threats rarely occur in the nominated property. There has never been a case of vandalism in the form of destruction of living assets (plants and animals) and buildings in the nominated property. There has been only one episode of theft, an isolated attempt to steal the highly valued eagleswood incense (*Aquilaria malaccensis*). Such theft is now closely monitored by the monitoring staff of FRIM, with the cooperation of the live-in community. Vandalism in the form of deliberate destruction of living assets is virtually unknown. Poaching is a minor issue and is limited to fishing and bird-trapping, both of which are prohibited. However, these human threats have to be constantly monitored.

Recreational Enthusiasts. Pre-COVID, a relatively large population of joggers, walkers and cyclists were seen in all parts of the nominated property in the mornings and late afternoons, adding to traffic congestion along the narrow roads at these times. There was also insufficient parking and this often led to them to park on the lawns or by the narrow roads and in between the trees. This has been a cause for concern as the narrow roads and tree-lined avenues are part of the Outstanding Universal Value and they have to be protected from tree root damage as well as curb damage. Also an issue is the feeding of animals by these recreational enthusiasts, which has to be addressed. If allowed to continue, in time this human-wildlife phenomenon will affect the biodiversity of the site. This is critical to keep in mind given that FRIM is not a public park but a scientific experimental site of the national forest research institute.

However, the significant reduction of recreational enthusiasts during the COVID-19 pandemic movement restrictions has had a positive effect on the management plan for FRIM FPS in allowing it to reset the clock. Zones for public access can be clearly defined, so as to protect the Outstanding Universal Value. This is not for the purposes of restricting public movement, but rather to offer and highlight the values of FRIM FPS. This new design will consider the needs of recreational enthusiasts by defining the zones for these activities and providing the amenities needed e.g. a visitor centre and parking. The botanic gardens as well as its man-made forest area with its forest trails supported by a boardwalk will be open for public use.

Social Venue Hire (e.g. weddings, Family Day). FRIM has been a popular wedding destination among the local population. Rental is affordable at about USD 400 per event in the historic buildings of Villa Aromatica; Villa Fragrans; and in the FRIM Auditorium, Dewan Alwy; as well as FRIM football field; Kepong Botanic

Gardens (activity space next to parking area); and Pavilion at Sg. Kroh Picnic Area. Guests in any one event can wander anywhere and park wherever there is space as designated parking is limited. These historic buildings have a high turnover of events and are decorated and redecorated for each event, giving rise to a high level of wear and tear, and repair and maintenance costs that exceeds the rental gained. This intrusion of uncontrolled visitors and their impacts on the nominated property and the image of FRIM have to be considered against the meager income derived from such events.

Again, COVID-19 has had a positive impact on the nominated property as there have been few requests to have events in FRIM FPS since 2020. This allows the CMP to reassess the management of FRIM FPS as a World Heritage Site, where its role as an events destination has to be carefully considered in the light of the site values and the Outstanding Universal Value of this cultural landscape site. A controlled ecotourism plan for FRIM FPS is being planned to provide sufficient funds without making it an indiscriminate events destination. It is imperative that the global position of FRIM FPS as a man-made forest conservation site with significant educational values to mankind is communicated to its visitors.

Social or Cultural Uses of Heritage. Within the nominated property there is a mosque that was originally built for the live-in community. However, as is standard practice, the mosque is open to anyone for prayers. Historic buildings namely Villa Aromatica (JKR501), Villa Fragrans (JKR502), and FRIM-MNS Nature Education Centre (FD15) are used for social functions such as wedding receptions and for the purposes of nature education. During every durian (*Durio zibethinus*) fruiting season, members of the Indigenous community who live outside the nominated property come to harvest the fruits, which has been a practice ever since the 1920s.

FRIM FPS has always been people-friendly and popular with the surrounding communities and visitors as a park for public recreation. However, the types of visitor and the visitation sites are a secondary concern to FRIM's role as a forest research institute. FRIM will continue to enjoy a free movement of research visitors besides FRIM's staff and associates. Risks to the nominated property that may degrade or affect its Outstanding Universal Value are low and manageable. As all its features have evolved naturally, it does not require major changes in organisational structure and behaviour to maintain and conserve FRIM FPS in its present state.

CHAPTER 5

PROTECTION AND MANAGEMENT OF THE NOMINATED PROPERTY

5.a Stakeholders
- (i) Ownership and Inhabitants
- (ii) Indigenous Peoples
- (iii) Participation

5.b Protective Designation

5.c Means of Implementing Protective Measures

5.d Existing Plans Related to Municipality and Region in which the Nominated Property is Located

5.e Property Management Plan

5.f Sources and Levels of Finance

5.g Sources of Expertise and Training in Conservation and Management Techniques

5.h Visitor Facilities and Infrastructure

5.i Policies and Programmes Related to the Presentation and Promotion of the Nominated Property

5.j Staffing Levels and Expertise

5.a STAKEHOLDERS

The stakeholders located in FRIM FPS consist of government agencies such as water, electricity, school, mosque, cemetery, and also the forestry training college.

FRIM Forest Park Selangor (FRIM FPS) is an entity of the government and managed by the Board of Forest Research Institute Malaysia (FRIM) as a federal research institution. The live-in community residing in the housing quarters of the nominated property are government staff and their families. There are no indigenous people or other local communities or private stakeholders living within the nominated property.

5.a (i) OWNERSHIP AND INHABITANTS

The nominated property is located within a 589-ha land allocated for federal forestry research by the State Government of Selangor in 1925 followed by the official Gazette Notification No. 5449 in October 1926. This provided legal authority for a forest research entity to establish management and control of the nominated property. This status has remained and has been strengthened by additional legal instruments, allowing the mission to create and maintain a man-made forest to continue unhindered till today. Additional legal protection has since been put into place by the grant of a permanent land title in April 2012 by the State of Selangor.

The forest research entity was named the Forest Research Institute Malaysia (FRIM) and placed under the Malaysian Forestry Research and Development Board, established by an act of Parliament (Act 319) in 1985. This Act provides the Board with the executive power to protect and manage the site. Another act, the FRIM Act 2016 (Act 782), officially came into force on 1 October 2016. This legislation gives FRIM more authority to implement research in the commercialisation and development of the forestry sector.

This authority empowers FRIM to protect the nominated property from any development that would have a negative impact on its Outstanding Universal Value. The nominated property is further protected by a substantial forest reserve buffer in its northern perimeter. Any future development along the southern buffer zone will be subjected to the legal authority of Selayang Municipal Council.

FRIM FPS	Population Size	Year
Nominated Property	192 live-in families *(FRIM Live-In Community Database, 2022)*	2022
Buffer Zone	22,555 families, 106,988 population *(Azreena et al., 2020)*	2018

Figure 5.1: Estimated population located within FRIM FPS and its buffer zone

5.a (ii) INDIGENOUS PEOPLES

There are no indigenous peoples living in or owning any part of the nominated property.

5.a (iii) PARTICIPATION

The live-in community is completely made up of government staff who live in the nominated property in houses provided by the government. They do not own the houses and they are not permanent residents on the site. As a live-in community, they have played a role since the time of the pioneers in monitoring and protecting the nominated property. FRIM has kept the live-in community informed regarding this nomination through the FRIM Housing Committee and has received support and encouragement from them. FRIM has also organise with the following events and received support and encouragement from all of participants (**Figure 5.2**).

No.	Event	Date
1.	FRIM National Heritage Site Launching Ceremony	12/5/2012
2.	FRIM World Heritage Secretariat Office Launching Ceremony	22/2/2013
3.	Conference of Selangor Heritage Site Conservation	18/11/2014
4.	Malaysia UNESCO Day Programme	22–25/5/2015
5.	Conference of Forestry & Forest Products Research 2015 (CFFPR 2015)	21–23/9/2015
6.	FRIM Heritage Site Workshop: Buffer Zone Criteria	30/9–1/10/2015
7.	Conference of FRIM Heritage Site: Outstanding Universal Value Studies	24–25/11/2015
8.	FRIM National Heritage Site Programme: Inspection & Monitoring	30/3 & 26/7/2016
9.	Conference of FRIM Heritage Site: Green Campus & Community Development	5–6/9/2016
10.	FRIM Heritage Site Workshop: Stakeholder Consultation	24/10/2016
11.	Green Community Development: Go Green FRIM Programme	28/10/2016
12.	Conservation Management Plan (CMP) Programme: Focus Group Discussion	21/4/2017
13.	FRIM Heritage Site Workshop: Buffer Zone Boundaries and Demarcation	9/10/2017
14.	Neighbourhood Community Committee Launching Ceremony	12/11/2017
15.	FRIM Heritage Site Workshop: Heart of Heritage Development	20/1/2018
16.	Conference of Selangor Heritage Site: Towards UNESCO-WHS Nomination	14–15/11/2018
17.	Pre-Evaluation Programme (External Consultant)	12–14/1/2019
18.	FRIM FPS Frontline Staff Dialogue Session	25/2/2019
19.	Conservation Management Plan (CMP) Programme: Built Heritage Workshop	21/8 & 12/9/2019
20.	Green Community Development: Community Product Workshop	16/3/2020
21.	FRIM FPS Green Community Centre Launching Ceremony	20/7/2020

Figure 5.2: Events with stakeholders of FRIM FPS

5.b PROTECTIVE DESIGNATION

The nominated property is protected under a range of statutory designations as in **Figure 5.3**.

No.	Designation	Extent and Date	Legislation Under Which Status is Provided
1.	*A Reserve for Public (Official) Purposes*	The nominated property was approved by the government in December 1925	The approval by the Government of Selangor was announced officially by Gazette Notification No. 5449 in October 1926
2.	*Heritage*	The nominated property was designated as a Heritage Site in April 2009 [P.U.(B)148]	The National Heritage Act 2005 (Act 645) is a comprehensive legislation that provides for the conservation and preservation of the national heritage, natural heritage, tangible and intangible, cultural heritage, underwater cultural heritage, treasure-trove and other related matters including, but not limited to, the administration and management of the national heritage
3.	*National Heritage*	The nominated property was declared as a National Heritage (Heritage Site) in January 2015 [P.U.(A)7]	
4.	*FRIM Land Title*	The nominated property was granted the permanent land title in April 2012	Approval by the Government of Selangor strengthens the original gazettement of 1926

Figure 5.3: Protective designation

Figure 5.4: Heritage plaque

Figure 5.5: National Heritage plaque

5.c MEANS OF IMPLEMENTING PROTECTIVE MEASURES

A number of existing Acts provide FRIM FPS with the means to take legal measures to protect the nominated property. The scope of the National Heritage Act 2005 is decidedly wide and all-encompassing. It is a comprehensive legislation casting a broad net over both tangible and intangible, natural, and cultural heritage, and how the legal measures for protection are to be administered and enforced. The preamble states that the Act aims "to provide for the conservation and preservation of National Heritage, natural heritage, tangible and intangible, cultural heritage, underwater cultural heritage, treasure-trove and for related matters." Besides the National Heritage Act (Act 645), there are other legal instruments to protect the site, which include the Forest Research Institute Malaysia Act (Act 782), the Wildlife Conservation Act (Act 716), the International Trade in Endangered Species Act (Act 686), and the Town and Country Planning Act (Act 172). Thus far, there have been no cases where any of the legal instruments have had to be used or have been challenged. This is due to the system of governance and the stringent adherence to the legal instruments as follows.

- **(Act 645) National Heritage Act 2005**

In terms of conservation and preservation of the nominated property as a heritage site, the Act which allows the Commissioner of the Department of National Heritage, after consultation with the State Authority, to make arrangements with the owner or occupier for the inspection, maintenance, conservation, and preservation of the heritage site. The Commissioner can contribute towards the costs of carrying out any agreed works of repair or conservation.

Planning permission or development orders relating to heritage sites are subject to the Commissioner's advice to the local planning authority. Upon approval of the planning permission, the Commissioner shall liaise, cooperate, and coordinate with the local planning authority. Together, they will conduct monitoring and supervision to ensure that the terms and conditions imposed relating to the conservation of heritage are complied with. Any failure to comply with any condition imposed is considered an offence.

The Act has also prescribed the following acts as punishable offences if done without the approval of the Commissioner:

a) *dig, construct, excavate, build, plant trees, quarry, irrigate, burn lime or deposit earth or refuse, on or in the heritage site or conservation area;*
b) *demolish, disturb, obstruct, modify, mark, pull down or remove any monument in any heritage site;*

c) erect any building or structure abutting upon a monument in any heritage site;
d) destroy the relationship of a building and its environment that is incompatible with the character of the neighbourhood in any heritage site;
e) clear any area or interfere with, destroy or remove any tree, plant undergrowth, weed, grass or vegetation in any heritage site; or
f) do any activities or actions that would likely cause damage to the adjacent and surrounding land which have been registered as heritage site.

- **(Act 782) Forest Research Institute Malaysia Act 2016**

Forest Research Institute Malaysia (FRIM) was established under the Malaysian Forestry Research and Development Board Act 1985 (Act 319) for the purpose of executing the functions of the Malaysian Forestry Research and Development Board (MFRDB). The FRIM Act 2016 officially came into force on 1 October 2016. This legislation enables FRIM to move forward on its own, to tackle issues and challenges, and to strengthen its own position, powers, functions, and obligations. The FRIM Act 2016 empowers FRIM as a legal entity to secure its continued existence as a forest research and development institute. FRIM is now able to administer and manage its activities and business on its own. The new Act enables FRIM to plan and implement research for the development of the forestry sector and the conservation of forest resources. It helps FRIM to resist any administrative or political threat or interference and to ensure the relevancy of FRIM's main campus, in which the FRIM FPS is located, as a forest research site.

- **(Act 716) Wildlife Conservation Act 2010**

The Wildlife Conservation Act 2010 significantly strengthens the legal protection of wildlife. It provides penalties for offences such as poaching, importing totally protected wildlife without permit, carrying out research or study on protected wildlife without permit, cruelty to wildlife, and provocation to wildlife. With the coming into force of this Act, the wildlife in FRIM FPS, as a paramount part of Malaysia's wealth of biological diversity, are afforded with stronger protection from human misconduct.

- **(Act 686) International Trade in Endangered Species Act 2008**

The International Trade in Endangered Species Act 2008 was gazetted on 14 February 2008 and came into force on 28 December 2009. With this Act, all of the import, export, and re-export activities of Convention on International Trade

in Endangered Species of Wild Fauna and Flora (CITES) listed species at entry and exit points has to be done in accordance to the CITES rules and regulations. This serves to ensure the conservation of the CITES-listed species.

- **(Act 172) Town and Country Planning Act 1976**

This is the Act for the proper control and regulation of town and country planning in Peninsular Malaysia and for related purposes. Several amendments provide relevant powers to the local authority to make provisions that will assist in the preservation and protection of the nominated property.

One of these is a section under Part V-A of the Act which provides a Tree Preservation Order that allows a local planning authority to place a preservation order on an individual tree or a group of them. This recognises that trees can be essential components in an area to be conserved.

The Conservation Management Plan for this nominated property forms an action plan to protect the Outstanding Universal Value.

Development control by statute is exercised by local authorities since every development proposal must obtain planning permission before it can be implemented. This ensures that development is in accordance with the specified regulations and guidelines that have been imposed on the site where the intended development is to be carried out.

Section 58 allows unlimited and discretionary authorisation for the State Authority and the National Physical Planning Council to make additional rules to expedite this Act for, among others, protection of buildings that have historic or architectural significance.

5.d EXISTING PLANS RELATED TO MUNICIPALITY AND REGION IN WHICH THE NOMINATED PROPERTY IS LOCATED

The nominated property is independent of the development plans related to the Municipality and District, i.e. Selayang Municipal Council, Kuala Lumpur City Hall, and Gombak District and Land Office. FRIM has the authority to protect nominated property through its legal instruments.

5.e PROPERTY MANAGEMENT PLAN

An appropriate Draft Conservation Management Plan (CMP) is submitted together with this Nomination Dossier in 2024. The detailed and final management plan for protecting and management of the nominated property will be submitted in February 2025.

The CMP is important for ensuring the continuous and effective protection of FRIM FPS. This document will enable the implementation of protection, conservation, and preservation activities, aimed at safeguarding and protecting the nominated property's Outstanding Universal Value from any possible threats, while planning tourism and development activities. Essentially, the CMP lays down clearly the objectives, policies, and strategies which would be implemented under a planned management framework.

The management framework is designed to allow for changes within the nominated property of FRIM FPS without compromising its Outstanding Universal Value. An open and flexible management framework is intended not just to benefit conservation and protection initiatives by allowing them to evolve, but also to avoid rigidities in management. It should enable future growth and encourage development in the local community, without compromising the Outstanding Universal Value, integrity, and authenticity of the World Heritage Site (WHS).

The CMP is an important document in planning for future land-based activities. The long-term framework formulated in this document will provide continuous guidance for both development and conservation programmes, including other associated programmes such as tourism, outreach, education, and monitoring.

FRIM FPS has full power to protect and manage the nominated property according to the CMP-FRIM FPS.

Besides, in terms of the protection of buffer zone as well as its wider setting, it relies significantly on the local authorities (Selayang Municipal Council and Kuala Lumpur City Hall) and other relevant stakeholders (e.g. Selangor Forestry Department). These organisations are equally important pertaining to the planning of buffer zones and its wider setting. However, CMP FRIM FPS will be taken into account which will avoid any interference to the Outstanding Universal Value as it has been stated under the Selangor State Structure Plan 2035, Local Plan of Selayang Municipal Council 2030 and the Kuala Lumpur Structure Plan 2040.

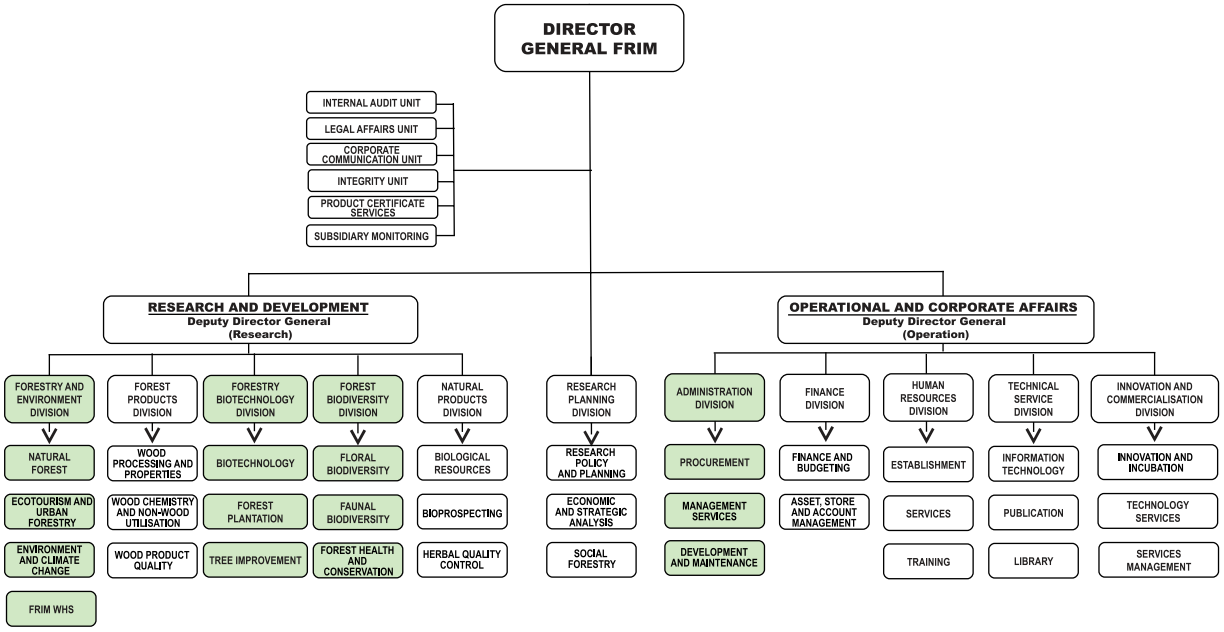


Figure 5.6: The main divisions responsible for the protection of the Outstanding Universal Value of the nominated property

FRIM is headed by its Director General and assisted by two Deputy Director Generals and 11 Directors of Divisions. The main divisions responsible for the protection of the Outstanding Universal Value of the nominated property are Forestry and Environment, Forestry Biotechnology, Forest Biodiversity, and Administration. This involves the conservation and management of the main attributes, i.e. the man-made tropical rain forest, historic estate layout, and live-in community. Given that FRIM FPS is a mission that began 100 years ago, the current organisation is strongly committed to continue and strengthen the mission with the scientific expertise it has.

5.f SOURCES AND LEVELS OF FINANCE

FRIM FPS's budget is part of FRIM's current annual operating and staff budget amounting to RM60 million (roughly USD 12 million). Besides an operating budget, FRIM has also received allocations for infrastructure and development projects from the Malaysian Federal Government averaging around RM25 million per year for the past five years.

Other than grants from the Malaysian government, FRIM has generated its own income from admission charges and sales of goods and services, amounting to almost RM6 million or 10% of the operating budget. These funds are kept in the

central fund pool and FRIM can seek approval from FRIM's Board to use these funds to carry out necessary development and maintenance work and to top-up any deficiency or shortfall in the operating budget.

Supplementary to that, FRIM has also received funds from donor agencies, local organisations/agencies, and corporate bodies, as well as from abroad in the amount of RM10 million a year. FRIM is considered a federal government agency established under an Act of Parliament and as such, it always has government support and funding for its activities.

In the past years of 2016–2020, FRIM World Heritage Secretariat received a total budget of about RM15 million for the nomination effort in preparation of nomination documents such as Tentative List, Nomination Dossier, Conservation Management Plan, as well as ground preparation works. Upon inscription, FRIM FPS will need to request financial support for the site. It is anticipated that future potential sources for the World Heritage Office (WHO) heritage fund will include funding from the federal and state governments and agencies as well as the private sector. The expenditure covers manpower, equipment, development, and maintenance related to the operation and management of the World Heritage Site. WHO will be supported by FRIM (Development Expenditure & Operational Expenditure) as well as efforts to fill up the heritage fund through financial aid from the state government, Corporate Social Responsibility (CSR), and other agencies.

5.g SOURCES OF EXPERTISE AND TRAINING IN CONSERVATION AND MANAGEMENT TECHNIQUES

FRIM is one of the leading institutions in tropical forestry research in the tropics. It has a full complement of scientists trained locally and overseas and itself provides training and consultancies for other bodies. Its scientists are required to solve problems through research and to keep abreast of advances in conservation and management.

This represents a government body of on-site knowledge and expertise, which is itself the source of expertise and training in providing conservation and management techniques to the nominated property. The expertise of scientists in FRIM FPS relevant to the safeguarding of site attributes is listed in **Figure 5.7** and the training courses in **Figure 5.8**. Since the COVID-19 pandemic started in 2020, courses in conservation and management techniques have been on-line.

Division	Expertise	Person
Forestry and Environment	Tropical Forest Management & Certification	Forest Silviculturist (2) Forester (2)
	Geospatial Technology & Forest Engineering	Geospatialist (4) Forest Engineer (1)
	Eco-Hydrology	Forest Hydrologist (2)
	Urban Forestry & Arboriculture	Arborist (1) Landscape Architect (1) Horticulturist (1)
	Communication, Education & Public Awareness (CEPA) & Social Forestry	Environmental Educator (2) Social Forestry Officer (1)
Forest Biodiversity	Higher Plant Taxonomy & Herbarium Curation	Herbarium Curator (1) Higher Plant Taxonomist (1) Lower Plant Taxonomist/Botanist (1)
	Plant Conservation	Plant Conservationist (3)
	Entomology (Tree Disease and Pest Identification)	Forest Entomologist (2)
	Mycology (Tree Disease and Pest Identification)	Forest Mycologist (2)
	Forest Zoology (Vertebrate)	Forest Zoologist (2)
	Forest Genetic	Forest Geneticist (4)
	Forest Soil Science	Forest Soil Scientist (1)
Forestry Biotechnology	Plant Breeding	Plant Breeder (3)
	Plant Propagation	Plant Propagation Officer (2) Nursery Manager (1) Seed Technologist (1)
Administration	Civil and Structure	Civil Engineer (1)
	Mechanical and Electrical	Mechanical Engineer (1)

Figure 5.7: Expertise of selected scientists in FRIM FPS relevant to the safeguarding of site attributes

Year	Training Course
2011–2013	Forest Tree Species Identification
2011–2013	Herbarium Techniques and Management
2012–2014	*Karas* Planting
2011–2017	Landscape and Tree Maintenance
2011–2017	Commercial Nursery Management
2013–2022	Wood Identification
2013–2022	Tree and Leaf Identification
2018	Pest and Disease Management
2018	Nature Guide
2018–2019	Plant Material Management
2018–2019	Forest Survey and Management
2019–2020	Introduction of GIS and QGIS Mapping
2019–2020	Fungi Identification
2019–2020	Insect Identification
2018–2022	Fauna Identification
2022	Wildlife Handling & Management
2022	Community Product Development

Figure 5.8: List of relevant training courses attended by staff in FRIM FPS since 2011

FRIM FPS hopes to see future collaboration with other agencies and organisations for site conservation and management. This includes cooperation and exposure to training courses conducted by the Department of National Heritage, Malaysia, World Heritage Institute of Training and Research for the Asia and the Pacific Region (WHITRAP), International Council on Monuments and Sites (ICOMOS), and International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM). FRIM FPS also hopes to benefit from expertise and training from national authorities or other organisations such as UNESCO World Heritage Site Manager Training Program.

5.h VISITOR FACILITIES AND INFRASTRUCTURE

Ever since COVID-19 restrictions were imposed by the Malaysian government in March 2020, the site has had few visitors, no recreational activities, and no rentals. Visitors have been kept away from the main campus. Thus, planning for future activities can now start on a clean slate. It would have to strictly consider the protection of the Outstanding Universal Value of the nominated property. These programmes will be addressed in the CMP.

There is a Visitor Information Centre (VIC) that acts as a one-stop centre in providing services such as the use of recreational facilities, tour guides, as well as venue hire and accommodation (**Figure 5.9**).

Current Recreational Facilities	Location
Jogging Trails	*Kepong Botanic Gardens*
***Forest Skywalk**	*At a high vantage point of the Kepong Botanic Gardens, offering panoramic view of the nominated property and distant areas*
***Nature Trails (Guided)**	• *Keruing trail* • *Engkabang trail* • *Sebasah trail* • *Salleh trail* • *Razak trail* • *Latif trail*
***Venue Hire**	• *Kepong Botanic Gardens (activity space next to parking area)* • *Field area* • *Pavilion at Sg. Kroh Picnic Area* • *Villa Aromatica* • *Villa Fragrans*

**Prior Booking*

Figure 5.9: Recreational facilities (FRIM Website, 2022)

For overnight stays, accommodation is available at the facilities as listed in **Figure 5.10.**

Accommodation	Facilities
Sungai Kroh Guest House	• *Total: 16 rooms (2–4 pax per room)*
Meranti Guest House	• *Total: 2 units (5 rooms per unit)*

Figure 5.10: Accommodation facilities (FRIM Website, 2022)

Recreational visitors may use the above facilities by booking and paying entrance fees are shown in **Figure 5.11.**

No.	Category	Change (RM)
1.	a) Citizen (per person / per entry)	
	-Adult	1.00
	-Children/Student (aged 13 years & above)	1.00
	-Children/Student (with school uniform and study in Malaysia)	Free
	-Disabled	Free
	b) Non-Citizen (per person / per entry)	
	-Adult	5.00
	-Children/Student (without school uniform)	1.00
	-Children/Student (with school uniform)	Free
	-Disabled	Free
2.	a) Car (per entry) *-Kepong Botanic Gardens*	5.00
3.	Motorbike (per entry)	3.00
4.	SLR/DSLR Camera	5.00

Figure 5.11: Current entrance fee for visitors (FRIM Website, 2022)

A current recreational guideline ensures visitors obtain quality recreational opportunities in a safe, healthy, and enjoyable environment. There is a published *"Code of Conduct for Visitors of FRIM Campus"* which comprises rules and regulations that have to be followed by visitors.

5.i POLICIES AND PROGRAMMES RELATED TO THE PRESENTATION AND PROMOTION OF THE NOMINATED PROPERTY

FRIM policy has always been to encourage conservation and public awareness. This can be seen as early as the 1920s when the pioneers embarked on their forest creation experimentation. Conservation and nature education has continued to be a major activity of FRIM carried out in parallel with forestry research. Thus, conservation education and transmission for future generations has always been an important role played by FRIM.

Future facilities and infrastructure to be considered in the CMP are the Visitor Information Centre (VIC), Forest Boardwalk (FB), Museum of the Forest (MOF), Horticulture Bazaar (HB), and Environmental Education Centre (EEC). These facilities will be assessed for impacts and capacity suitability before development. They will also be managed to meet the protection and management requirements of the nominated property in accordance with the CMP.

5.j STAFFING LEVELS AND EXPERTISE

As of 2020, FRIM currently employs 863 full-time staff which are categorised into three levels, namely top management, management and professional, and support staff. At present, site management of FRIM FPS is carried out by FRIM which is headed by its Director General and assisted by two Deputy Director Generals and eleven Directors of Divisions. The organisational chart is shown in **Figure 5.12.**

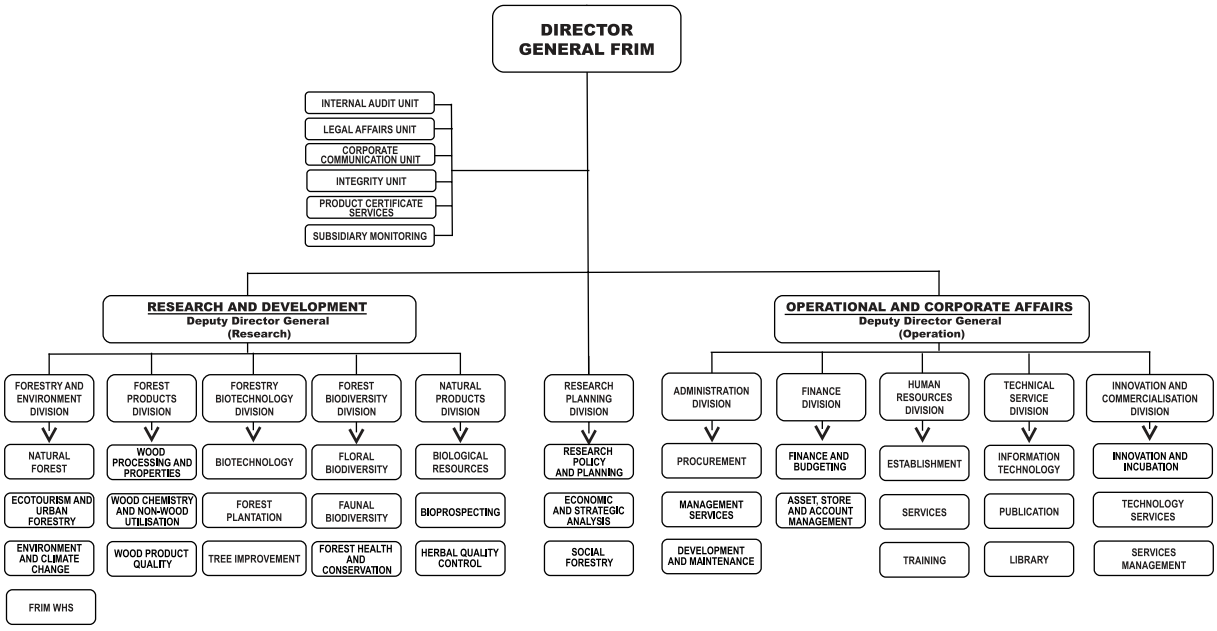


Figure 5.12: FRIM organisational chart

The main divisions responsible for the protection of the Outstanding Universal Value of the nominated property are Forestry and Environment, Forestry Biotechnology, Forest Biodiversity, and Administration. Most of the staff from these divisions are qualified in the relevant scientific disciplines such as forestry and urban forestry, botany, biology, zoology, entomology, mycology, plantation management, forest soil, forest genetic, biotechnology, and geographical information system. The job description of each division is listed in **Figure 5.13.**

Category	Division	Job Description
Research and Development	***Forestry and Environment**	Develop technologies and provide solutions to support and ensure the sustainable management of resources and ecosystem services of the natural, urban, and recreational forests
	Forest Products	Focus on the development of Research, Development, and Commercialisation towards improvement of durability, service life, and utilisation of wood resources and lingo-cellulosic materials available for producing various high quality or value-added products
	***Forestry Biotechnology**	Develop technologies and products based on biodiversity esources for forests and herbal plantations for related industries through biotechnological approaches
	***Forest Biodiversity**	Provide and develop key scientific knowledge to safeguard biodiversity and ecosystem services in Malaysia for their wise management and sustainable utilisation
	Natural Products	Support the national bio-economy agenda via the empowerment of natural product-based industries through bioactive feedstock security
Operational and Corporate Affairs	***Administration**	Conduct all general operational-related jobs in the aspect of management and maintenance such as administrative, finance, human resource, information communication technology, and publication service
	Finance	
	Human Resources	
	Technical Service	
	Innovation and Commercialisation	
	Research Planning	Conduct socio-economic research and strategic analysis on forestry and environmental issues for national development

**those divisions responsible on the protection of the Outstanding Universal Value of the nominated property*

Figure 5.13: Job description of the eleven divisions in FRIM

Upon inscription, FRIM Forest Park Selangor World Heritage Office (FRIM FPS-WHO) (**Figure 5.14**) will be established as a new entity within FRIM. This new entity will be responsible for the management and protection of the Outstanding Universal Value of the nominated property, and new guidelines will have to be established for the operation of FRIM FPS-WHO.

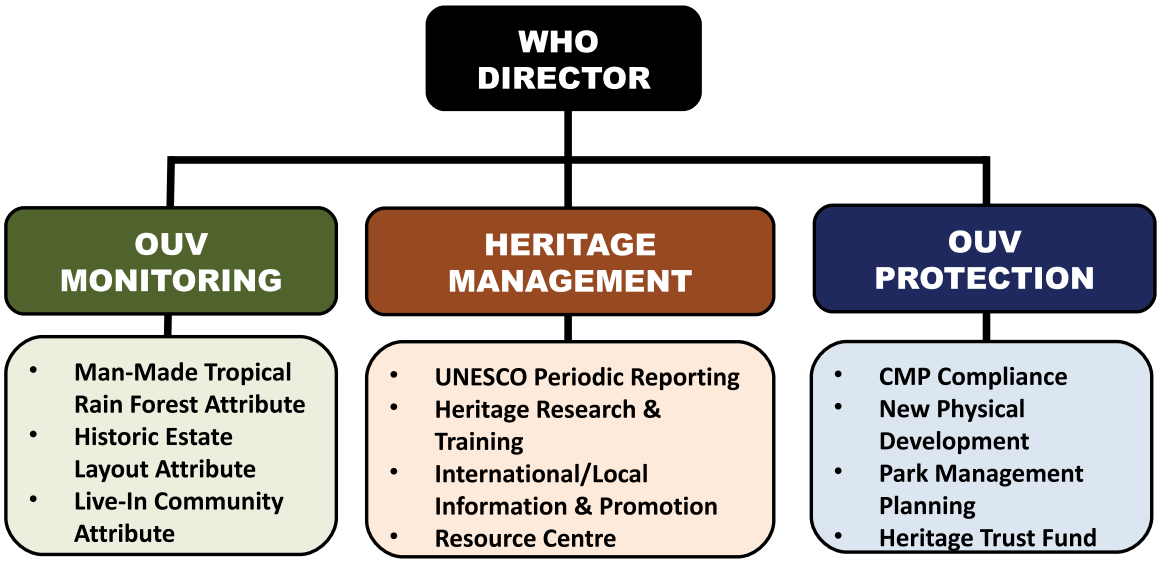


Figure 5.14: Proposed organisational chart of FRIM FPS-WHO

FRIM FPS-WHO will function as a government body with on-site knowledge and expertise, which underpins the successful protection and management of Outstanding Universal Value of the nominated property and its associated functions. Hence, it requires sufficient staff as well as staff with the necessary qualifications. The Director should be familiar with the attributes of the nominated property and have a good understanding of the UNESCO World Heritage guidelines, and Outstanding Universal Value protection and its management on the ground, as well as possess a global outlook on heritage management. It is important that the Director is supported by staff with knowledge and background in World Heritage as well as the CMP. This is because the CMP needs to be implemented as soon as possible.

Basic staff qualifications required for the good management of the nominated property can be summarised as follows:

- ***OUV Monitoring***: All members of staff, other than assistants, have either a first degree or a postgraduate degree in the relevant disciplines of science, architecture, engineering, social forestry, and heritage conservation monitoring.

- ***Heritage Management:*** All members of staff, other than assistants, have either a first degree or a postgraduate degree in the relevant disciplines of social science, social communications, social forestry, science, information science, and heritage management.

- ***OUV Protection:*** All members of staff, other than assistants, have either a first degree or a postgraduate degree in the relevant disciplines of architecture, landscape architecture, engineering, and business administration.

This new entity known as FRIM FPS-WHO will be an arm of FRIM that undertakes to protect and manage the Outstanding Universal Value of the nominated property according to the plans in the gazetted and approved Conservation Management Plan (CMP). This is to assure the successful continuation of the inscription. The FRIM FPS-WHO will also be responsible for the smooth operation of the CMP and for the Periodic Reporting as required by UNESCO. The current work of the relevant divisions in managing the nominated property will continue until FRIM FPS-WHO is established. Additional new tasks will be the responsibility of the FRIM FPS-WHO. Hence, the roles and functions of the FRIM FPS-WHO will have to be defined.

FRIM FPS-WHO plays a dual role as:

a) the internal arm that coordinates and monitors the FRIM FPS UNESCO World Heritage Site together with the relevant divisions in FRIM within the framework of CMP and;
b) the external arm that links the nominated property to its stakeholders, to the federal, state, and local governments, and to UNESCO on all issues pertaining to the inscription of FRIM FPS.

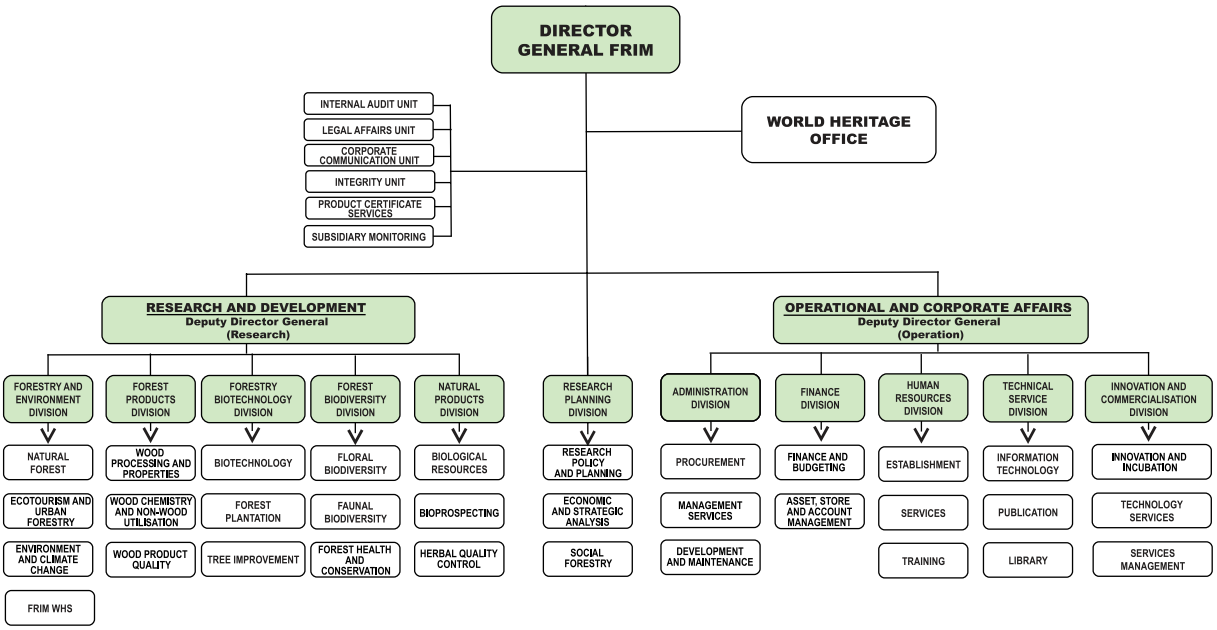


Figure 5.15: The suggested placement of FRIM FPS-WHO in the current FRIM organisational chart

Given these wide roles and responsibilities, it is suggested that FRIM FPS-WHO be placed in a special position under the Director General's office (**Figure 5.15**) because:

1) FRIM FPS nominated property covers the whole entity of FRIM
2) FRIM FPS-WHO is FRIM's external arm to the federal, state, and local governments and to UNESCO with regards to matters relating to the UNESCO World Heritage inscription
3) It is an entity that coordinates site monitoring and management from all divisions in FRIM under the purview of the Director General
4) It has a high-level steering committee, the Heritage Steering Committee that is chaired by the Secretary General of the Ministry of Tourism, Arts and Culture

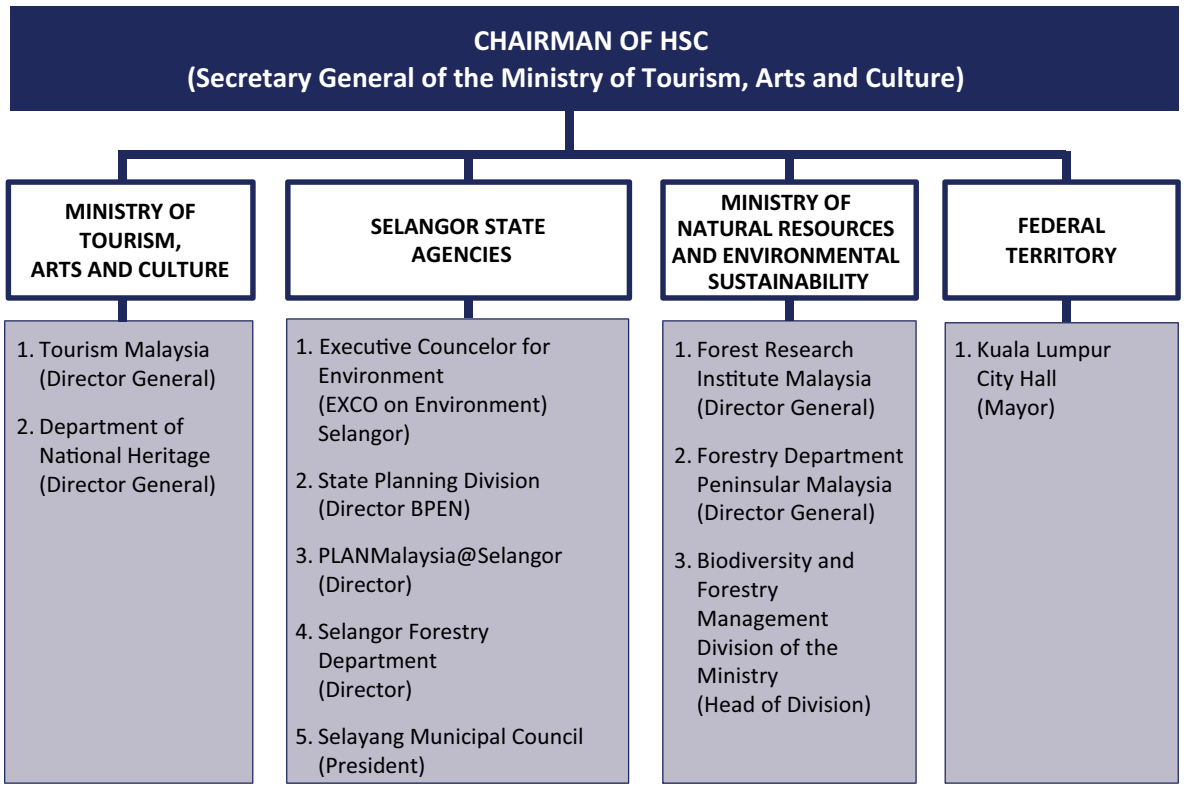
The FRIM FPS Heritage Coordinating Committee (FRIM FPS-HCC) chaired by the Director General will review the quarterly report from FRIM FPS-WHO. Specific roles of the FRIM FPS-HCC include:

a) review the protection and management of the nominated property within the framework of CMP;
b) allocate annual funding for the FRIM FPS;
c) assist sufficient man power for FRIM FPS-WHO Division; and
d) adjudicate on disputes arising from the internal stakeholders.

The FRIM FPS Heritage Steering Committee (FRIM FPS-HSC) as in **Figure 5.16** will be the highest level authority to monitor the implementation of the CMP-FRIM FPS. The HSC will be chaired by the Secretary General of the Ministry and will have representatives from federal, state and local governments. FRIM FPS-WHO will act as the secretariat to the Heritage Steering Committee (HSC).

The Heritage Steering Committee will undertake the following roles:

a) approve and support the nominated property within the framework of sustainable development;
b) review the protection of the buffer zones of the nominated property;
c) provide government guidance and encouragement to ensure the continued protection of the nominated property:
d) review annual funding for the FRIM FPS; and
e) adjudicate on disputes arising from the external stakeholders.



-Secretariat: FRIM FPS-WHO

Figure 5.16: Members of FRIM FPS Heritage Steering Committee (FRIM FPS-HSC)

CHAPTER 6

MONITORING

6.a Key Indicators for Measuring State of Conservation

6.b Administrative Arrangements for Monitoring Property

6.c Results of Previous Reporting Exercises

6.a KEY INDICATORS FOR MEASURING STATE OF CONSERVATION

The important attributes of the nominated property that have to be monitored are the:

- Man-Made Tropical Rain Forest
- Historic Estate Layout
- Live-In Community

The key indicators for monitoring and measuring the state of conservation of each of the above attributes as well as its periodicity, the division responsible for the monitoring, and the location of the monitoring records are shown in **Figure 6.1.** These key indicators have to be monitored in order to maintain the Outstanding Universal Value of the nominated property.

The Man-Made Tropical Rain Forest

- **Forest Biodiversity Composition** is a key indicator for measuring its equivalence to a mature natural tropical rain forest. The man-made forest in the nominated property has attained the mature five-layered forest structure and rich biodiversity composition of natural tropical lowland rain forest. This forest diversity has to be monitored as it is a key indicator of a tropical rain forest. It is not possible to document and monitor every plant and animal in a tropical forest but it is possible to counter any decline. These are usually due to natural causes such as lightning strikes and windstorms, which result in gaps. These gaps are repaired naturally by seedlings and saplings that already exist in the forest, but repair is further expedited by prompt human intervention to clear debris and carry out remedial planting. It is not possible to identify frequency of gaps because it is a natural phenomenon. Monitoring has to be continuous. Thus, forest biodiversity is maintained through replacement planting whenever there is a tree death.

While it is not possible to document and monitor every plant and animal in the forest, it is possible to counter any decline by keeping the forest enriched with new plant species continuously in the forest, arboreta, and botanic gardens. This constant introduction of new plant species will increase its biodiversity.

- **Forest Health and Condition** Human-induced tree mortalities due to soil compaction are reduced by preventive measures. It is not possible and not necessary to check the health of every individual tree in a forest of hundreds of thousands of trees. As in the natural forest, those in the nominated property are allowed to grow and die as they would in a natural forest.

However, where possible those in the arboreta, gardens, and avenues will be monitored for pest, diseases, and mortality. Vandalism and theft of plants and poaching of animals are discouraged by security staff on patrol. The approach in monitoring in this nominated property is to maintain and increase its biodiversity through replanting and introduction of new species and the recording of new sightings of vertebrate animals.

Indicator	Implementation	Periodicity	Location of Records
1. Forest Biodiversity Composition	1.1 Record the number of replacement planting and introduction of species in mature forest and arboreta	Continuous	ODD: -Forestry & Environment -Forest Biodiversity
	1.2 Record the number of new sightings of wildlife in mature forest and arboreta	Periodic	ODD: -Forest Biodiversity
	1.3 Record the number of Endangered, Rare, and Threatened plant species in botanic gardens	Continuous	ODD: -Forest Biodiversity
2. Forest Health and Condition	2.1 Identify forest gaps caused by lightning, storms, and diseases through aerial surveillance and ground truthing	Periodic	ODD: -Forestry & Environment
	2.2 Monitor soil compaction on forest trails and erosion on slopes	Continuous	ODD: -Forestry & Environment
	2.3 Check pests and diseases of tree in the arboreta, avenues, and botanic gardens	Continuous	ODD: -Forest Biodiversity

Indicator	Implementation	Periodicity	Location of Records
3. Physical condition of the historic estate layout	3.1 Maintenance of roads, tree-lined avenues, and pavements	Periodic	ODD: -Forestry & Environment -Administration
	3.2 Conservation of historic buildings (Administration Building, Villa Aromatica, JKR503, FRIM328) according to the Conservation Management Plan	Continuous	ODD: -Administration
	3.3 Pollution and sedimentation monitoring of water bodies	Periodic	ODD: -Forestry & Environment
4. The presence of a live-in community in a historic estate ambience	4.1 Maintenance of the social organisation, community engagement, and ambience	Continuous	ODD: -Administration -FRIM FPS World Heritage Office

Figure 6.1: Key indicators of the state of conservation

**NOTES:*

Periodic: frequency to be determined by the division Continuous: as and when necessary ODD: Office of Divisional Director

Physical Condition of the Historic Estate Layout

- **Roads and Avenues** that wind their ways following the gradient of the land give character to the nominated property and have maintained its integrity over the decades. The historic main road known as Jalan Foxworthy has remained the main road into the nominated property. This was constructed in the 1920s and soon after it branched out into Jalan Jelutong, and other roads that joined to the main artery, for access to living and working areas. Trees planted along the major roads today are shaded avenues with pavements. They are still the narrow roads that they were. These major avenues of narrow roads with trees alongside are to be monitored for safety. The trees have to be monitored and the tarred roads have to be checked. The pavements and drainage have to be maintained.

- **Buildings (4)** have to be specially monitored. They are the Administration Building and three units of housing quarters that are good examples of built heritage elements that form part of the historic estate landscape and have survived over time. They have to be conserved for their architectural significance, social history, and heritage value. The conservation of these buildings will be detailed in the Conservation Management Plan.

- **Water Bodies** in the nominated property include wetlands, ponds, and lakes which have to be protected from pollution. Over time, the murkiness of the water and the presence of algae are visible indicators of health. It has to be checked that the drainage system does not drain sewage and chemicals from cleaning agents and other dangerous substances into these ponds and lakes. Sedimentation of lakes and ponds is a continuous process and gradually they become shallower, and they need to be deepened along the edges. Sedimentation and pollution of the water bodies have to be checked and addressed through planned maintenance periodically.

Presence of a Live-In Community

The nominated property has always had a community of staff working and living in the forested environment as its “eyes and ears” and with an informal social organisation. Their presence adds to the historic ambience while they and their families play a role in conservation and environmental awareness programmes.

6.b ADMINISTRATIVE ARRANGEMENTS FOR MONITORING PROPERTY

The nominated property will be monitored by four different divisions in FRIM for respective site attributes (**Figure 6.2**).

Site Attributes	Components	Administrative Arrangements
1. Man-Made Tropical Rain Forest	**Mature Forest**	
	-Forest Structure	-Forestry & Environment Division -Forest Biodiversity Division
	-Biodiversity	-Forest Biodiversity Division
	Support Facilities	
	-Arboreta	-Forest Biodiversity Division
	-Botanic Gardens	-Forest Biodiversity Division
	-Experimental Plots	-Forestry Biotechnology Division
	-Research Nursery	-Forestry Biotechnology Division
2. Historic Estate Layout	**Roads and Avenues**	-Administration Division -Forestry & Environment Division
	Administration Building	-Administration Division
	Housing Quarters	-Administration Division
	Water Bodies	-Forestry & Environment Division
3.Live-In Community	**Social Organisation**	-Administration Division -FRIM FPS World Heritage Office
	Ambience	

Figure 6.2: Administrative arrangements for monitoring property

The agency responsible for the monitoring the nominated property:

Forest Research Institute Malaysia (FRIM)
52109 Kepong,
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MALAYSIA
Tel: +603-6279 7000
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Email: *feedback@frim.gov.my*

6.c RESULTS OF PREVIOUS REPORTING EXERCISES

The nominated property has never had to make a report to any national or international organisations on its state of conservation. FRIM FPS is not part of international programmes such as Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat (RAMSAR) or Man and Biosphere (MAB). Overall, the nominated property is in good condition and is being maintained according to established standards.

CHAPTER 7

DOCUMENTATION

7.a Photographs and Audiovisual Image Inventory and Authorization Form

7.b Texts Relating to Protective Designation, Copies of Property Management Plans or Documented Management Systems and Extracts of Other Plans Relevant to the Nominated Property

7.c Form and Date of Most Recent Records or Inventory of the Nominated Property

7.d Address Where Inventory, Records and Archives are Held

7.e Bibliography

7.a PHOTOGRAPHS AND AUDIOVISUAL IMAGE INVENTORY AND AUTHORIZATION FORM

The authorisation table indicated in the column 'non-exclusive cession of rights' may be used by UNESCO in the way described in Annex 5 of the *Operational Guidelines for the Implementation of the World Heritage Convention* (World Heritage Centre, 2021).

The photographs are attached to the Nomination; **Annex 1** (USB memory) as electronic images in jpg format at a minimum of 300 dpi resolution.

All photographs and audiovisual images are the property of FRIM. The photographs and audiovisual image inventory and authorization form is shown in **Figure 7.1.**

ID No.	Format	Caption	Date of photograph (mo/yr)	Photographer*	Copyright owner*	Contact details of copyright owner*	Non exclusive cession of rights
1	Digital photo	FRIM FPS Administration Building in its present man-made forest setting	7/2013	Asmar Hassan	FRIM	FRIM	Yes
2	Digital photo	Aerial photo of FRIM FPS (2013)	7/2013	Asmar Hassan	FRIM	FRIM	Yes
3	Digital photo	Aerial view of FRIM FPS in 1974	1/1974	FRIM	FRIM	FRIM	Yes
4	Digital photo	A 2018 view of the forest canopy from below, made possible by suppression of the understorey, showing the phenomenon of crown shyness	10/2018	Mohamed Harun Abdul Rahman	FRIM	FRIM	Yes
5	Digital photo	The Dipterocarp Arboretum in 2020	2020	FRIM	FRIM	FRIM	Yes

ID No.	Format	Caption	Date of photograph (mo/yr)	Photographer*	Copyright owner*	Contact details of copyright owner*	Non exclusive cession of rights
6	Digital photo	Crown shyness phenomenon seen from above	7/2013	Asmar Hassan	FRIM	FRIM	Yes
7	Digital photo	Wooden house on stilts built in local *kampung* (village) style	8/2022	FRIM	FRIM	FRIM	Yes
8	Digital photo	Lagong Lake, provides a panoramic mirror image of the surrounding landscape	9/2012	Yow Chung Kee	FRIM	FRIM	Yes
9	Digital photo	Profiles of man-made forest in FRIM FPS	9/2012	Lee Shing Yaw	FRIM	FRIM	Yes
10	Digital photo	FRIM FPS Administration building completed in 1929, surrounded by deforested slopes and pools of water created by tin-mining	-	FRIM	FRIM	FRIM	Yes
11	Digital photo	Villa Aromatica front porch	11/2017	Muhamad Yusuf Muhamad Yamin	FRIM	FRIM	Yes
12	Digital photo	Waterfall of the Sungai Kroh in FRIM FPS	2/2009	FRIM	FRIM	FRIM	Yes

*FRIM – Forest Research Institute Malaysia, 52109 Kepong, Selangor Darul Ehsan, Malaysia

Tel: +603-6279 7000 Fax: +603-6273 1314 E-mail: feedback@frim.gov.my

Figure 7.1: Photographs and audiovisual image inventory and authorization form

7.b TEXTS RELATING TO PROTECTIVE DESIGNATION, COPIES OF PROPERTY MANAGEMENT PLANS OR DOCUMENTED MANAGEMENT SYSTEMS AND EXTRACTS OF OTHER PLANS RELEVANT TO THE NOMINATED PROPERTY

Large prints of relevant maps referred to in the nomination dossier are separately stored in a canister and labeled with their FRIM FPS Reference Number from the text in the nomination dossier and a title e.g. FRIM FPS Annex 3: Topographic Map of FRIM Forest Park Selangor.

Bound copies of texts relating to protective designation and excerpt of relevant plans related to the nominated property are labeled with their FRIM FPS Annex Reference Number from the text in the nomination dossier and a title e.g. FRIM FPS Annex 5: National Heritage Act 2005 (Act 645) are stored in the Document Box: FRIM FPS Nomination Dossier Annexes, as below:

- Topographic Map of FRIM Forest Park Selangor **-Annex 2 (Map canister)**
- Nominated Property and Buffer Zone Map of FRIM Forest Park Selangor **-Annex 3 (Map canister)**
- Gazettement as Heritage **-Appendix 2**
- Gazettement as National Heritage **-Appendix 3**
- National Heritage Act 2005 (Act 645) **-Annex 4 (Document box)**
- Forest Research Institute Malaysia Act 2016 (Act 782) **-Annex 5 (Document box)**
- Wildlife Conservation Act 2010 (Act 716) **-Annex 6 (Document box)**
- International Trade in Endangered Species Act 2008 (Act 686) **-Annex 7 (Document box)**
- Town and Country Planning Act 1976 (Act 172) **-Annex 8 (Document box)**

7.c FORM AND DATE OF MOST RECENT RECORDS OR INVENTORY OF THE NOMINATED PROPERTY

Record	Date	Form
Checklist of Species Inventory	2013	Database
Checklist of Fauna (Birds, Mammals, Butterflies, Reptiles, Amphibians, Freshwater Fish)	2018	Book
Checklist of Arboreta Collections	2022	Database
Checklist of Kepong Botanic Gardens Collections	2022	Database
Checklist of Bukit Hari Plantation Species Collections	2022	Database
Checklist of Plant Nursery Collections	2022	Database
Checklist of Medicinal Plants	2022	Database
Checklist of Tree Avenues	2022	Database
Checklist of Digital Tree Inventory (Terrestrial Laser Scanning)	2022	Database
Checklist of Herbarium Specimen (BRAHMS)	2022	Database
Checklist of Entomological Reference Collections	2022	Database
Records of FRIM Experimental Plot	2015	Report
Records of Man-Made Tropical Rain Forest	2022	Report
Records of British-Malay Historic Estate Layout	2022	Report
Records of Live-In Community	2022	Report
Records of Green Community Engagement Programme	2022	Report

Figure 7.2: Form and date of most recent records or inventory of the nominated property

7.d ADDRESS WHERE INVENTORY, RECORDS AND ARCHIVES ARE HELD

All documents, records, and archives concerning FRIM Forest Park Selangor are kept at the following premise:

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7.e BIBLIOGRAPHY

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CHAPTER 8

CONTACT INFORMATION OF RESPONSIBLE AUTHORITIES

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CHAPTER 9

SIGNATURE ON BEHALF OF THE STATE PARTY

This Nomination Dossier is hereby submitted to the World Heritage Committee, UNESCO, for application to be inscribed in the World Heritage List as:

FRIM FOREST PARK SELANGOR

by

MALAYSIA

DATO SRI TIONG KING SING

MINISTER
MINISTRY OF TOURISM, ARTS AND CULTURE

JANUARY 2024