PART I: INTRODUCTION

1.1 Background

The Ulu Kalumpang Wullersdorf Sustainable Forest Management Project (UKW SFM) was incorporated in 2007 covering an area of 65,901.74 ha, comprising Ulu Kalumpang FR (50,964.00 ha); Mount Wullersdorf FR (8,857.00 ha); part of Madai Baturong FR (2,312.7 ha) and a cluster of Kalumpang FR i.e. VJR107C (950 ha), VJR107D (1,950 ha) and VJR107E (868 ha). This area is located about 50 km north of Tawau. However, a total of approximately **948** ha were excised in 2013 to pave the way for socio-economic development of the State. The excised areas are, part of Ulu Kalumpang FR (**228** ha) and Mount Wullersdorf FR (**720** ha). Hence, the remaining areas of Ulu Kalumpang FR and Mt. Wullersdorf FR is 50,736 ha and 8,317 ha respectively, and the total area of UKW SFM is now reduced to **64,953.74 ha.** The management goals as a conservation area however remain unchanged. The management of UKW SFM project areas comes directly under the jurisdiction of the Kunak Forestry District of the Sabah Forestry Department.

All forest reserves in UKW SFM are now classified as either Class I, Protection Forest Reserve or as Virgin Jungle Reserves **(Fig. 1.1).** Ulu Kalumpang FR was originally gazetted as a forest reserve in 1956 and re-gazetted as a Commercial Class II forest reserve in 1984. The status was changed to Class I Protection Forest in 1992 mainly to preserve the watershed to supply both Kunak and Tawau districts.

Ulu Kalumpang was logged repeatedly from 1960-1984 thus, much of the forest is considered as secondary forest land **(Table 1.0)**. However, a number of Iban people from Sarawak that worked in the logging industry settled into the forest reserve after logging ceased and have opened the forest to plant agricultural crops. Originally the Iban planted rice and fruit trees but currently most of the areas have now been planted into oil palm. The Iban settlers have also been reported to sell parts of the forest reserve to locals that have set up small oil palm plantations. The result is that a significant portion of Ulu Kalumpang is now heavily degraded due to encroachments of Ibans and local settlers to plant oil palm in the forest reserve. As such, the SFD has recently taken the decision to remove the oil palm and rehabilitate Ulu Kalumpang FR, Mt Wullersdorf FR and the Kalumpang Virgin Jungle Reserves for watershed management as well as to preserve habitat and biodiversity to support wildlife populations and provide representative samples of native species.

Table 1.0 Logging history of the project areas

Forest Reserve	Year
Ulu Kalumpang & Madai Baturong	1960 - 1984
Kalumpang VJR	1959 - 1978
Mt. Wullersdorf	1970 - 1981

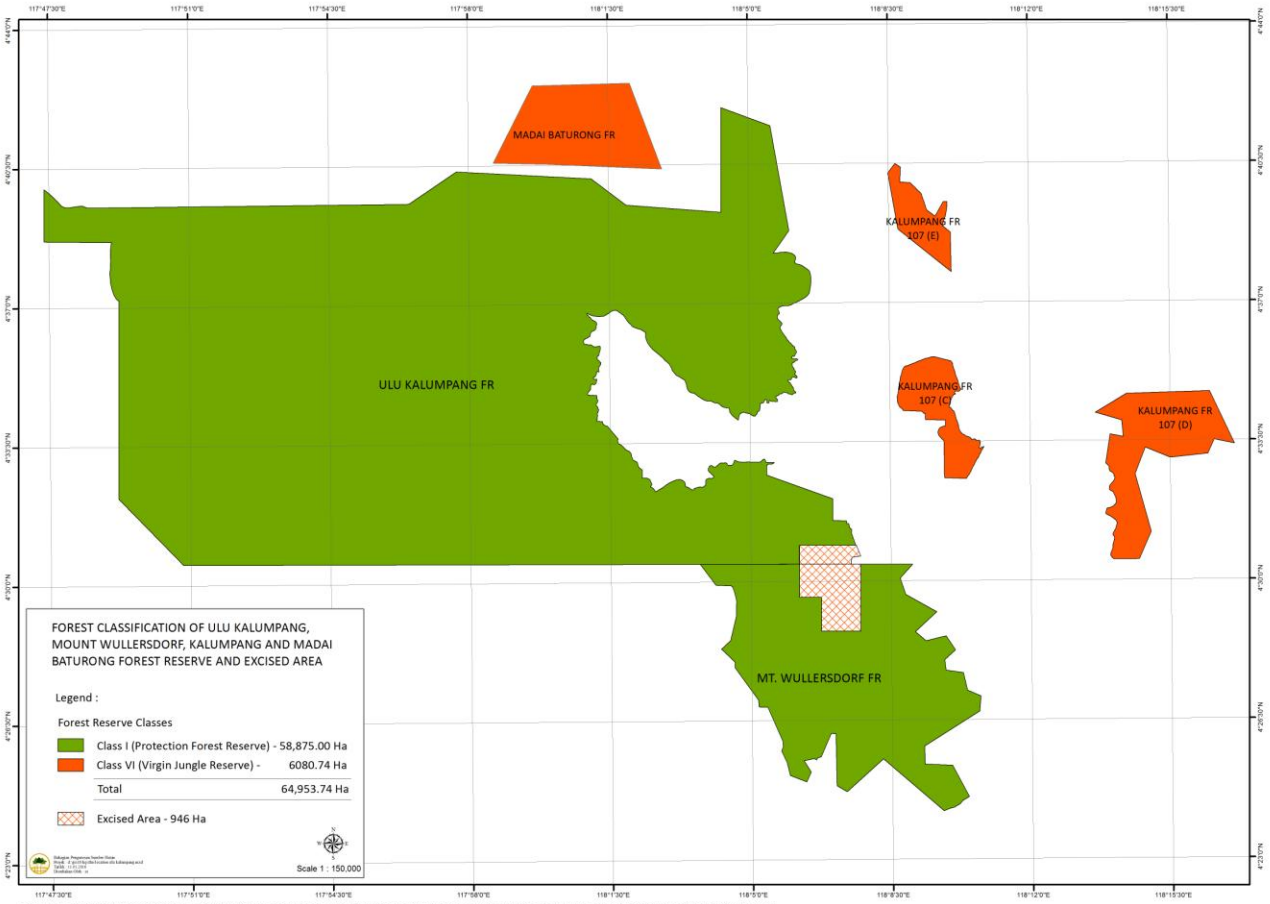


Figure 1.1 Forest Classification of Ulu Kalumpang, Mount Wullersdorf, Kalumpang and Madai Baturong Forest Reserves and excised area.

1.2 Legal Authority and Period of Operation

This plan is called the 10-year Forest Conservation Management Plan (FCMP) for Ulu Kalumpang Wullersdorf Sustainable Forest Management Project UKW SFM). The FCMP was approved by the Director of Forestry on 5th September 2011. This is the first revision of the FCMP. The revision is necessary to incorporate the changes on the size of the project area due to the excisions of Ulu Kalumpang FR (part of) and Mount Wullersdorf FR (Part of), to update information on High Conservation Value (HCV) assessments, and latest management activities such as silviculture treatment, forest restoration, EIA and wildlife monitoring.

This plan provides essential guidelines for the management of the conservation area for the period starting 2011-2020. It is the intent of this plan that all forest resources and services within the areas are managed for conservation of natural resources such as biodiveristy, wildlife habitat, conservation of forest based carbon and to provide watershed to benefit the districts of Kunak and Tawau. The management plan shall be revised every 5 years as part of the management process for conservation or to include other management objectives.

1.3 Policy Statement

The SFD is commited to the basic criteria of forest conservation by ensuring that SFD's activities in Ulu Kalumpang; Mount Wullersdorf; Kalumpang FR and Madai Baturong will bring long term environmental and economic benefits to the state of sabah.

The specific Policy Statements are as follows:

- Sabah Forestry Department is committed to managing the Project Area in accordance with the principles of sustainable and responsible management as prescribed by the Forest Stewardship Council (FSC) or the Malaysian Criteria and Indicators (MC&I) of the Malaysian Timber Certification Council (MTCC), and in conformity with all existing State forest policies, environmental policies, legislation and regulations.

- The SFD will manage the forest reserves under conservation to provide long term source of water for local communities

- The SFD is committed to support the effort to combat global warming in the forest reserves through protection of the forest reserves that will continue to improve in forest quality and sequester carbon and produce carbon credits that would otherwise be lost to continual conversion to agriculture especially oil palm.

- The SFD shall maintain and enhance the high conservation values (HCV), biodiversity, wilderness, soil, and water resources that are ecologically justified, technically and financially viable within the regulatory framework of the SFD.

- The SFD shall incorporate input & support from local, national, and international stakeholders in its efforts to manage the conservation areas.

- The SFD shall optimize economic returns to the State on a long-term basis by producing carbon credits and other environmental services through conservation activities.

- The SFD will strive to protect the project area from illegal activities, such as encroachment, hunting, felling and fires, to enhance the safe, sound and responsible management of the forest for future generations.

- Preference in employment and service contracts are given to local/rural communities wherever possible

1.4 Management Objectives

The overall goal of the SFD is to manage the conservation areas for economic, social, environmental and carbon sequestration benefits to the State. The long-term objectives are as follows:

- To remove all encroached commercial agricultural planted areas mainly consisting of oil palm and restore forest cover to enhance diversity and rehabilitate key ecosystem functions.

- Protect the forest from encroachment and continual conversion to agricultural crops such as oil palm as well as from other illegal activities such as poaching wildlife or illegal logging.

- Restore and maintain forests for water resources, habitat wildlife populations and rare, threatened and endangered species.

- To sequester carbon through rehabilitation of planted and severely degraded areas using species local to Sabah and the region**.**

- To develop a long-term management system in line with international requirements for certification such as FSC and CCBS for carbon sequestration and production of carbon credits.

1.5 Legal Framework

Laws and regulations on forest legislation are the legal instruments, which are necessary in the implementation of the objectives of a forest policy. Forest legislation reflects the principles of sustainability in order to support implementation of forest policy. Management guidelines, on the other hand, provide advice and promote more extensive application of forest management practices. In this context, the following are the Sabah legal regulations and SFD guidelines related to Ulu Kalumpang and associated forest reserves:

i. State Forest Policy, 1954;
ii. Forest Enactment, 1968;
iii. Forest Rules, 1969;
iv. Environmental Protection Enactment, 2002;
v. Environmental Protection Enactment (Prescribed Activities), 2005;
vi. Wildlife Conservation Enactment, 1997;

vii. Land Ordinance, 1930;
viii. Water Resources Enactment, 1998;
ix. Cultural Heritage (Conservation) Enactment, 1997;
x. Sabah Conservation Strategy, 1992;
xi. Biodiversity Enactment, 2000;
xii. Environmental Quality Act, 1985;
xiii. Sabah Labour Ordinance;
xiv. The Employment Act; and
xv. Health and Safety Regulations.

PART II: GENERAL AND HISTORICAL INFORMATION

2.1 Name, Location and Legal Status

This management plan is prepared for Ulu Kalumpang FR / Mt Wullersdorf FR / Kalumpang FR & Madai Baturong FR that in total encompasses **64,953.74** ha. These forest reserves are located adjacent to Tawau Hills Park to form a large contiguous forest area located north of Tawau, Sabah. Its geographical position is between longitude E 117° 50' and 118° 10" and between latitude of N 4° 40' and 4° 25' (**Figure 2.1)**.

Ulu Kalumpang was first announced as a forest reserve in 1956 as a block of land about 862 km square that was reduced to about 530 km square by 1979. It was re-gazetted and classified as a Class II Commercial Forest Reserve in 1984, and eventually in 1992 it was re-classified into a Class I Forest Reserve with an area of 51,118 ha.

Mount Wullersdorf Forest Reserve along with Ulu Kalumpang FR is situated in the Tawau highlands that consists of undulating topography that is associated to the mountainous area of Tawau Hills Park. Mount Wullersdorf is also a Class I Protection Forest Reserve that has some encroachment on the edges of the reserve. The forest reserves comprised five main forest types, that includes: lowland mixed dipterocarp forest, upland mixed dipterocarp forest, lowland mixed & kerangas forest and a small portion consists of lower montane forest. One section of Madai Baturong FR is also located just north of Ulu Kalumpang FR separated by a narrow strip of private land.

One of the objectives of linking these forest reserves is to support watershed management for Kunak and Tawau Districts and to support management to secure long -term survival of viable populations of wildlife. The division of Madai Baturong and Ulu Kalumpang forest reserves by the narrow strip of private land that is part of an oil palm estate should be joined to support wildlife movement between the areas as one of the holistic management objectives of collectively managing the forest reserves.

2.2 Climate

The entire Ulu Kalumpang FR and associated areas generally experiences an equatorial climate characterized by warm and humid weather all year round. Average annual temperature in the lowland is 26.3^{o}C and decreases about 0.6^{o}C for every 100 m elevation until 3,000m. The annual average precipitation in the area is about 1960 mm (P L Lohuji & K Ohta, 1996. Hydrological study in the tropical rainforest in Sabah Malaysia. Forest Research Center, SFD)

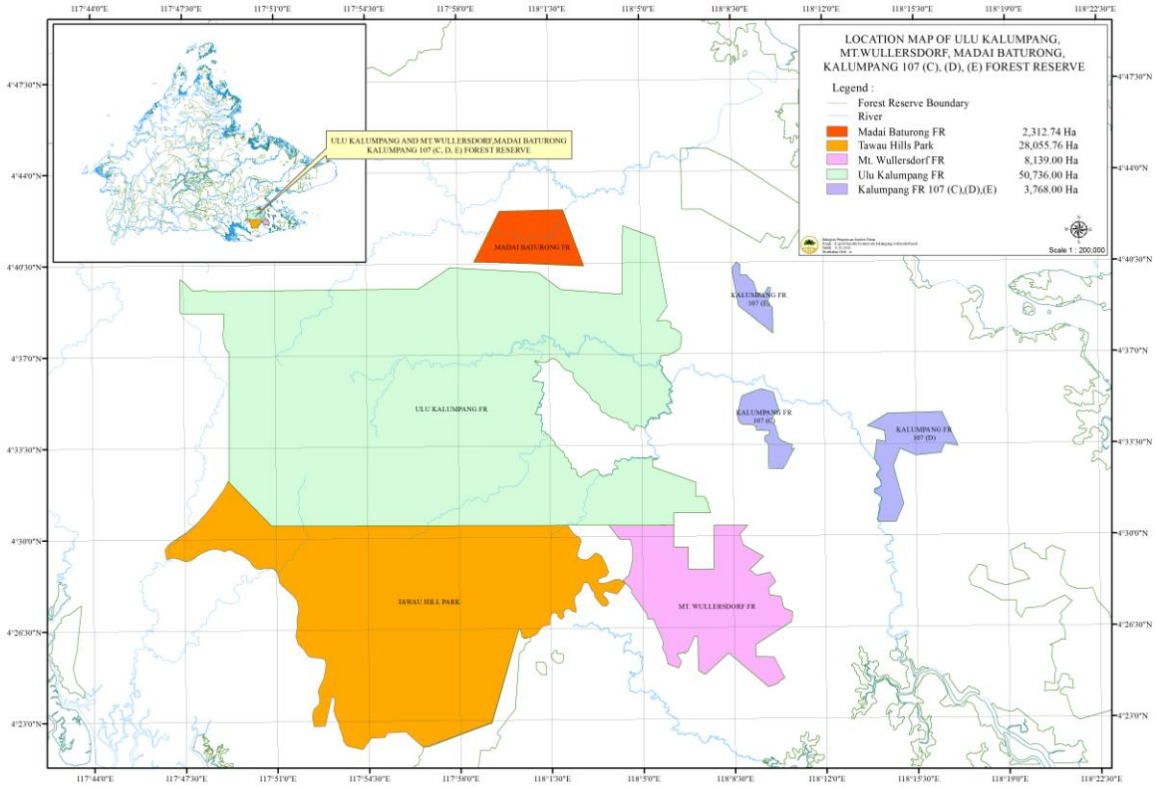


Figure 2.1 Location Map : Ulu Kalumpang, Mount Wullersdorf, Kalumpang and Madai Baturong Forest Reserves.

2.3 Physical Features

The general landform of Ulu Kalumpang FR ranges from gentle to considerably rugged terrain with several peaks on the southern border of Tawau Hills Park including Mount Magdalena (1310 meters), Mount Lucia (1201 meters) and Maria Peak (1083 meters).

Madai Baturong is generally flat while Mt Wullerdorf and the smaller Kalumpang FR are generally broken topography to steep hilly areas.

2.3.1 Geology

Areas of Ulu Kalumpang FR, Mt. Wullersdorf FR, Madai Baturong FR and Kalumpang FRs are underlain by three main rock types: sedimentary, igneous and miscellaneous rocks. Sedimentary rocks of the Kulapis Formation consist of red calcareous sandstone, mudstone and shale while igneous rocks are composed largely of serpentinite, peridotite, dunite and pyroxenite.

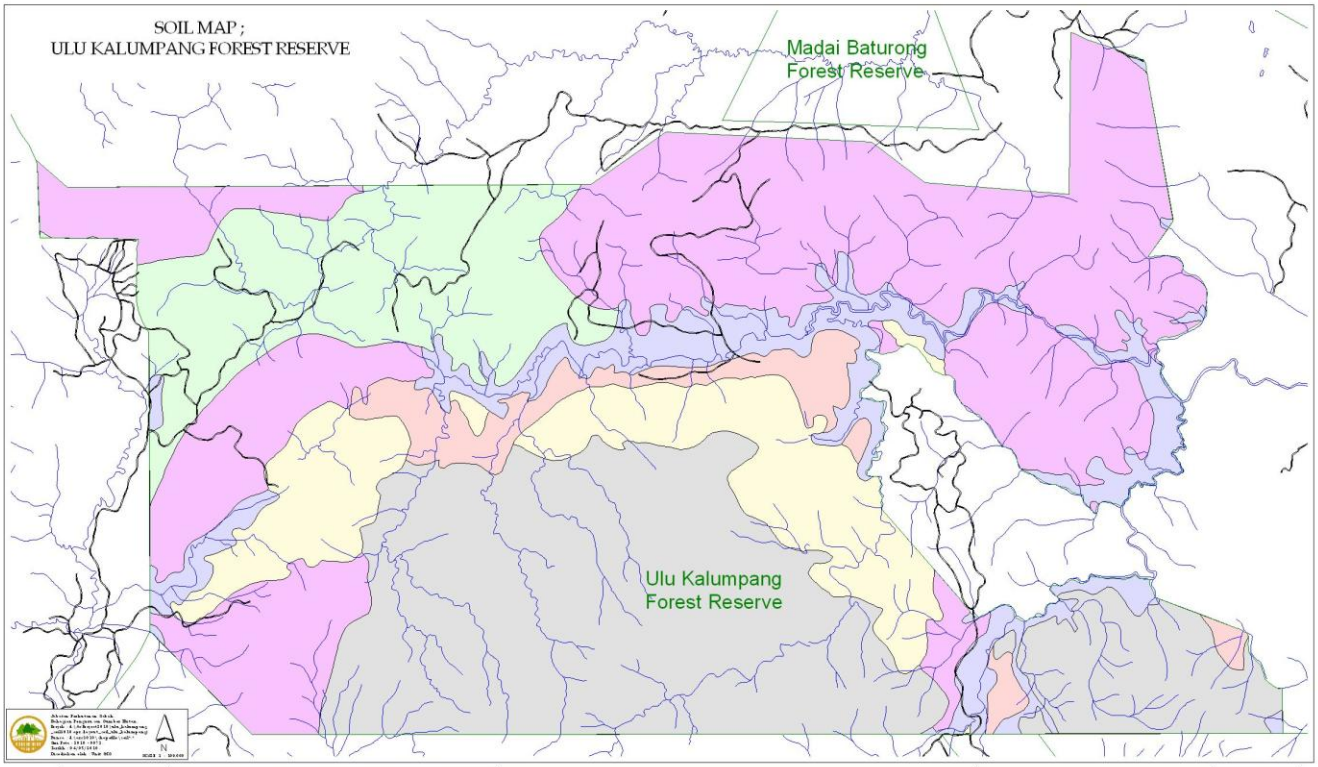
2.3.2 Soils

Soil association is a grouping of soil units that occur together within landscape with characteristic patterns of landform, parent material and vegetation. Soils of the four forest reserves ranged within eleven soil associations which are Apas, Bang, Brantian, Gumpal, Gomantong, Kinabatangan, Sapi, Sipit, Table, Tinagat and Wullersdorf (**Table 2.0** & **Fig 2.2a–d**).

Table 2.0: Soils in Ulu Kalumpang, Madai Baturong, Mount Wullersdorf & Kalumpang FR

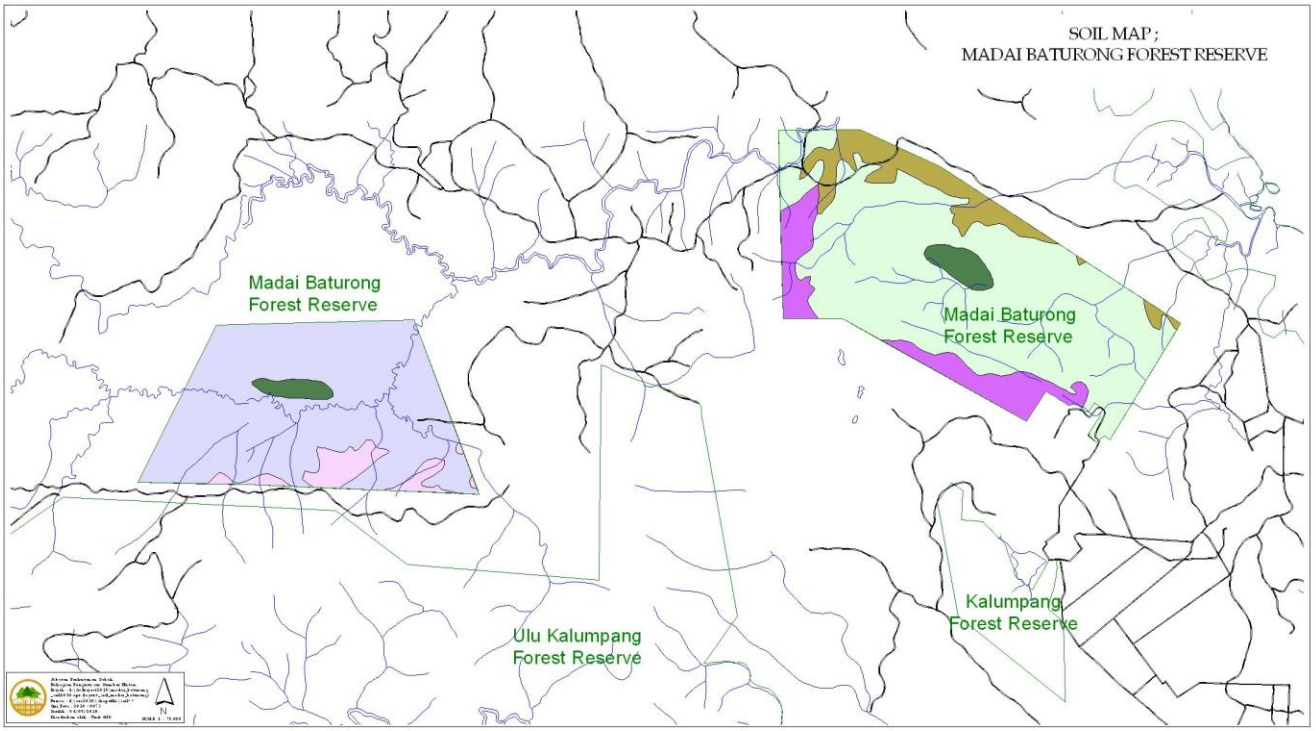
Soil association	Parent material	Main soil units	Landform	Area occupied (ha)			
				Ulu Kalumpang FR	Mt. Wullersdorf FR	Madai Baturong FR	Kalum-pang FR
Apas	Intermediate and Acid igneous rocks	Rhodic Ferrealsol, Orthic Luvisol, Eutric Cambisol	Moderate hills: slopes 15° - 25°	2,080	25	-	-
Bang	Mudstone, Sandstone and Miscllaneous rocks	Orthic Acrisol, Dystric Cambisol	Very high hills: slopes 15° - 25°	6,250	-	-	-
Bidu-Bidu	Ultrabasic igneous rocks	Rhodic and Orthic Ferralsol, Eutric Cambisol, Chromic and Orthic Luvisol, Lithosol	Mountains and hills	-	-	-	-
		Orthic, Ferric and Gleyic					

Brantian	Alluvium	Acrisol, Gleyic Podzol	Terraces	4,500	480	2,063	360
Gumpal	Mudstone, Sandstone and Miscellaneous rocks	Orthic Acrisol, Orthic Luvisol, Dystric and Eutric Cambisol, Lithosol	Mountains and hills	17,600	-	190	2,283
Gomantong	Limestone	Calcic Luvisol, Rendzina	Very high hills: slopes >25°	-	-	162	-
Kinabatangan	Alluvium	Gleyic Acrisol, Gleyic Luvisol, Humic, Dystric and Eutric Gleysol	Floodplains	-	-	-	118
Sapi	Alluvium and peat	Humic, Dystric and Eutric Gleysol, Dystric Histosol	Swamps	-	-	-	2
Sipit	Mudstone, Sandstone and Miscellaneous rocks	Ferric and Orthic Acrisol, Orthic Luvisol	Low hills: slopes 0° - 15°	-	-	-	75
Table	Basic igneous rocks	Xanthic and Orthic Ferralsol	Dissected plateaus with flat to gently undulating surfaces	-	-	-	280
Tinagat	Basic and intermediate igneous rocks	Eutric Cambisol, Lithosol, Ferric Luvisol	Mountains	5,650	30	-	650
Wullersdorf	Intermediate and Acid igneous rocks	Eutric Cambisol, Lithosol	Mountains	15,038	8,322	-	-
Total				51,118	8,857	2,415	3,768



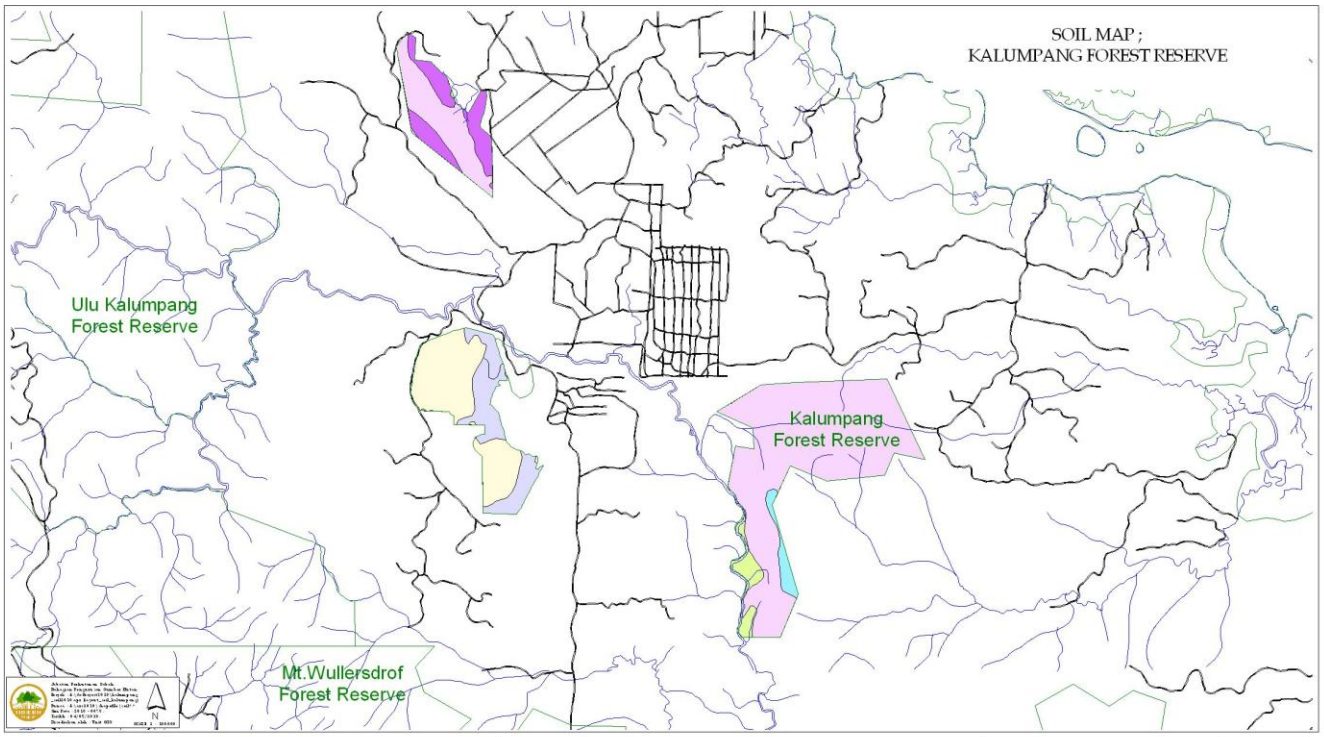
So_associa	Parent_mat	Main_so_un	Landform	Area (HA)
Apas	Intermediate and Acid igneous rocks	Rhodic Ferralsol; Orthic Luvisols; Eutric Cambisol	Moderate hills: slopes 15° - 25°	2,080.00
Bang	Mudstone, Sandstone and Miscellaneous rocks	Orthic Acrisol; Dystric Cambisol	Very high hills: slopes 15° - 25°	6,250.00
Brantian	Alluvium	Orthic, Ferric and Gleyic Acrisols; Gleyic Podzol	Terraces	4,500.00
Gumpal	Mudstone, Sandstone and Miscellaneous rocks	Orthic Acrisols; Orthic Luvisols; Dystric and Eutric Cambisols; Lithosol	Mountains and hills	17,600.00
Tinagat	Basic and intermediate igneous rocks	Eutric Cambisol; Lithosol; Ferric Luvisol	Mountains	5,650.00
Wullersdorf	Intermediate and Acid igneous rocks	Eutric Cambisol; Lithosol	Mountains	15,038.00

Figure 2.2a : Soil association in Ulu Kalumpang.



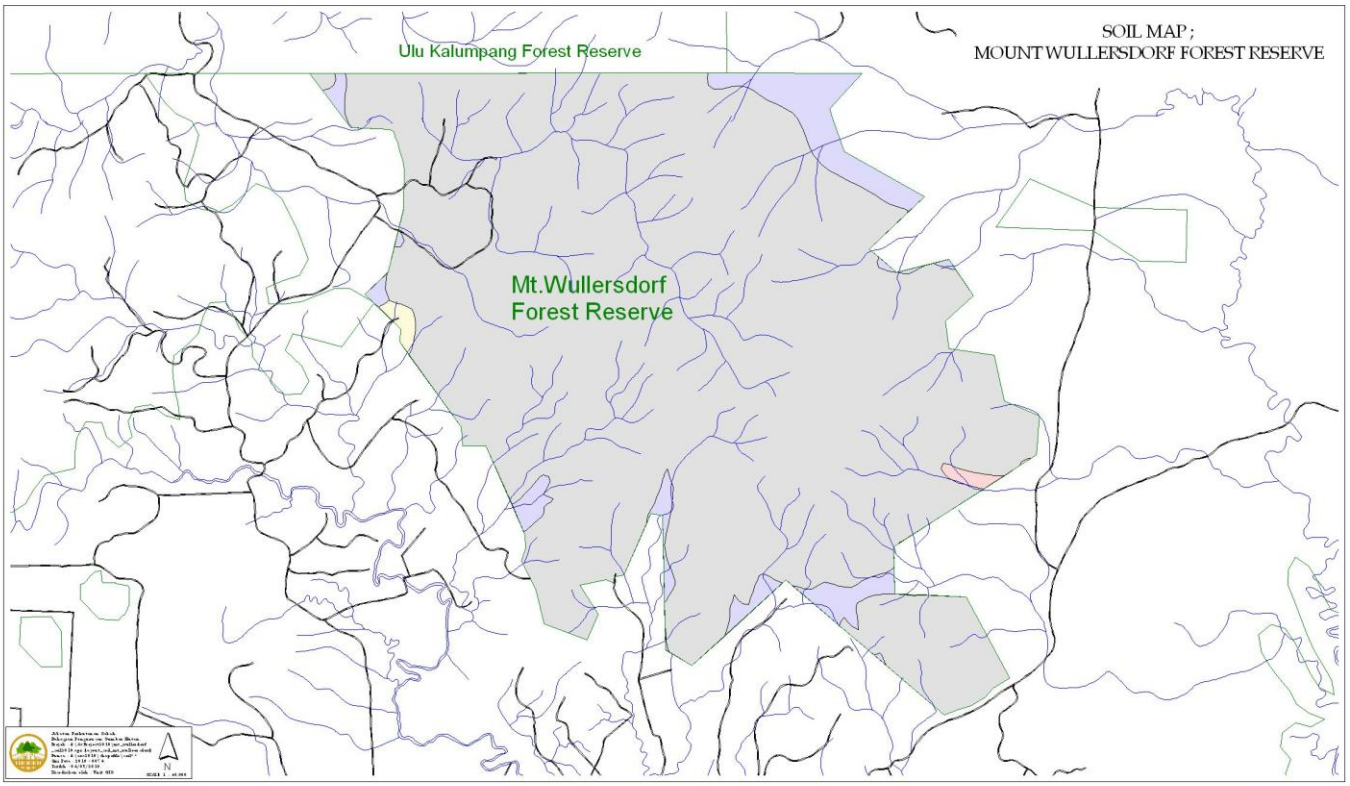
So_associa	Parent_mat	Main_so_un	Landform	Area (HA)
Bang	Mudstone, Sandstone and Miscellaneous rocks	Orthic Acrisol; Dystric Cambisol	Very high hills: slopes 15° - 25°	2,660.00
Bidu-Bidu	Ultrabasic igneous rocks	Rhodic and Orthic Ferralsol; Eutric Cambisol; Chromic and Orthic Luvisols; Lithosol	Mountains and hills	386.00
Brantian	Alluvium	Orthic, Ferric and Gleyic Acrisols; Gleyic Podzol	Terraces	2,063.00
Gumpal	Mudstone, Sandstone and Miscellaneous rocks	Orthic Acrisols; Orthic Luvisols; Dystric and Eutric Cambisols; Lithosol	Mountains and hills	190.00
Gomantong	Limestone	Calcic Luvisol; Rendzina	Very high hills: slopes > 25°	162.00
Table	Basic igneous rocks	Xanthic and Orthic Ferralsols	Dissected plateaus with flat to gently undulating surfaces	406.00

Figure 2.2b : Soil association in Madai Baturong.



So_associa	Parent_mat	Main_so_un	Landform	Area (HA)
Kinabatangan	Alluvium	Gleyic Acrisol; Gleyic Luvisol; Humic, Dystric and Eutric Gleysols	Floodplains	118.00
Sapi	Alluvium and Peat	Humic, Dystric and Eutric Gleysols; Dystric Histosol	Swamps	2.00
Brantian	Alluvium	Orthic, Ferric and Gleyic Acrisols; Gleyic Podzol	Terraces	360.00
Gumpal	Mudstone, Sandstone and Miscellaneous rocks	Orthic Acrisols; Orthic Luvisols; Dystric and Eutric Cambisols; Lithosol	Mountains and hills	2,283.00
Tinagat	Basic and intermediate igneous rocks	Eutric Cambisol; Lithosol; Ferric Luvisol	Mountains	650.00
Sipit	Mudstone, Sandstone and Miscellaneous rocks	Ferric and Orthic Acrisols; Orthic Luvisols	Low hills: slopes 0° - 15°	75.00
Table	Basic igneous rocks	Xanthic and Orthic Ferralsols	Dissected plateaus with flat to gently undulating surfaces	280.00

Figure 2.2c : Soil association in Kalumpang FR.



So_associa	Parent_mat	Main_so_un	Landform	Area (HA)
Apas	Intermediate and Acid igneous rocks	Rhodic Ferralsol; Orthic Luvisols; Eutric Cambisol	Moderate hills: slopes 15° - 25°	25.00
Brantian	Alluvium	Orthic, Ferric and Gleyic Acrisols; Gleyic Podzol	Terraces	480.00
Tinagat	Basic and intermediate igneous rocks	Eutric Cambisol; Lithosol; Ferric Luvisol	Mountains	30.00
Wullersdorf	Intermediate and Acid igneous rocks	Eutric Cambisol; Lithosol	Mountains	8,322.00

Figure 2.2d : Soil association in Mt Wullersdorf FR.

The Wullersdorf soil association is the most extensive soil (covers 35% of the total project area) which is found covering majority of Mt. Wullersdorf FR and southern Ulu Kalumpang FR. This soil association is typically found in mountainous terrain.

Gumpal soil association covers 30% of the project area particularly in Ulu Kalumpang FR, Madai Baturong FR and Kalumpang FR. The largest proportion is in the northeast and southwest of Ulu Kalumpang FR. It is followed by the west in Kalumpang FR and the smallest proportion of Gumpal soil association is in the south of Madai Baturong FR.

Ten percent of the total conservation area is occupied by Tinagat soil association which is found in eastern and western Ulu Kalumpang FR; western Mt. Wullersdorf FR and western Kalumpang FR. These areas are mountainous consisting basic and intermediate igneous rocks as parent materials.

Brantian is the only soil association found in within all conservation areas with the largest area in south of Ulu Kalumpang FR. This is followed by Madai Baturong FR where a major portion of the area is covered with Brantian Soil Association. Small proportion of this soil association was detected in the northeast of Mt. Wullersdorf FR and east of Kalumpang FR, which made up a total of 11% overall.

Northwest of Ulu Kalumpang FR and west of Madai Baturong FR are covered with Bang Soil Association (9%) that is located on steep slopes between 15° - 25° on very high hills.

Apas Soil Association is usually found on moderate hills with slope steepness 15° - 25°. Center of Ulu Kalumpang FR and southernmost of Mt. Wullersdorf FR were found to have Apas soil association which makes up a total of 3% in the project area.

Table soil association covers only 280 ha (0.5%) of the Ulu Kalumpang FR, is mainly found in northeast and southwest of Kalumpang FR. The landform adjacent to the Table soil association consists of dissected plateaus with flat to gently undulating surfaces.

Gomantong Soil Association only occupies in the center of Madai Baturong FR, covers 0.2% of the total project area.

Another 0.2% of the total project area is of Kinabatangan Soil Association which is found in the southwest of Kalumpang FR.

Sipit soil association covers 0.1% and is only found in southeastern Kalumpang FR.

The remaining area of 2 ha is swamps in southwestern Kalumpang FR, which is occupied by Sapi soil association (<0.01% of total project area).

2.3.3 Hydrology

The Ulu Kalumpang Forest Reserve area serves as a watershed for numerous river tributaries. The main river is Kalumpang River; its tributaries being the Mantri and Melati Rivers that supports Kunak District. Others include Binuang River that flows into the Tingkayu and finally the Merotai Kanan which flows southwards from the reserve through Tawau Hills Park to support Tawau District (**Fig 2.3**).

One of the key objectives of managing the Ulu Kalumpang FR, Mt Wullersdorf FR, Kalumpang VJR 107 (C,D,E) and Madai Baturong VJR 107F is to maintain the watershed areas, which is the important water sources for Tawau and Kunak district.

Water sampling within the Ulu Kalumpang FR was conducted at 8 points along Sg Kalumpang, Sg Merotai Kanan, Sg Merotai Besar, Sg Melati & Sg Mantri. The results indicated the water quality was in compliance to Malaysian standards in regards to biological and chemical oxygen demand, effluent discharge and general chemical content (**Appendix I**).

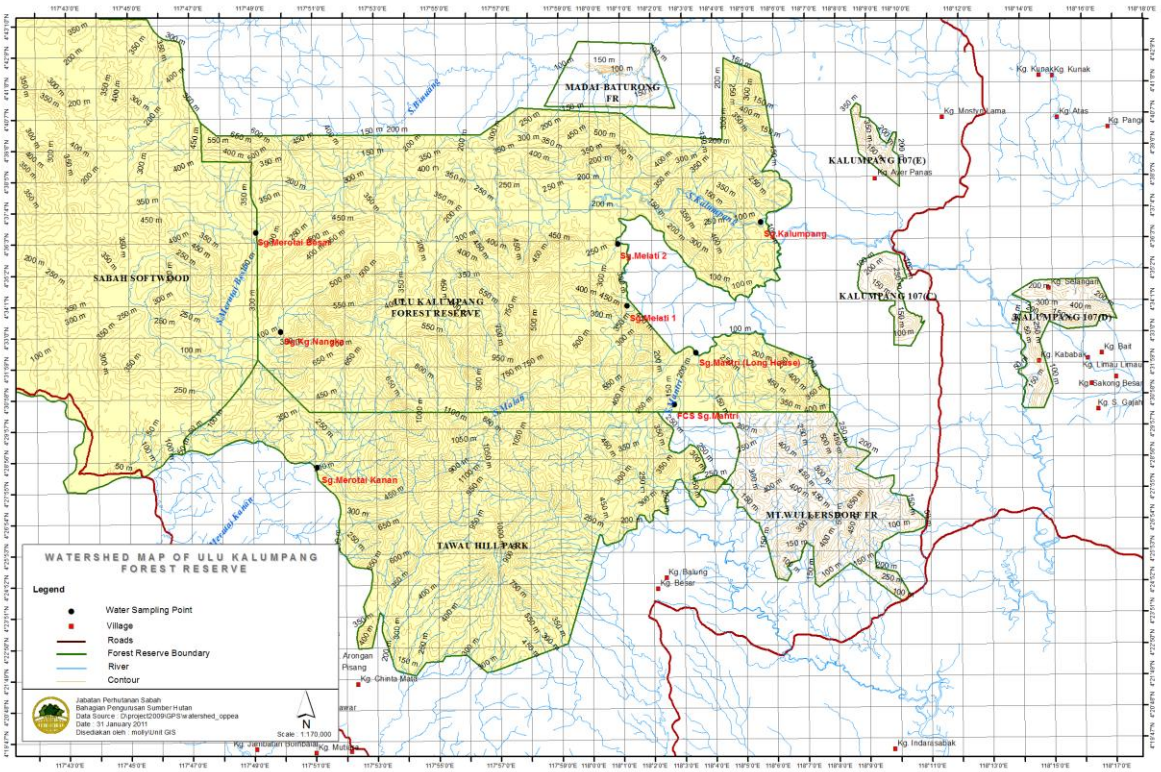


FIGURE 2.3: Watershed system originating from Ulu Kalumpang Forest Reserve

2.4 Socio Economic Environment

There were three (3) illegal settlements in Ulu Kalumpang FR occupied by the migrant workers in the abandoned buildings previously used by logging company after the cessation of logging activities in late 1980s. However, these settlements are no longer exist as they have moved out from the reserve after the establishment of the project in 2007. Therefore, there is now no community living inside this project area. Based on the information from HCV assessments, there are four villages located within 5 km radius outside the boundaries of the project area. These are Kampung Sri Bahagia, Kg. Airpot Batu 10, Kg. Checkpoint and Kg. Balung Cocos.

All of the villages have good road access to employment, medical and educational facilities in the neighboring towns in Lahad Datu, Kunak, Tawau, Balung and Semporna. All villages are equipped with basic infrastructure, such as electricity and telephone line. Two of the communities (Kg. Airport and Kg.Balung Cocos) have amenities such as clean piped water while the other two (Kg. Sri Bahagia and Kg. Checkpoint) have to rely on raw water sources such as rain and underground water supplemented by water obtained from rivers and streams in the vicinity.

The HCV assessment also found that the forests of UKW SFM bear no relevance to the fulfilment of Basic Needs with the exception of Basic Need 5 (water sources) and play no important role in the cultural and/or spiritual identities of these communities. **However, should Social Impact Assessment (SIA) be required, this will be carried out as part of the prescribed activities during the second half period of this FCMP.**

2.5 Past Management

2.5.1 Timber production and encroachment

Commercial exploitation in Ulu Kalumpang FR started in the 1960s' and continued until year 1984 while Mt Wullersdorf FR began in the 1970s-1981. The conventional logging practices have resulted in parts of the area becoming degraded. The logging company used many workers from Sarawak mostly ethnic Ibans who constructed several long houses in the forest reserve following completion of the logging license.

A significant portion of the forest area is expected to be degraded through previous logging activities. The Iban workers established several long houses following completion of logging and started to clear the logged over areas for planting. Encroachment by the Iban settlers have been significant over the past 30 years in Ulu Kalumpang FR. Mt Wullerdorf has approximately 700 ha of planted oil palm and the smaller Kalumpang FR VJRs have approximately 400 ha of planted oil palm.

SFD has recorded the advancement of oil palm in Ulu Kampumpang FR from 1986 – 2009 (**Table 2.1**). (**Fig 2.4a-c**) illustrate the rapid advance of encroachment & agricultural development from 1986-2002. The estimate of encroached areas in Ulu Kalumpang :

Table 2.1: Areas cleared for planting oil palm from 1986-2009 measured through mapping aerial photography and satellite imagery.

Year	Area (ha)
1986	106
1994	4778
2002	8980
2009	9947

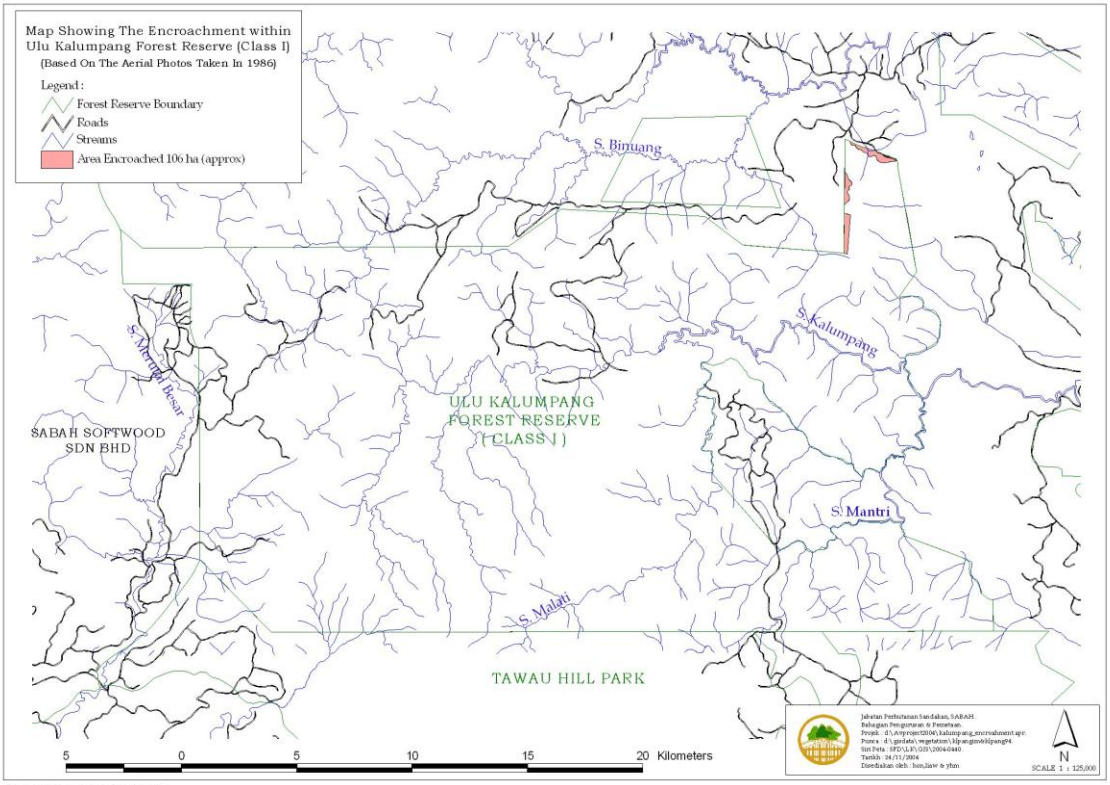


Figure 2.4a : Encroachment 1986

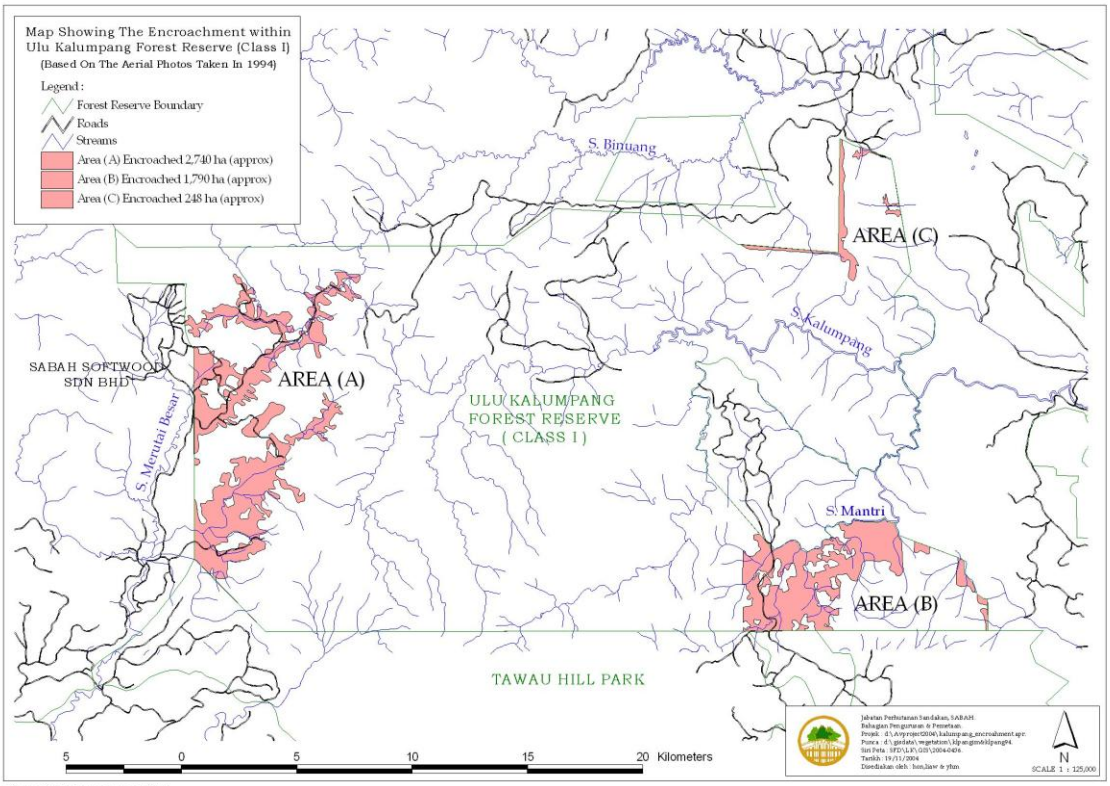


Figure 2.4b : Encroachment 1994

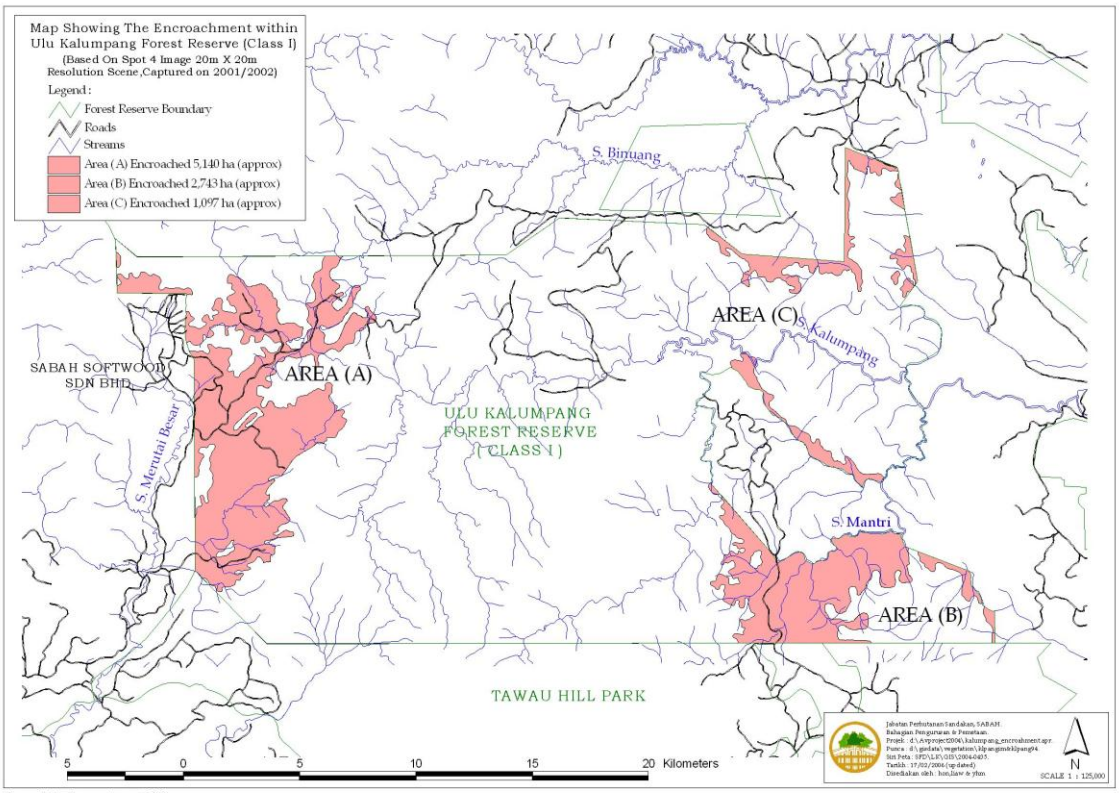


Figure 2.4c : Encroachment 2002

2.5.2 Management Review (2007 – 2015)

The UKW SFM project was established in 2007 for the purpose of extensive forest restoration and the protection of vital watershed. The forests of UKW SFM project are mostly degraded due to excessive logging in the past. A significant portion of the area was encroached, mainly with the oil palm since the cessation of logging activities. Consequently, the FMP was formulated to achieve the management objectives, amongst other, are:

- To remove all encroached commercial agriculture planted areas particularly oil palm and restore forest cover to enhance diversity and rehabilitate key ecosystem functions;
- To protect the project area from further encroachment as well as poaching and illegal logging;
- To restore and maintain forest functions for water resources and wildlife habitat;
- To sequester carbon through forest rehabilitation and restoration;
- To develop long term management system in line with international requirements for certification.

The operational works in the project area was started in 2007 before the inception of the 1st FMP in 2011. Forest rehabilitation and restoration have been actively carried out which include silviculture treatment and restoration planting. Some of the illegally cultivated oil palm within the project area have been gradually demolished and restored with native species. Since inception of the 1st FMP in 2011, forest rehabilitation and restoration are implemented progressively following the schedule as prescribed in the FMP and Annual Work Plans (AWPs). Forest protection and monitoring of wildlife were also carried out as vital activities of the forest management of UKW SFM project. The following are the activities undertaken in UKW SFM project over a 9 year period from 2007 to 2015.

2.5.2.1 Destroying of illegally cultivated oil palm

Part of the project area of approximately 9,900 ha were heavily encroached and mainly, planted with oil palm. Since 2008, the Department had destroyed large areas of the illegally planted oil palm, and then restoring the areas through a proper forest restoration programme. As of 2015, a total of 3,774 ha of illegally cultivated oil palm have been successfully destroyed. **Table 2.2** shows the total area that have been destroyed throughout 2007 to 2015.

Table 2.2 Total area of illegally cultivated oil palm that have been destroyed from 2007 to 2015

Location	Area (ha)
Ulu Kalumpang FR	2,924.00
Kalumpang VJR 107C (Mt. Forbes & Mt. Sangster)	300.00
Mt. Wullersdorf FR	455.30
Kalumpang VJR 107D (Sapang)	94.70
Total	**3,774.00**

2.5.2.2 Forest Restoration (enrichment planting)

Forest restoration activities in the project area are an ongoing effort to ensure that the encroached areas are recoverable. The objective is to restore the forest structures, ecological function and biodiversity. The total area targeted to be restored in each year is subject to the fundings approved by the State Government. Actual planting operation commenced in 2007, during the preparation of the FMP. Throughout the period from 2008 to 2015, the project has successfully restored an area of 1,726.80 ha with various species of Dipterocarps and Non-Dipterocarp, such as, Batai, Talisai, Ketapang, Kapur, etc. Batai is planted mainly for the purpose of providing food sources for wild animals. **Table 2.3** shows the total of restored areas from 2008 to 2015.

Table 2.3 Area restored through enrichment planting from 2008 to 2015

Location	**Area (ha)**
Sg. Mantri, Ulu Kalumpang FR	600.00
Cenderamata/Landau, Ulu Kalumpang FR	600.00
Kalumpang VJR107C (Mt. Forbes & Mt. Sangster)	119.80
Mt.Wullersdorf FR	360.00
Kalumpang VJR107D	40.00
Ulu Kalumpang FR & Madai Baturong VJR107F (adjacent to Sime Darby Binuang Estate	7.00
Total	**1,726.80 ha**

2.5.2.3 Silviculture treatment

Silviculture treatment was carried out to maintain the structure of forest stands and to enhance tree growth. The method used is to cut climbing bamboos and woody vines that suppress the growth of trees. As of 2015, a total of 1,000 ha were successfully treated. **Table 2.4** shows the total silviculturally treated areas in UKW SFM from 2008 to 2015.

Table 2.4 Silviculture treated areas from 2008 to 2015

Location	Area (ha)
Madai Baturong VJR107F (Binuang)	450.00
Kalumpang VJR 107D (Sapang)	300.00
Sg. Mantri, Ulu Kalumpang FR	125.00
Wullersdorf FR	125.00
Total	1000.00

2.5.2.4 Forest Protection

Forest protection is one of the fundamental activities undertaken in the UKW SFM project area to safeguard forests against harmful effects of forest fires, hunting and poaching, illegal felling and encroachment. Permanent security forest checking stations are strategically established and maintained at each of the forest reserves within the project area. Regular surveillance is ongoing and routine activities, including air, river and ground patrolling. Ground and air surveillances were carried out in crime prone areas. With better

enforcement and regular surveillance, the occurrence of forest crimes was observed to decline since 2006.

2.5.2.5 Wildlife monitoring

Wildlife monitoring is also an important forest management activity in the UKW SFM project area. The monitoring results shall provide information on the existence and the population of wildlife. Several methods have been used to monitor wildlife in the forest management unit, such as camera trap technique, recce walk, opportunistic sighting and hornbill observation. One of the methods commonly used is camera trap technique. Cameras were installed in strategic locations to monitor the existence of wildlife especially in areas that have been restored in 2008. In 2012, there was a collaboration work on wildlife monitoring project between SFD, Word Wildlife Fund (WWF) and Institute for Tropical Biology and Conservation of University Malaysia Sabah to gather information on wildlife in UKW SFM Project. The objective of this project was to monitor the existence of Banteng (*Bos javanicus)* and Clouded Leopard (*Neofelis nebolusa)* and other wildlife species by using camera traps. The project has managed to record several images of animals which are listed as threatened species, and rated as a Critically Endangered or Vulnerable in the 2004 IUCN Red List of threatened animals in the project area. The recorded images, include those of threatened species, such as Banteng (*Bos javanicus*), Clouded Leopard (*Neofelis nebolusa,* Asian Elephant *(Elephas maximus),* Malayan porcupine (*Hystrix brachyuran)*, Pig tailed macaque (*Macaca nemesrina)*, Palm Civet, etc.

2.5.2.6 Total accumulated expenditure from 2006 to 2015

The overall expenditure since the inception of the project has amounted to RM19, 326,762.59 (**Table 2.5**). The allocation has sourced from the State Government Development Budget under the RMK-9 and RMK-10, and this will be continued in RMK-11.

Table 2.5 Total expenditure from 2006 to 2015

Year	Expenditure (RM)
2006	298,886.54
2007	995,614.00
2008	1,994,724.00
2009	2,088,466.00
2010	2,618,874.51
2011	1,288,030.89
2012	2,535,937.37
2013	2,506,229.28
2014	2,900,000.00
2015	2,100,000.00
Total	**19,326,762.59**

2.6 Lesson Learned and Managerial Implications for first revision of the FMP

2.6.1 Monitoring of wildlife

The UKW SFM project area is an important wildlife refuge. These networks of forest reserves link to Tawau Hills Park and serve as wildlife corridors that provide habitats to support viable populations of numerous wildlife species, including the Sabah iconic wildlife such as the Orang Utan, pigmy elephant and sun bear. Over the period of 1st half of 1st FMP, monitoring of wildlife has been conducted mainly using camera traps. However, the data collected thus far is still insufficient to assess magnitude of the impact of the project activities on biodiversity conservation. Therefore, periodic wildlife monitoring by using combination of techniques, namely, camera traps, transects and opportunistic sighting will be implemented to determine the long-term population trend (increase or decrease) of wildlife species.

2.6.2 Forest Certification

The management of UKW SFM project area aims to pursue forest certification under the FSC, as a well-managed forest. Hence, the implementation of forest management activities shall to comply with the principle and criteria of the FSC. This also helps enhancing the standard of forest management in the project area towards a responsible forest management. Human resource development and capacity building are essential to support the high standard of forest management. Therefore, continuous training on relevant aspects of forest management should be given to the officers and staff working in the project area. The strategy to capitalize on the strength of SFM practices is also need to be explored for its contribution to mitigate of climate change and to maximize their full range of economic and no-market benefit.

2.6.3 Forest fire management

Forest fire remains a major threat as the impact is catastrophe and it will take decades for the burnt areas to recover its plants and wildlife diversity. To ensure the project areas are effectively protected from fires, it is essential to develop systematic procedures in implementing and maintaining the fire precautionary as well as a control measure. Patrolling and monitoring of fire are conducted regularly. All the necessary forest firefighting equipment are in place and appropriate forest fire training was also given to the officers and staffs. However, Forest Fire Management Plan (FFMP) should be developed to provide guidelines for an effective implementation of preventive and control measures. For that matter, the FFMP should be prepared in the second-term of this management Plan as one of the major activities. A fire danger rating system should also be adopted which provides 24-hour monitoring of fire hazards especially during dry spell.

PART III: FOREST RESOURCES

3.1 Forest Resource Assessment

Forest mapping of the conservation areas was originally based on satellite imagery taken in 1996 and aerial photography from surveys conducted in the late 1990s. As part of the preparation of this conservation management plan, SFD along with GFS staff conducted an evaluation of the current status of land use and forest quality in each of the Forest Reserves. The methods used to estimate forest quality included satellite imagery, aerial survey, followed by limited ground verification. The initial stage to identify the current forest strata within the conservation areas used the satellite imagery taken in year 2006 (**Fig 3.0**) followed by an aerial survey conducted using a helicopter in July 2009. The aerial survey was used to obtain video footages of forest quality and confirm the presence of areas cleared for oil palm as well as currently planted. The aerial survey was also used to identify GPS points for potential helicopter landing points for ground survey and wildlife work following the aerial survey. A revised land use / forest stratum map was drafted based on the video footages and visual interpretation relative to the satellite images. The draft land use and forest strata map was then used for ground verification.

Forest quality is defined according to strata based on number of commercial trees/ha over 60cm DBH based on SFD classifications (**Table 3.0**).

Table 3.0: Forest Stratum

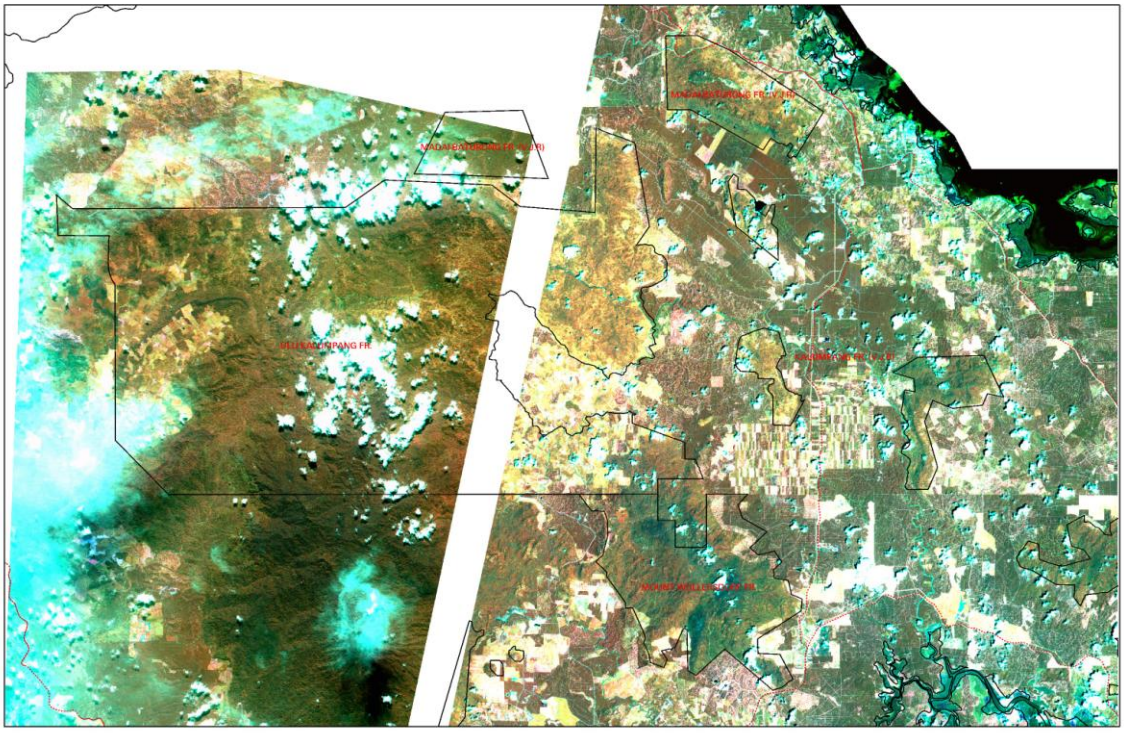
Stratum	Forest Description	Number of trees ha^{-1} ≥ 60 cm dbh
1	Good forest	> 16
2	Moderate forest	9-16
3	Poor forest	5-8
4	Very poor forest	0-4
5	Small crown forest*	NA

* Small crown forest: Forests on ultrabasic soils where trees are naturally of smaller diameters, not exceeding 60 cm dbh.

SATELLITE IMAGE MAP OF ULU KALUMPANG, MADAI-BATURONG (V.J.R)
AND KALUMPANG (V.J.R) FOREST RESERVES

Based on SPOT-4 (10m Resolution), Captured on 2006
Scale 1:170,000

MAP SERIES: 043/2015



3.2 Ground verification of land use and forest strata

3.2.1 Methods

Ground verification was conducted from October 2009 to May 2010, covering each forest conservation area based on establishing strip lines and circular sample plots. The size of a strip line was 100m x 10m (0.1 ha), where all trees above 20cm dbh were measured, enumerated, and recorded. Circular sample plots were 20m in radius (0.126 ha); trees above 15cm dbh were measured, enumerated, marked with numbers, and recorded. Circular sample plots were used to facilitate long term monitoring of forest growth as the design locates individual trees against a center point by recording bearing and distance that can be used in the future as a permanent sample plot. All sample plots and strip lines were located using GPS coordinates and all trees within sample plots were numbered.

A total of 180 sample plots were established in the conservation areas that consisted of 77 strip lines and 103 circular sample plots. The sample size for ground verification was estimated based on the relative sizes of the strata identified in the draft forest strata map following the initial evaluation combining satellite imagery and aerial survey results. Below is the distribution of sample plots in different stratum and in areas cleared for oil palm:

- Stratum 4 - 60 plots
- Stratum 3 - 50 plots
- Stratum 2 - 40 plots
- Encroached area - 30 plots
- Total sample plots - 180 plots

There is limited accessibility into the conservation forest reserves to conduct ground verification for forest stratum. As such, plots are mainly located near the forest reserve boundary and areas accessible by roads, river or on foot. To facilitate verification of interior areas, 4-helicopter landing points were identified along Sg. Kalumpang for ground verification and wildlife survey work and located on the draft forest stratum map. GPS locations for the landing points are shown in **Table 3.1.**

Table 3.1: Helicopter landing points in Ulu Kalumpang FR

Helipad no.	GPS location	Accessibility
1	N 04° 36’ 57.8” E 118°02’ 17.5”	Helicopter & trail
2	N 04° 37’ 25.7” E 118°01’ 18.2”	Helicopter & trail
3	N 04° 36’ 50.5” E 117°58’ 52.4”	Helicopter access
4	N 04° 36’ 52.7” E 117°55’ 52.6”	Could not access

3.2.2 Results - Ground Verification

Based on the analysis of data obtained through ground verification, the conservation area forest reserves consisted of 4 strata: Stratum 1- Good forest, Stratum 2-Moderate forest, Stratum 3- Poor Forest, Stratum 4- Very Poor Forest as well as Encroached areas that were currently planted in oil palm or areas of scrub forest and grasses from previous clearing. **Table 3.2** shows the total areas and percentage of each stratum for the entire conservation area.

Table 3.2: Area and percentage of forest stratum for the total area of all Conservation Forest Reserves

Stratum	Forest Description	Number of trees ha^{-1} ≥ 60 cm dbh	Area (ha)	% of total area
1	Good forest	> 16	12,960	19.6
2	Moderate forest	9-16	14,074	21.3
3	Poor forest	5-8	28,266	42.8
4	Very poor forest	0-4	808	1.2
	Encroached area- oil palm & scrub	NA	9947	15.1
Total			**66,055**	**100**

Based on the data obtained through ground verification the forest stands contained greater number of commercial trees over 60 cm dbh and greater volume than estimated through the aerial survey and satellite imagery. Thus many areas originally thought to be strata 4 were actually verified on the ground to be strata 3. Also some areas thought to be strata 2 were actually strata 1. Thus all the sample plots and strip lines that were originally located in areas thought to be strata 4 based on the draft map resulted in containing adequate number of commercial trees /ha over 60 cm dbh to be upgraded to strata 3 or even strata 2. **Table 3.3** presents the average volume (m3/ha) for each forest stratum over the conservation forest reserves based on ground verification data from each sample plot.

Table 3.3: Summary of estimated tree volume and percentage of Dipeterocarps according to forest stratum and in encroached areas.

Stratum	# of sample plots	Average volume (DBH 60cm+) m^3/ha	Average volume (Total) m^3/ha	Dipterocarps %	Non Dipterocarp %
1	42	160.46	359.26	41.4	58.6
2	82	98.94	289.21	30.2	69.8
3	26	106.19	271.56	17.9	82.1
4	-	-	-	-	-
Encroached area	30	67.0	212.54	22.8	77.2
Total	**180**				

The areas identified as encroached, planted in oil palm and forest quality strata in each forest reserve was mapped in a GIS system based on ground verification data from each sample plot. The ground data plots were used in conjunction with video to determine the

boundaries of each strata and encroached / planted areas in each forest reserve. The resulting information was mapped in the GIS system to the calculate area consisting of the various strata, encroachment and planted in oil palm.

Forest stratification maps for each of the forest reserves were developed based on the results of ground verification according to SFD strata classes for trees over 60 cm dbh/ ha (**Figure 3.1-3.4**). Cumulative data from the GIS mapping of each conservation forest reserve is presented in **Table 3.4.**

Table 3.4: Encroached areas and forest stratum areas within each forest reserve based on GIS mapping data.

Forest Reserve	Encroached & planted oil palm (ha)	Stratum 4 (ha)	Stratum 3 (ha)	Stratum 2 (ha)	Stratum 1 (ha)	Total GIS data (ha)
Ulu Kalumpang	8528	808	28,266	8,172	6,412	52,186
Mt. Wullersdorf	734	-	-	2,879	4,222	7,85
Kalumpang 107 C	614	-	-	380	-	994
Kalumpang 107 D	72	-	-	330	1,678	2,080
Kalumpang 107 E	-	-	-	-	647	647
Madai Baturong	-	-	-	2,313	-	2,313
Total	9948	808	28,266	14,074	12,959	66,055

Forest Stratum map for the entire project area (**Figure 3.1**) indicates 19.6% of the area is good forest and 21.3% includes moderate forest, while about 42.8 % is classified as poor forest while only 1.22% is very poor forest. A significant portion of the area (about 15%) is classified as encroached area that includes areas planted by oil palm and scrub forestland. The cumulative area physically planted in oil palm was estimated to be approximately 3,500 ha across the conservation forest reserves.

Figure 3.1: Forest Stratum Map of Conservation Forest Reserves

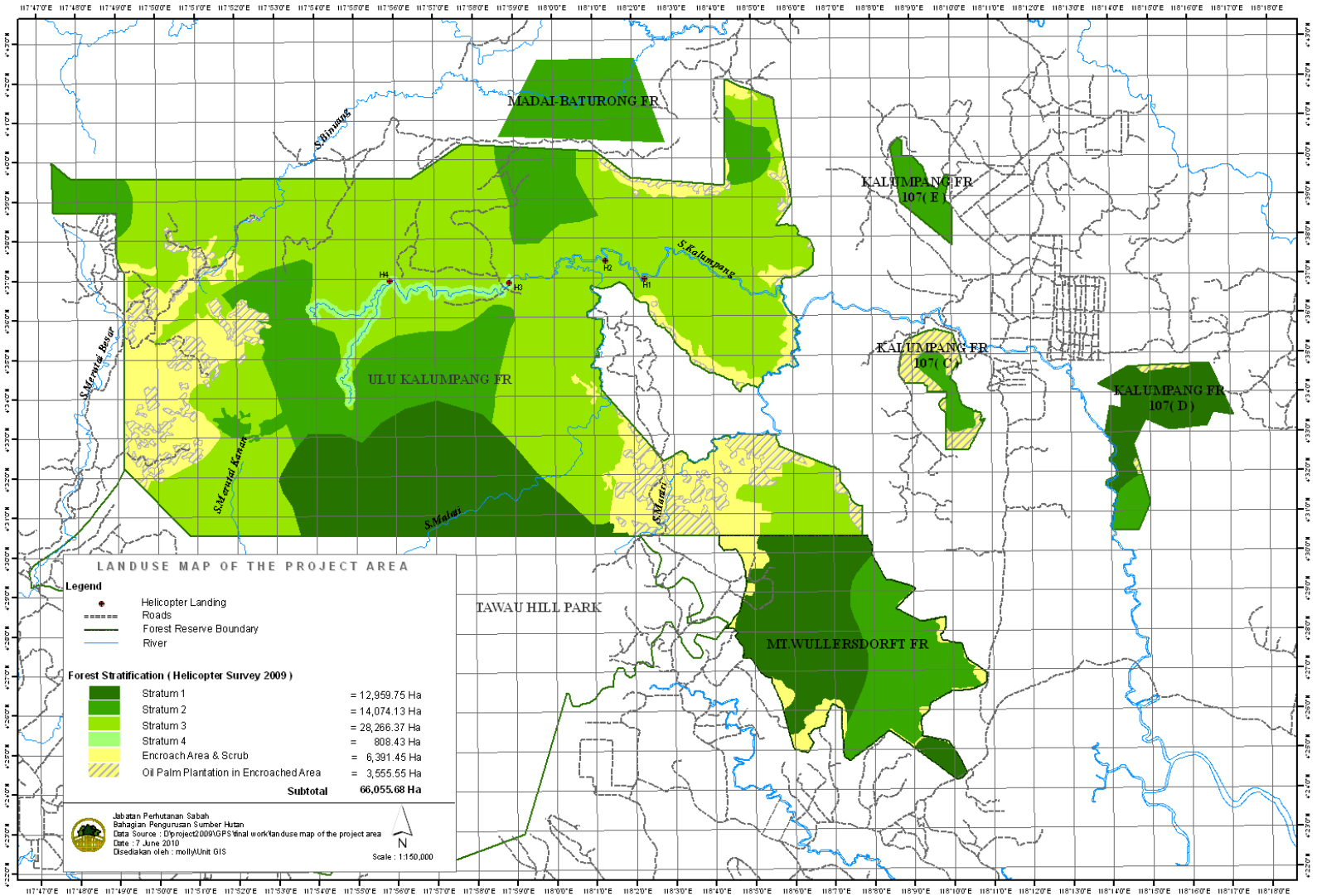


Figure 3.2: Forest Stratum Map of Ulu Kalumpang & Madai Baturong including sampling points

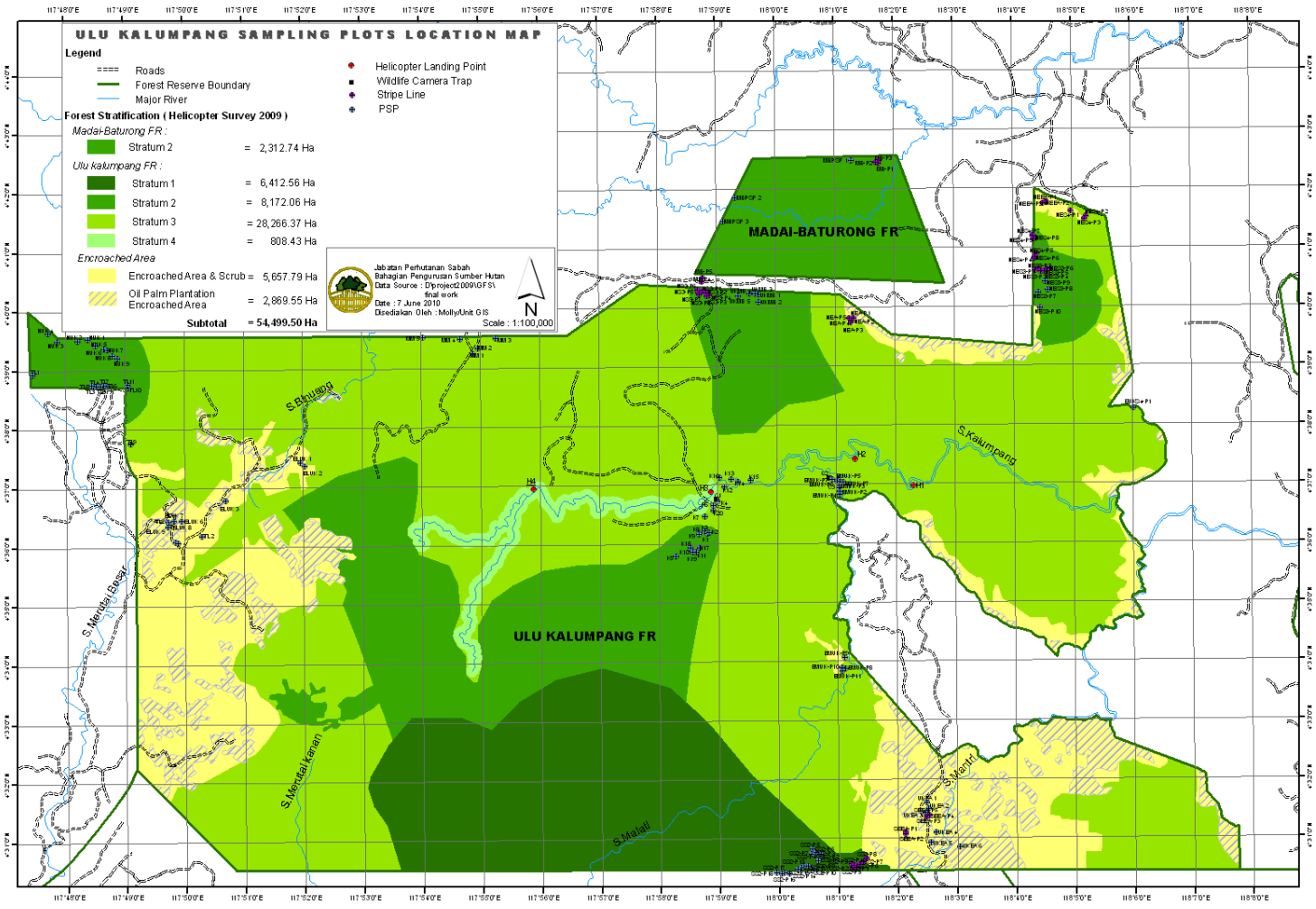


Figure 3.3: Strata map for Kalumpang FR (VJR) 107 CDE

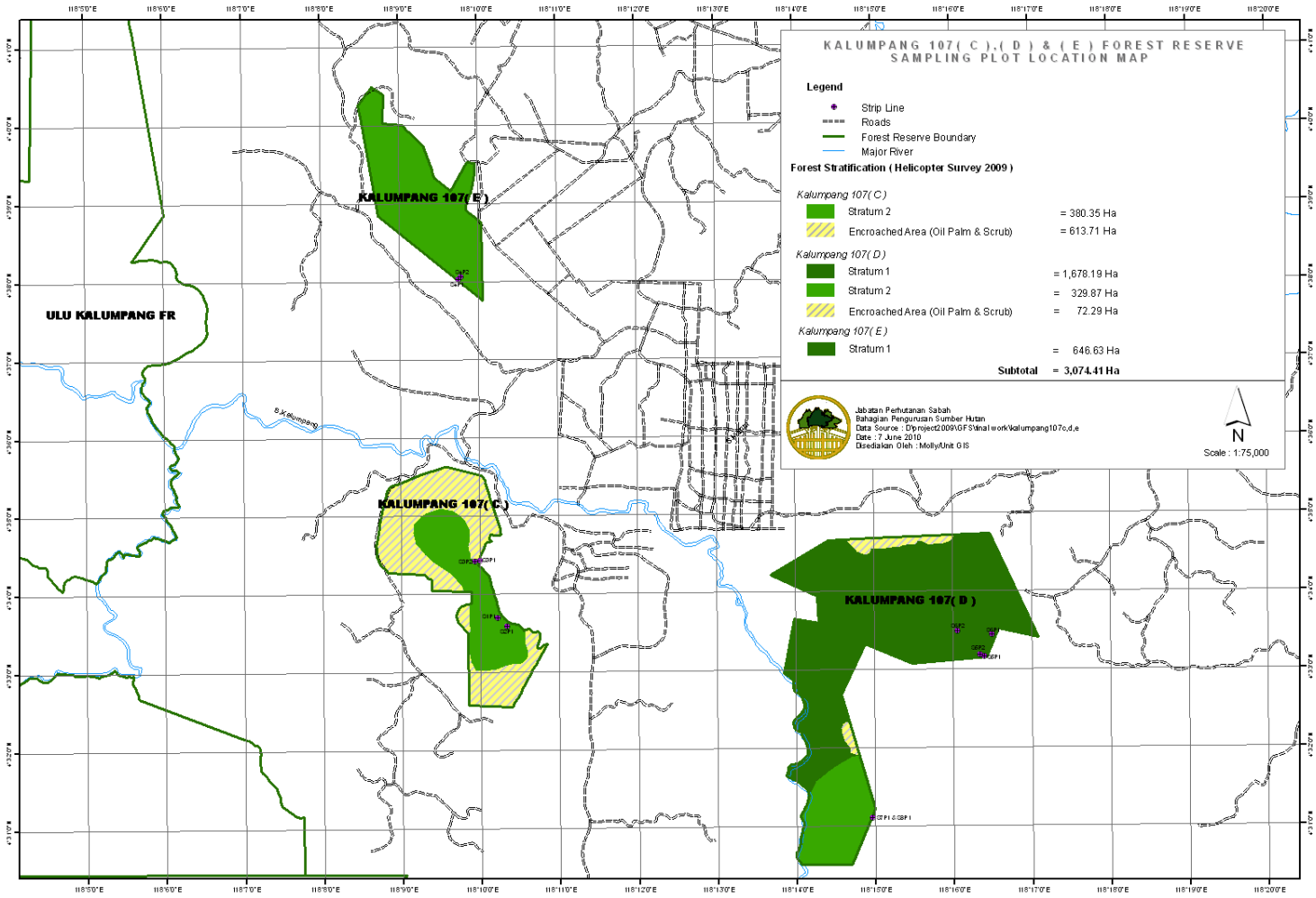
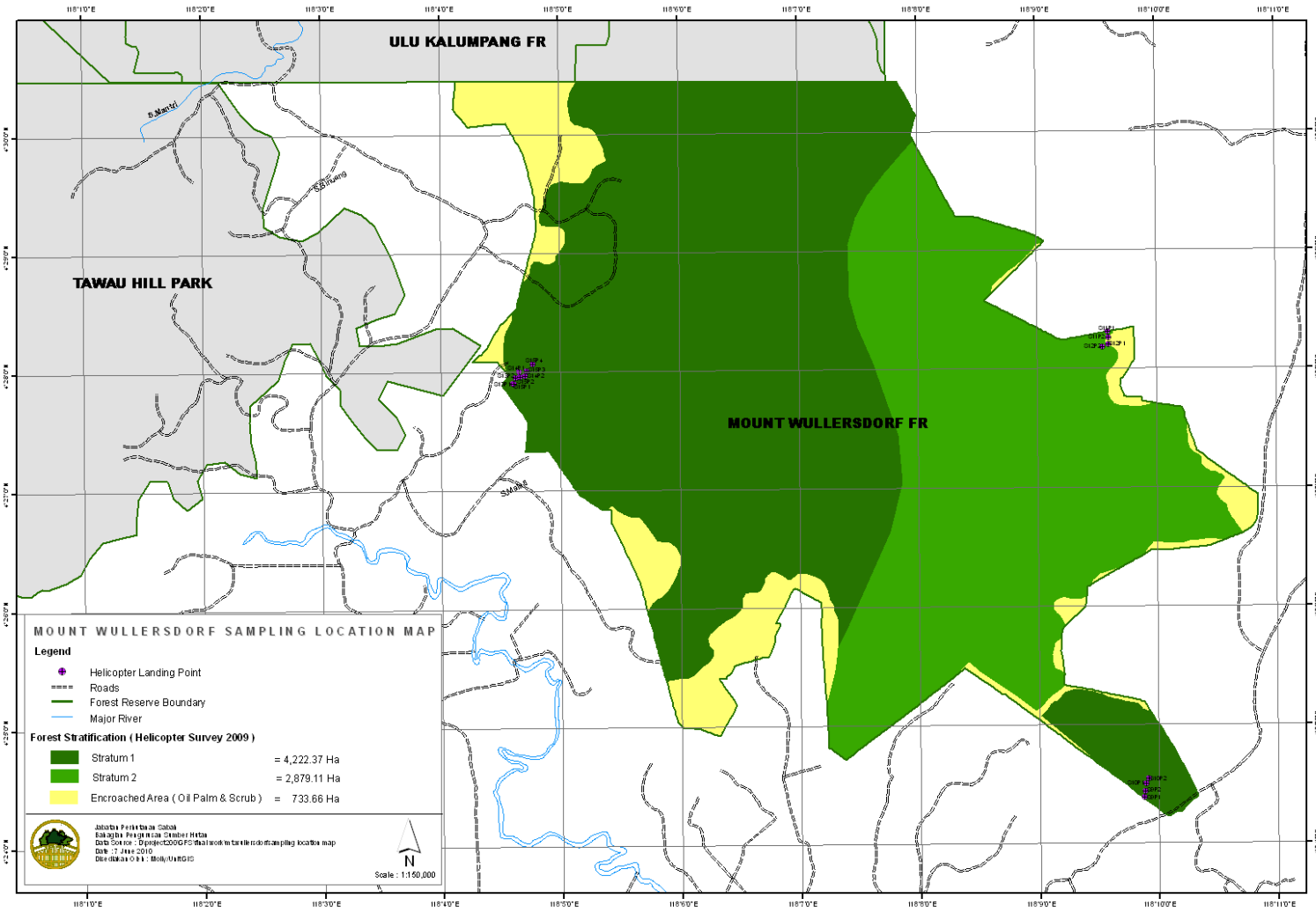


Figure 3.4: Strata map for Mt. Wullersdorf FR including sampling points



PART IV: ENVIRONMENT & WILDLIFE

4.1 Environmental Impact Assessment

Sustainable forest management involves a range of activities where some of them may affect the environment directly or indirectly. The severity of impact varies depending on the scale of the disturbance. Implementation of sustainable forest management project in UKW SFM project area under the 10-year management plan may not have a severe impact on the environment since there will be no logging activity and the management are focused on the conservation of biodiversity and natural forest protection. Nevertheless, the implementation of this project may be subjected to some form of disturbances to the environment from within the project itself or from the adjacent activities.

The Environmental Impact Assessment (EIA) provides assessment of the environment consequences of forest management activities in a systematic, holistic and multidisciplinary way. Although EIA is not mandatory for conservation based forest management area, it is somewhat a requirement for forest certification under the Principle 6 of FSC Principal & Criteria. In order to fulfill this requirement, SFD had conducted an internal EIA to identify potential environmental impacts of SFM implementation in UKW SFM project area, and have proposed appropriate mitigation measures to mitigate and minimize the impacts. The key environmental impacts that may arise during the implementation phase of UKW SFM project are soil erosion, water pollution and waste pollution, and adverse impacts on forest ecosystem, flora, wildlife and the social aspects. As the activities in UKW SFM project area are mainly on forest rehabilitation and restoration for sustainable manage of resources and conservation, the impact on the environment will be minimal. In long term, the impact from the above activities towards the existing environment is expected to be **positive**.

4.2 The Impact on Environment during the implementation phase

Key environmental impacts and mitigation measures during the implementation phase of UKW SFM project are summarized as follows:

Key Environmental Impacts		Key Mitigation measures
Physical	Soil erosion (minor impacts)	• Reducing land area disturbed. • Protection of steep areas • Preservation of Riparian Reserves • Road construction must not exceed 8^0 slopes.
	Water quality deterioration	• Preservation of riparian reserves • Proper bridges and culverts for stream crossing
	Forest fire hazards	• No open burning allowed on-site, either for land clearing or waste/garbage/biomass disposal. • Identify water resources and provide water facilities near potential area for forest fire. • Conduct regular training and awareness programs. • Arrange with local authorities for assistance in case of fire within project area.

		• Prepare fire management plan based on prevention, detection and suppression. • Provide signage or notices at the strategic or high risk area on forest fire.
	Waste pollution	Solid waste management • Proper sanitary and waste management • Awareness programme for better understanding on garbage management especially for on-site worker.
		Scheduled waste management • Storage, handling and disposal of schedule waste will be done in accordance to the standard requirements. • Scheduled waste must be labelled and stored in a Scheduled Waste Store. Storage site must not less than 50 m from stream or any water bodies. • The collected scheduled wastes will be disposed periodically in accordance to the legal requirements.
Ecological	Improvement of degraded forest ecosystems (Major impact)	Management activities already prescribed mitigation measures to improve degraded forest as follows: • Proper silviculture treatment • Enrichment planting • Protection from forest fire and encroachment
	Protection of wildlife	• Protection from illegal hunting • Habitat improvement and enhance food sources through forest restoration • Awareness program for public
Social	Safety and health	• provide hygienic environment and implement hygienic practice • provide safety environment and proper safety requirement

It is essential and practical to incorporate a monitoring to provide information that will aid impact management, and to achieve a better understanding of cause-effect relationships and to improve impact prediction and mitigation methods. The project management will formulate Environmental Monitoring Programme (EMP) and will be coordinated by an environmental officer. It is anticipated that biodiversity and ecosystem monitoring will correspond to the management and monitoring prescribed in the HCV study. This monitoring will involve site inspection activities by the designated project personnel and the environmental officer, and to prepare a monitoring compliance report annually. The recommended impact-monitoring programme is as listed in the framework tabulated as follows:

Key environmental components	Recommended Impact mitigation
Soil erosion	• Compliance guidelines and regulation during construction of infrastructures, i.e road, nursery, etc. • Regular maintenance inspection • Forest restoration and silviculture treatment in riparian reserves, water catchment, steep areas.
Water quality	• Long term monitoring on water quality

Waste pollution	• Regular inspection on sanitary structure • regular monitoring on management operations that involve chemical usage
Forest ecosystems	• Site specific procedure in forest restoration for habitat enhancement • Forest fire prevention programme • Prevention of encroachment
Flora	• Compliance guidelines and regulation on removal of plants (silviculture treatment)
Wildlife	• Implementation of wildlife management and monitoring programme • Compliane guidelines and regulation during the implementation of forestry activities, i.e. silvicultural treatment and chemical usage
Social aspects	• Compliance with the guidelines and regulations for workers health and safety

4.3 Water Quality Monitoring

Water quality monitoring is an important aspect of this forest conservation management plan since a key objective includes watershed management to provide water to Kunak and Tawau districts. Periodic water quality monitoring is needed to ensure the quality of outflow from forest reserves are not contaminated.

4.3.1 Water samples collection

Water Quality Sampling was carried out by Hydrology Unit of Forest Research Centre on 1-3 December 2015 to investigate the water quality of 7 rivers, namely for Sg. Binuang (Muis Melewar), Sg. Binuang 2 (FCS Binuang), Sg. Lombong Mas (Southsea Gold), Sg. Mantri (FCS Mantri), Sg. Landau and Sg. Kalumpang (**Figure 4.1**). This assessment is part of the study component required for the development of the Sustainable Forest Management Project area for Ulu Kalumpang Wullersdorf Sustainable Forest Management Project Area (UKW SFM)

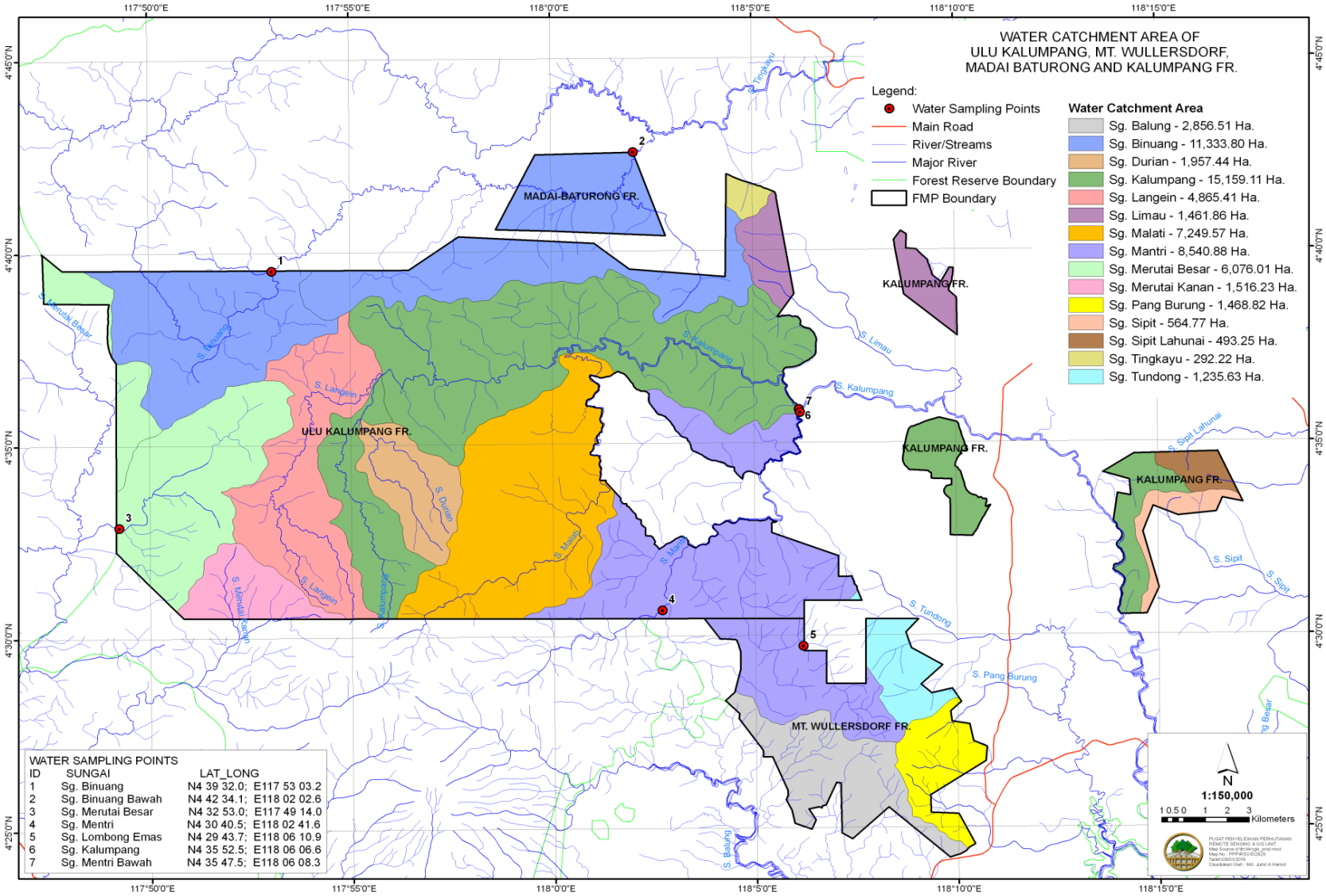
Table 4.1. The location of water quality sampling points in Ulu Kalumpang-Wullersdorf SFM Project Area.

Sample Point No.	Location	Date of Sampling	Surrounding Condition	Prevailing Weather conditions (24 hours)	GPS Location	
					North	East
W1	Sg. Binuang (Muis Melewar)	01/12/2015	Secondary forest	Clear weather.	$04^0$39’32.0”	$117^0$53’03.2”
W 2	Sg. Binuang 2 (FCS Binuang)	01/12/2015	Secondary forest	Clear weather.	$04^0$42’34.1”	$118^0$02’02.6”
W 3	Sg. Merotai (FCS Landau).	02/12/2015	Secondary forest	Clear weather.	$04^0$32’53.0”	$117^0$49’14.0”
W 4	Sg. Sg. Mantri (FCS Mantri)	02/12/2015	Secondary forest	Clear weather.	$04^0$30’40.5”	$118^0$02’41.6”
	Sg	02/12/2015	Secondary	Clear weather.	$04^0$29’43.7”	$118^0$06’10.9”

W 5	Lombong Mas (Southsea Gold)		forest			
W 6	Sg. Kalumpang	03/12/2015	Secondary forest	Clear weather.	$04^0$35’52.5”	$118^0$06’06.6”
W7	Sg. Mantri Bawah	03/12/2015	Secondary Forest	Clear weather.	$04^0$35’47.5”	$118^0$06’08.3”

From the water test results as shown in **Appendix 1 - River Water Testing Result**, the water bodies of rivers and streams in ULU KALUMPANG FR are classified as clean water (Class I or Class IIA / IIB) based on the content of in B.O.D (Biological Oxygen Demand), C.O.D (Chemical Oxygen Demand) Fecal Coliform (*E.coli*) and Total Coliform parameters. Please refer to **Appendix 2 - National Water Quality Standards for Malaysia** for further details.

Figure 4.1 The location of water sampling points to assess river water quality in Ulu Kalumpang-Wullersdorf SFM Project Area, Sabah.



4.4 Wildlife

Although Ulu Kalumpang FR and Mt Wullersdorf FR have been logged over and encroached, the residual forests provides habitat to support viable populations for numerous wildlife species in the forest reserve that connects to Tawau Hills Park to form an important conservation area. Through previous surveys conducted and recorded by various organizations and government departments there is an estimated 180 species of birds are present in the Ulu Kalumpang area, which makes it an important site for lowland forest species in Sabah, especially for hornbills (six species) and pheasants. Ulu Kalumpang is also home to Orang Utan whose numbers are estimated to be around 150 individuals, as well, the endangered Borneo Pygmy Elephant (*Elephas maximus*) are found to roam in this part of Sabah. Other animals prevalent to the area include various types of deer, wild boars and several species of monkeys such as the Bornean Gibbon, Long-tail and Short-tail Macaques and the Redleaf Monkey. A wildlife survey which was conducted from 2nd to 6th November 2015 has also recorded two (2) Borneon endemic species in UKW SFM project area, i.e. Borneon Yellow Muntjac (*Muntiacus atherodes*) and Plain Pigmy Squirrel (*Exiliscirius exilis*).

4.4.1 Methods of Wildlife Monitoring

Monitoring of wildlife is still on going and several methods have been use to carried out the monitoring activities such as;

a) Camera trapping
b) Opportunity Sighting
c) Recce walk/transect
d) Hornbill observation

4.4.1.1 Camera trapping

Presence of wildlife in Ulu Kalumpang FR, Madai Batruong & Mt Wullersdorf was identified based on the observation during ground verification by the identification of large mammal tracks, vocalization, fecal material, claw marks, nests, direct or opportunistic sightings. In addition 4 camera traps were located near the Ulu Kalumpang river in the Ulu Kalumpang FR. The objective of setting up camera traps was to photograph and determine types of terrestrial wildlife in the forest reserves. The results showed that Pig-tailed Macaque is the most common wildlife species found in UKW SFM area, and followed by wild bearded pig. It also shown that Borneo pygmy elephant which categorised as endangered species by IUCN is presence in Ulu Kalumpang-Wullersdorf Forest Reserve area. The locations of cameras and wildlife species recorded from the month of January to Jun 2016 are shown in **Table 4.2.**

Table 4.2: Location of camera-traps in Ulu Kalumpang FR and number of wildlife species recorded from the month of January to Jun 2016.

No.	Location / Species	UKW 1 (F0014416)	UKW 2 (F0014417)	UKW 3 (F0014418)	UKW 4 (F0014420)	Total	Percentage (%)
01.	Pig-tailed Macaque	21	2	1	4	28	34.6%

02.	Wild/Bearded pig	14	3	4	-	21	25.9%
03.	Sambar deer	-	-	21	-	21	25.9%
04.	Long-tailed Macaque	2	-	-	-	2	2.5%
05.	Common porcupine	3	-	-	-	3	3.7%
06.	Treeshrew	2	-	-	-	2	2.5%
07.	Crested Fireback	1	-	-	-	1	1.2%
08.	Borneo pygmy elephant	-	-	1	-	1	1.2%
09.	Malay badger	1	1	-	-	2	2.5%
					TOTAL	81	100%

4.4.1.2 Opportunistic Sighting

Opportunistic sighting is one of the methods used to monitor the population of wildlife in the project area. These data were recorded during wildlife monitoring and patrolling activities within the forest reserves area. The results showed that long-tailed Macaque has the highest percentage compare to other species that found in forest reserve area (**Table 4.3).** Two species that categorised as endangered species; Bornean pygmy elephant and Bornean gibbon are also found during data collection.

Table 4.3 Number of wildlife species that was recorded through opportunistic sighting

No.	Species	Jan-March	Apr-Jun	Total	Percentage (%)
1	Long tailed macaque	3	7	10	16.2%
2	Pig tailed macaque	4	4	8	13.0%
3	Bornean pygmy elephant	8	1	9	14.5%
4	Wild pig	1	4	5	8.1%
5	Sambar deer	4	1	5	8.1%
6	Malay civet	0	5	5	8.1%
7	Lesser mouse deer	2	0	2	3.2%
8	Leopard cat	1	1	2	3.2%
9	Bornean yellow muntjac	1	1	2	3.2%
10	Giant squirrel	1	1	2	3.2%
11	Common palm civet	0	2	2	3.2%
12	Barn owl	0	2	2	3.2%
13	Black squirrel	1	0	1	1.6%
14	Porcupine	1	0	1	1.6%
15	Bornean gibbon	0	1	1	1.6%
16	Flat-headed cat	0	1	1	1.6%

17	Horse-tailed squirrel	0	1	1	1.6%
18	Western tarsier	0	1	1	1.6%
19	Banded-palm civet	0	1	1	1.6%
20	Ayam hutan	0	1	1	1.6%
	Total	**27**	**35**	**62**	**100%**

4.4.1.3 Recce walk / Transect

Recce walk/transect line is also used by wildlife survey team for wildlife monitoring activities. There are four (04) permanent transect lines for data collection by identifying wildlife trace including footprints, sound, direct sightings and scratching marks. The monitoring activity using this technique was conducted from January to Jun 2016, and have recorded about 92 wildlife species within the UKW SFM project (**Table 4.4**).

Table 4.4 wildlife index percentages recorded through "Recce Walk" technique for the period of January to June 2016

LIST OF UKW SFM SPECIES			QUARTER 1 (JAN-MARCH) 2016	QUARTER 2 (APR-JUNE) 2016	SUB TOTAL	TOTAL TRANSECT DISTANCE SURVEY FOR HALF YEAR 2016	Index = N/ DISTANCE	INDEX (%) = N/TOTAL DETECTION OF ALL SPECIES
NO.	**SPECIES**	**SCIENTIFIC NAME**						
01.	Bornean pygmy elephant	*Elephas maximus*	3	0	3	8	0.38	3.26%
02.	Wild pig	*Sus barbatus*	9	48	57	8	7.13	61.96%
03.	Lesser mouse deer	*Tragulus javanicus*	2	3	5	8	0.63	5.43%
04.	Banteng	*Bos javanicus*	2	0	2	8	0.25	2.17%
05.	Sambar deer	*Cervus unicolor*	2	6	8	8	1.00	8.70%
06.	Sun bear	*Helarctos malayanus*	1	2	3	8	0.38	3.26%
07.	Greater mouse deer	*Tragulus napu*	2	1	3	8	0.38	3.26%
08.	Bornean yellow muntjac	*Muntiacus atherodes*	1	0	1	8	0.13	1.09%
09.	Giant squirrel	*Ratufa affinis*	1	0	1	8	0.13	1.09%
10.	Black squirrel		1	0	1	8	0.13	1.09%
11.	Bornean gibbon	*Hylobates muelleri*	0	5	5	8	0.63	5.43%
12.	Malay badger	*Mydaus javanensis*	0	2	2	8	0.25	2.17%
13.	Treeshrew	*Tupaia tana*	0	1	1	8	0.13	1.09%
	TOTAL:		**24**	**68**	**92**	**8**	**11.55**	**100%**

4.4.1.4 Hornbill Observation

Monitoring of the important ecosystems health and forests quality can be done, amongst other, by using wildlife species such as, bird species as indicators. For example, the species could include babblers, pittas and partridges as indicators of intact forest, hornbills for availability of fruiting trees, kingfishers for aquatic life, Chinese egret for migratory waterbirds, and raptors for small mammal availability. The presence of hornbill is one of the indicators used in UKW SFM project area. The monitoring technique is by direct sighting or birdsong detection. The results showed that two species of hornbill i.e. Rhinoceros hornbill and Black hornbill are found most frequently within the project site. Overall, there are nine (08) hornbill species recorded in UKW SFM area as shown in **Table 4.5**.

Table 4.5 the presence of hornbill species recorded based on monthly observation from January – June 2016

No.	Species Name	Scientific Name	Observation					
			Jan	Feb	Mar	Apr	May	June
01.	Rhinoceros hornbill	*Buceros rhinoceros*	/	/	/	/	/	/
02.	Black hornbill	*Anthracoceros malayanus*	/	/	/	/	/	/
03.	Oriental Pied hornbill	*Anthracoceros coronatus*	X	/	/	/	/	/
04.	Helmeted hornbill	*Rhinoplax vigil*	X	X	/	/	/	/
05.	Bushy crested hornbill	*Anorrhinus galeritus*	X	X	X	/	/	X
06.	White Crowned hornbill	*Aceros comatus*	X	X	X	/	/	/
07.	Wreathed hornbill	*Rhyticeros undulatus*	/	X	/	/	/	/
08.	Wrinkled hornbill	*Aceros corrugatus*	X	/	/	X	/	X

PART V: HIGH CONSERVATION VALUE FORESTS

5.1 Introduction

High Conservation Values (HCVs) in UKW SFM are congruent to the assessment, management and monitoring of forest conservation from a global, national and local perspective based on Forest Stewardship Council Principle 9. The assessment follows the national standards as prescribed in the High Conservation Value Forest Toolkit for Malaysia in 2009 (**Table 5.1**). The HCV assessments for HCV 1-4 and HCV 5-6 were conducted separately. For assessment of HCV 1-4, it was conducted from 12th -17th October 2015 and 7th – 12th December 2015 by team of multiple disciplines ranging from botanists, ecologists, conservationists and foresters from the Sabah Forestry Department. The team reviewed the available biological resources in the field, documented reports and on-going monitoring activities by the management team and WWF to assess the HCV elements in the project area. While the assessment of HCV 5-5, it was conducted by social experts consultant The assessments are aims to enhance relevant information on HCV element 1–6 for UKW SFM area, ensuring the Department meets the international standards and principles of Sustainable Forest Management and obtaining the FSC certification.

Table 5.1 HCVs as described in the HCVF Toolkit for Malaysia (2009)

HCV	Element
1	Forest area containing globally, regionally or nationally significant cocentrations of biodiversity values
1.1	Protected areas
1.2	Threatened and endangered species
1.3	Endemic species
1.4	Critical temporal use
2	Globally, regionally or nationally significant large landscape-level forests
3	Forest areas that are in or contain rare, threatened and endangered ecosystems
4	Forests areas that provide basic services of nature in critical sitautions
4.1	Forests critical to water catchments
4.2	Forests critical for erosion control
4.3	Forests providing barriers to destructive fire
5	Forest areas fundamental to meeting basic needs of local communities (e.g subsistence, health)
6	Forest areas critical to local communities' traditional cultural identity

5.2 High Conservation Values in UKW SFM landscape

5.2.1 HCV 1 Biodiversity Value

5.2.1.1 Category HCV 1.1 Protected areas

Definition

All forest areas that have been legally gazette as Protected Areas under Malaysia legislation (either federal or state), are HCV 1.1. The Master List of Protected Areas in Malaysia, commissioned by the Ministry of Natural Resources and Environment, has listed all areas that fall under this category, and should therefore be the first point of reference. However, it is noted that in Sarawak there is no overlap between FMUs and TPAs.

Site perspective

Ulu Kalumpang and Mt Wullersdorf are Class I Protected Forest, whereas Kalumpang and Madai-Baturong are Class VI Virgin Jungle Reserve that prescribe protection and preservation management of ecosystem function and prohibit all forms of destructive activities.

The rationale for the identification of HCV attribute

The entire UKW SFM is categorised as HCV 1.1 (**Figure 5.1**).

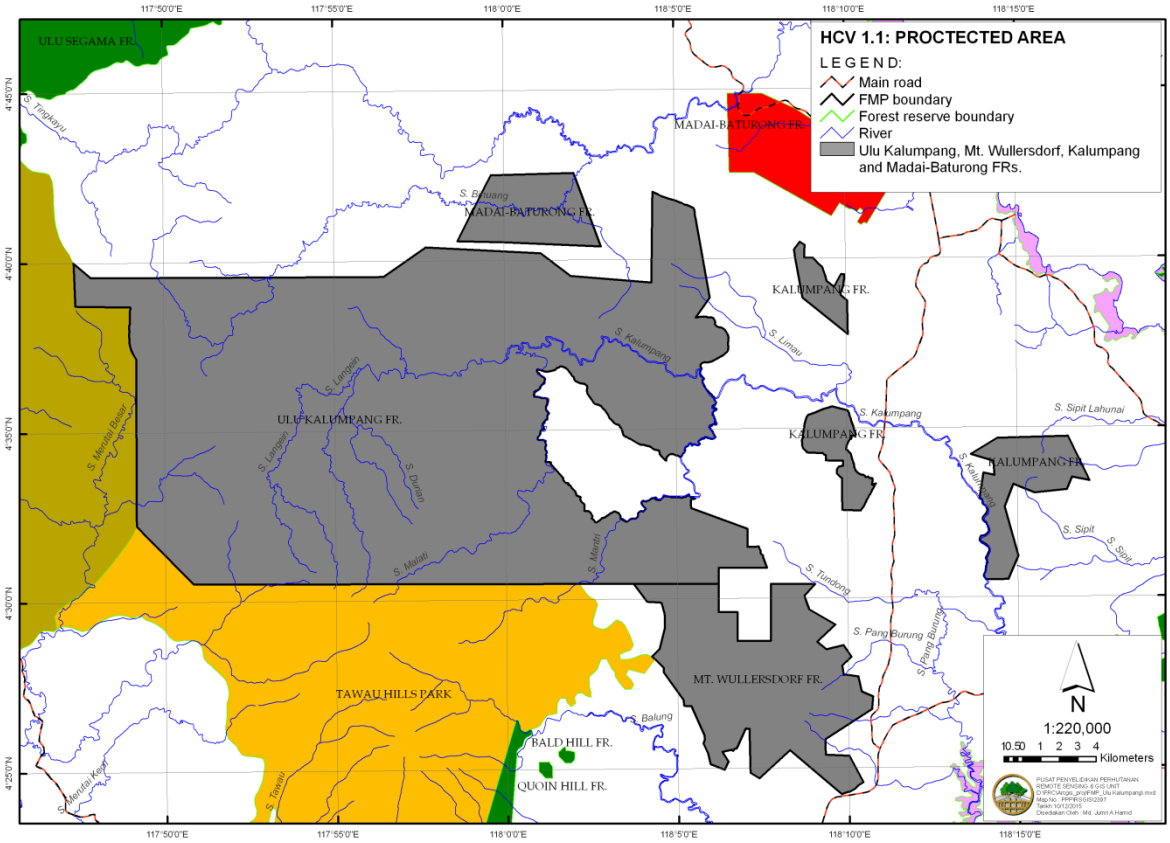


Figure 5.1. The entire Ulu Kalumpang Wullersdorf SFM Project Area is categorised as HCV 1.1.

5.2.1.2 Category HCV 1.2 Threatened and Endangered Species

Definition

Any species categorized as either Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) on the IUCN Red List, Appendix I of CITES or listed as protected under Malaysian legislation (federal or state), is HCV 1.2. However, for practical reasons forest managers may want to limit field surveys of fauna to mammals (particularly large ones, over 20kg in weight), birds and herpetofauna, unless literature indicates that there are other species in the area which require specific attention. This does not mean that other taxa are unimportant, and wherever possible, if the expertise and survey protocols are available there should be covered too. It is also recommended to cross check the IUCN Red list with the Malaysian Red Data Book, once that is available. Where there may be difference between the Malaysian Red Data Book and the IUCN Red List, the Malaysan Red Data Book should always take precedence.

A. Flora

Site perspective

Of the 434 taxa of recorded plants in UKW SFM, 26 species that derived from 7 families of plants are rare, endangered or threatened plant species. There are 12 plant species that listed in the IUCN red list as Vulnerable (VU), 5 as Endangered (EN) and 9 as Critically Endangered (CR) are known from this project area (Appendix II). About 70 % of these threatened species are from the family Dipterocarpaceae, the most dominant group of trees in the lowland area and important source of timber for the state in the past. However, 76 % of the flora recorded from this area are yet to be evaluated under IUCN categories and the assessment and updating process by the relevant research agencies will take a considerable period of time.

In reference to the Sabah Wildlife Conservation Enactment 1997 (SWD, 1997), 12 species that derived from 5 families are listed and recorded in the project area. Under Sabah Forest Rules 1969, the director of forest may for reasons of silviculture or for any other reason prohibit or restrict the cutting or removal of plant species in the forest reserve. There are 38 plant species in these FMUs that fall under the prohibited species by the Director of Sabah Forestry Department. Furthermore, 9 species are listed under CITES list.

Due to high presence of high conservation value flora in the reserve, it is important to protect and enhance the forest ecosystems in its natural setting even though the forest is under various regenerating status. Long-term monitoring activities by using permanent sample plots are useful to determine long-term population trends of increase or decrease that can be related to human disturbance or short term fluctuations caused by variations in weather or unpredictable natural catastrophic events.

The rationale for the identification of HCV attribute

In relation to the flora diversity and high number of outstanding conservation values, the assessment indicates that the whole area of UKW SFM should be categorized as HCV

1.2 that indicates habitats for threatened and endangered flora in the project area (**Fig. 5.2).**

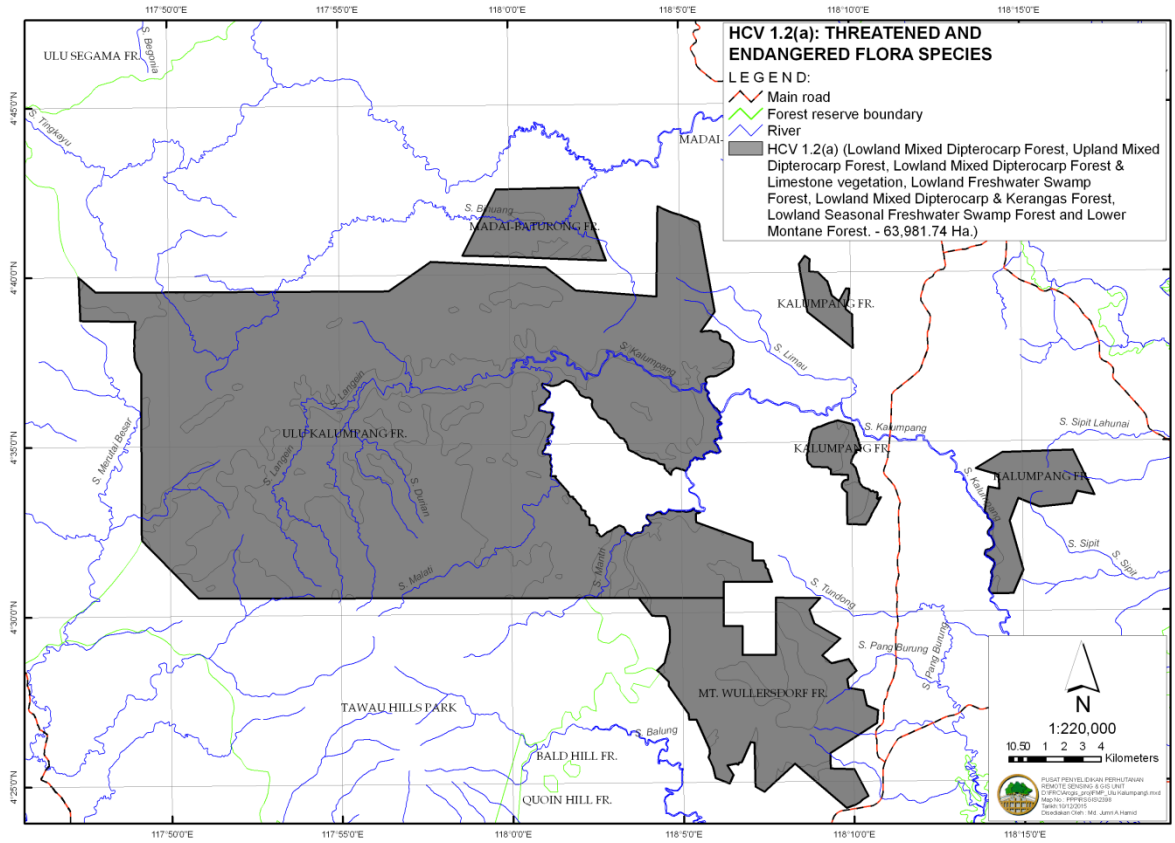


Figure 5.2. The entire Ulu Kalumpang Wullersdorf Sustainable Forest Management Project Area is categorised as HCV 1.2 that indicates habitats for threatened and endangered flora.

B. Fauna

Site perspective

As listed in Appendix II, 11 mammals are categorized to be threatened and endangered. Under the IUCN criteria, two (2) is categorized as vulnerable and five (5) as endangered. Six (6) of the mammals recorded in the project area are listed under Schedule I that bearing the status as Totally Protected, and two (2) under Schedule II of the Sabah Wildlife Conservation Enactment 1997 (Appendix II, Table A). Under the CITES list, six mammals are listed as Appendix I. About four of the birds are categorized as Vulnerable under the IUCN Redlist, and 23 species are listed under Schedule II of the Sabah Wildlife Conservation Enactment 1997.

In general, the presence of high conservation status fauna may conclude that this reserve is an important for nesting and foraging habitats wildlife. However, the presence of these high conservation value wildlife during the assessments may not be able to

verify the stability of population. Therefore, the present wildlife monitoring activities using combination of techniques, namely camera traps, transects, opportunistic sightings should be carried out. It is important to distinguish long-term population trend of increase or decrease of these species that may have been influenced by human disturbance or environmental factors, such as fluctuations of weather or unpredictable natural catastrophic event.

The rationale for the identification of HCV attribute

The management should consider that the whole area lowland mixed dipterocarp (including those associated with kerangas and limestone vegetation), lowland seasonal freshwater swamp and lowland freshwater swamp forests should be categorised as HCV 1.2 for its importance in providing potential foraging habitats for endangered and threatened wildlife **(Fig. 5.3).**

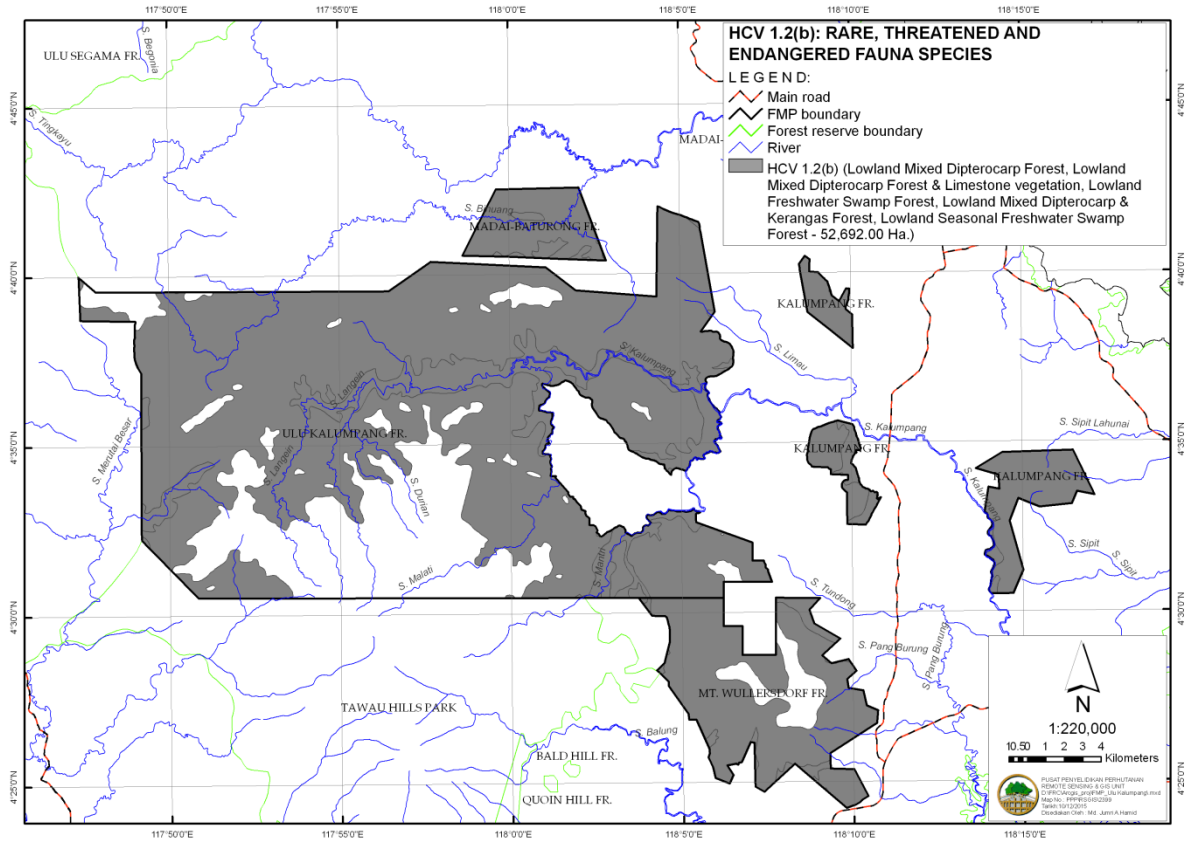


Figure 5.3. The whole lowland mixed dipterocarp (including those associated with kerangas and limestone vegetation), lowland seasonal freshwater swamp and lowland freshwater swamp forests are categorised as HCV 1.2 areas that are important habitats for threatened and endangered fauna in Ulu Kalumpang Wullersdorf Sustainable Forest Management Project Area.

5.2.1.3 HCV 1.3 Endemic Species

Definition

Any forest containing endemic species as identified by FRIM, MNS, SFC, Forestry Departments and published literature, particularly in high concentration or highly restricted distribution, can be considered HCV 1.3.

A. Flora

Site perspective

Based on data compiled from previous studies and Sandakan Herbarium database, there is a total of 98 species that are recognized as endemics to Borneo, representing about 23 % of tree species known from the project area. Of these numbers, 6 species are endemic to Sabah.

A total of 9 endemic tree species are currently protected under Schedule 1 of the Forest Rules 1969, and 14 endemic plants are threatened and endangered under the IUCN red list that consist of 7 species as critically endangered, 3 species as vulnerable and 4 species as endangered. However, the presence of these endemic flora may not be able to verify the stability of population. Therefore, the existing long-term monitoring activities by using permanent sample plots are useful to determine long-term population trends of increase or decrease that can be related to human disturbance or short term fluctuations caused by variations in weather or unpredictable natural catastrophic events.

The rationale for the identification of HCV attribute

In relation to the flora diversity and a number of outstanding conservation values, the assessment indicates that the assessment indicates that the whole area of UKW SFM should be categorized as HCV 1.2 that indicates habitats for endemic flora in the project area area (**Fig. 5.4**).

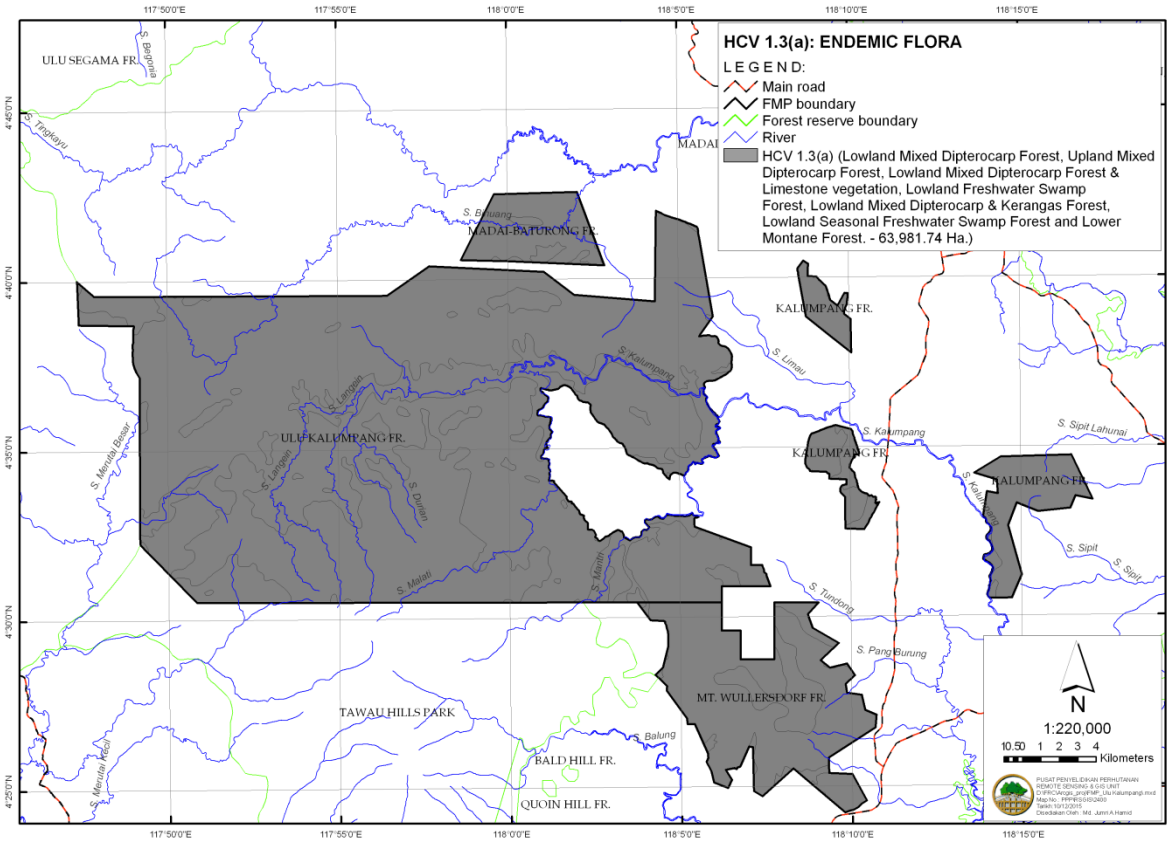


Figure 5.4. The entire Ulu Kalumpang Wullersdorf Sustainable Forest Management Project Area is categorised as HCV 1.3 that indicates habitats for endemic flora.

B. Fauna

Site perspective

At least 5 medium to large mammal species (including subspecies) recorded in UKW SFM are endemic (Appendix III, Table A). Recent survey also found that at least 21 birds and 8 insects are endemic species in the project area (Appendix III).

The rationale for the identification of HCV attribute

The management indicates that the whole area lowland mixed dipterocarp (including those associated with kerangas and limestone vegetation), lowland seasonal freshwater swamp and lowland freshwater swamp forests should be categorised as HCV 1.3 for its importance in providing potential foraging habitats for endemic wildlife (Fig. 5.5).

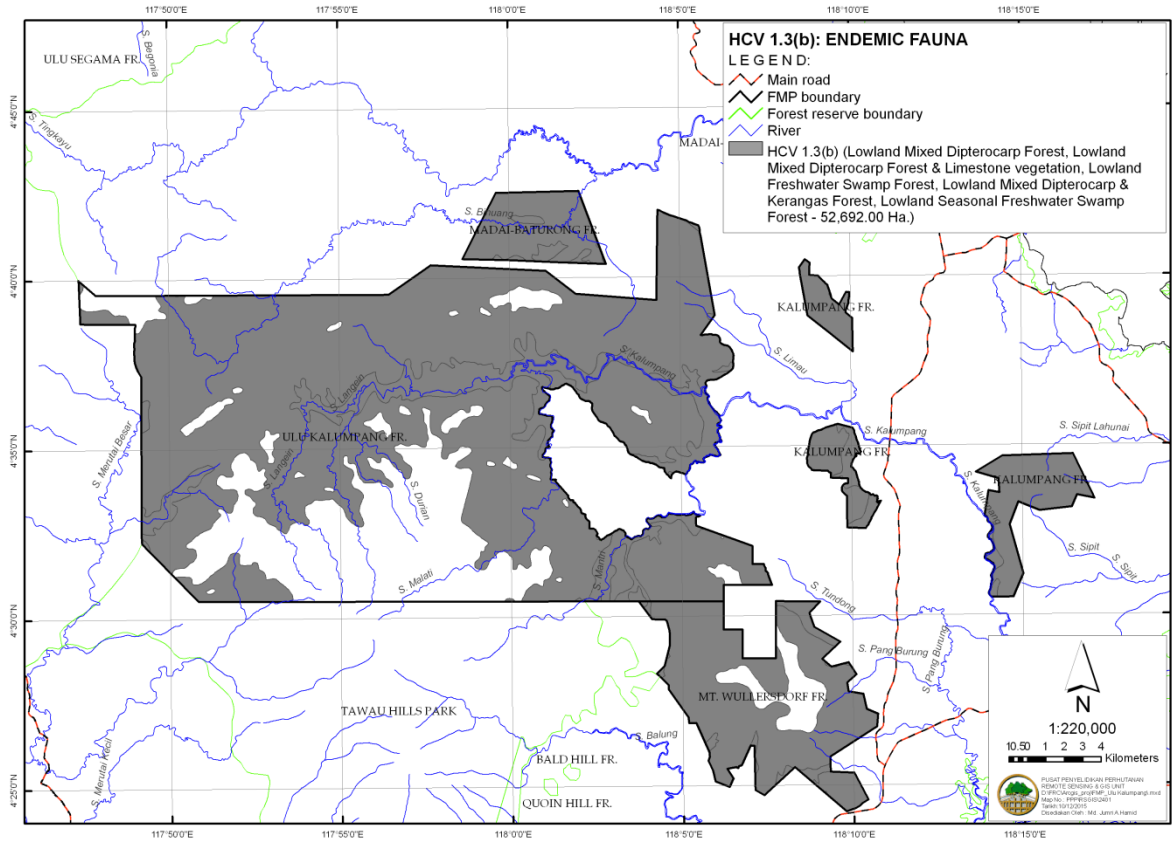


Figure 5.5. The whole lowland mixed dipterocarp (including those associated with kerangas and limesto limestone vegetation), lowland seasonal freshwater swamp and lowland freshwater swamp forests are categorised as HCV 1.3 areas that are important habitats for endemic fauna in Ulu Kalumpang Wullersdorf Sustainable Forest Management Project Area, Sabah.

5.2.1.4 HCV 1.4 Critical temporal use

Definition

Any forest area which is important to wildlife for feeding, nesting, roosting, and migration or contains saltlicks is HCV 1.4. Limestone hills, although important as habitat, are captured under HCV 3 Ecosystems.

Site perspective

The limestone karst in Madai-Baturong FR is an important nesting site for swiftlet, bats and other troglofauna. Appropriate management is required to monitor this critical nesting site especially on illegal harvesting of birdnest during the management period of the project area.

The rationale for the identification of HCV attribute

The lowland mixed dipterocarp and limestone vegetation is categorised as HCV 1.4 to protect troglofauna habitat (**Fig. 5.6**).

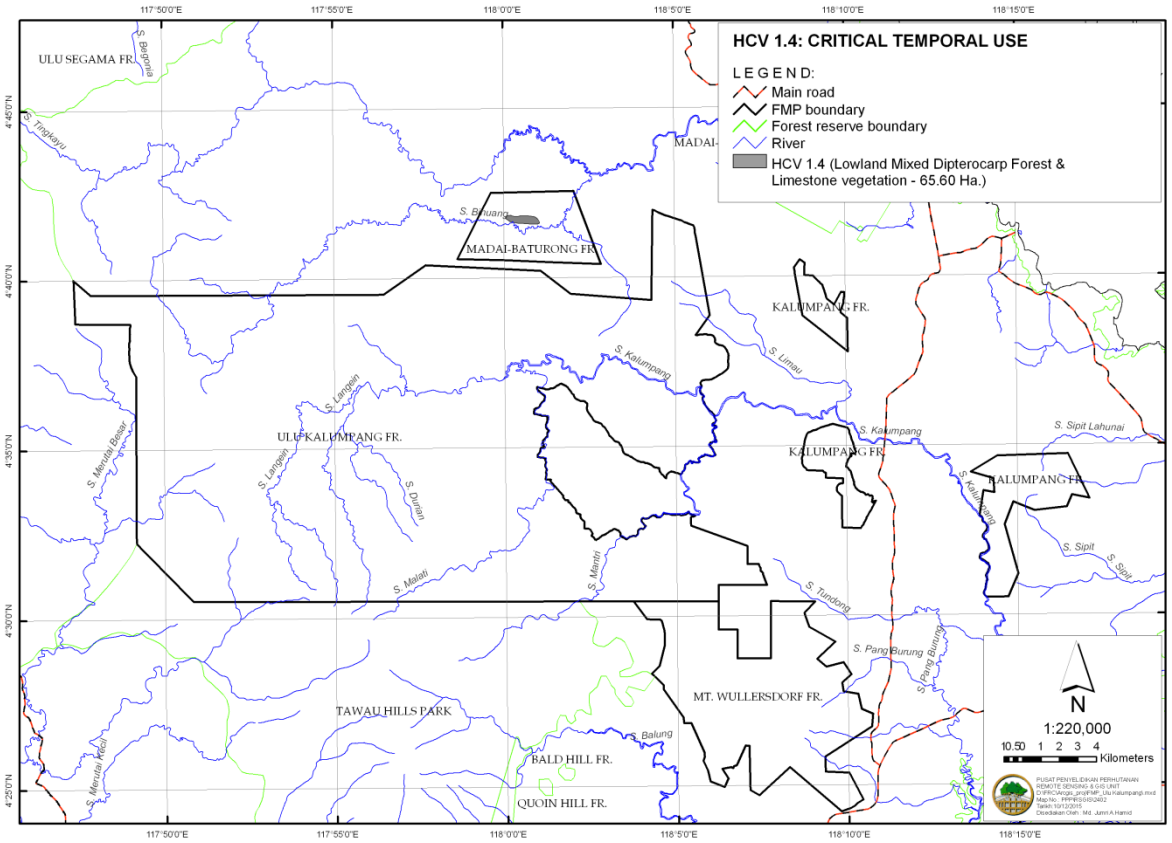


Figure 5.6. The lowland mixed dipterocarp and limestone vegetation is categorised as HCV 1.4 to protect troglofauna habitat in Ulu Kalumpang Forest Wullersdorf Sustainable Forest Management Project Area.

5.2.2 HCV2 Globally, regionally or nationally significant large landscape-level forests

Definition

Forest area contains or is part of a globally, regionally or nationally significant large landscape level forest where significant populations of most if not all naturally occurring wildlife species exist in natural patterns of distribution and abundance. Any forest area that forms or is part of a linkage between larger forest complexes, and can thus provide connectivity between fragments or act as a wildlife corridor for the movement of animals from one complex to another, is considered HCV 2. This HCVF can serve as a buffer zone to protected areas. Its identification and management should be tailored towards the needs of umbrella species i.e. sensitive, wide ranging wildlife that are particularly susceptible to forest fragmentation and human population pressures.

Site perspective

At the landscape level, this project area is fragmented and not connected to the large contiguous forest at central Sabah**.** The only connected and form contiguous forest cover in Ulu Kalumpang and Mt Wullersdorf, where both connected to Tawau Hills Park, a state park. Recent findings by WWF have mapped elephant migratory route from Madai-Baturong to Ulu Kalumpang and Ulu Kalumpang to the greater forested area in Ulu Segama through Sabah Softwood Sdn Bhd, an agroforestry plantation **(Figure 5.7 & 5.8).** Due to these findings, Yuwang Plantation, an oil palm company has set aside a narrow corridor low vegetation cover and planting of oil palm to connect the forests of Madai Baturong and Ulu Kalumpang. The width of the corridor could be arguably insufficient to allow elephant movement and required further monitoring activities to determine suitable corridor size. Currently, establishment of wildlife corridor connecting Ulu Kalumpang and Ulu Segama is on progress. WWF also did an Orang Utan nest count and discovered that most of the population were recorded within the intact forest in Ulu Kalumpang, Mt Wullersdorf and Tawau Hills Park, and only a small number in Madai-Baturong FR **(Figure 5.9).** This raise concerned that the orang-utan population in Madai-Baturong may not be able to venture to the greater forest area in the south due to the 300 m oil palm plantation barrier and the existing elephant corridor may not be sufficient to lure them to cross over. A wider corridor and higher forest structure may be required to establish.

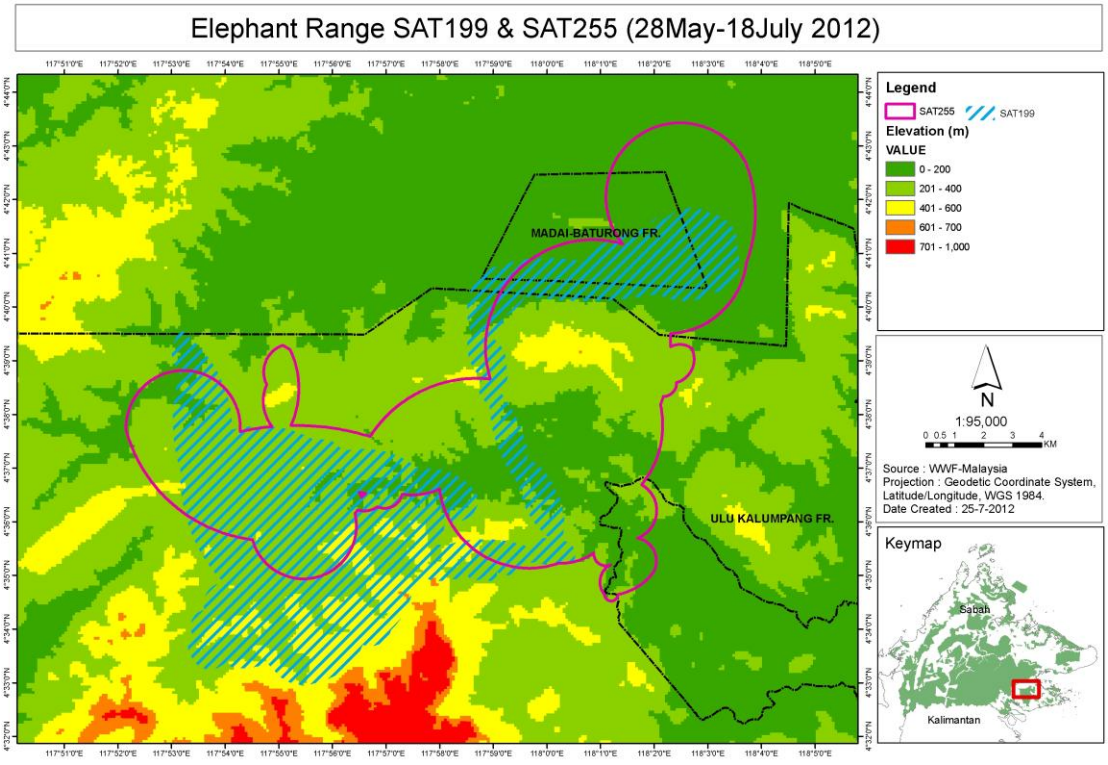


Figure 5.7. Map shows the potential extend or possible home range of 2 elephant herds– Kuma and Daisom, by monitoring their movement by using satellite tracking between Ulu Kalumpang and Madai-Baturong forest reserves, Sabah (Source: WWF, Sabah).

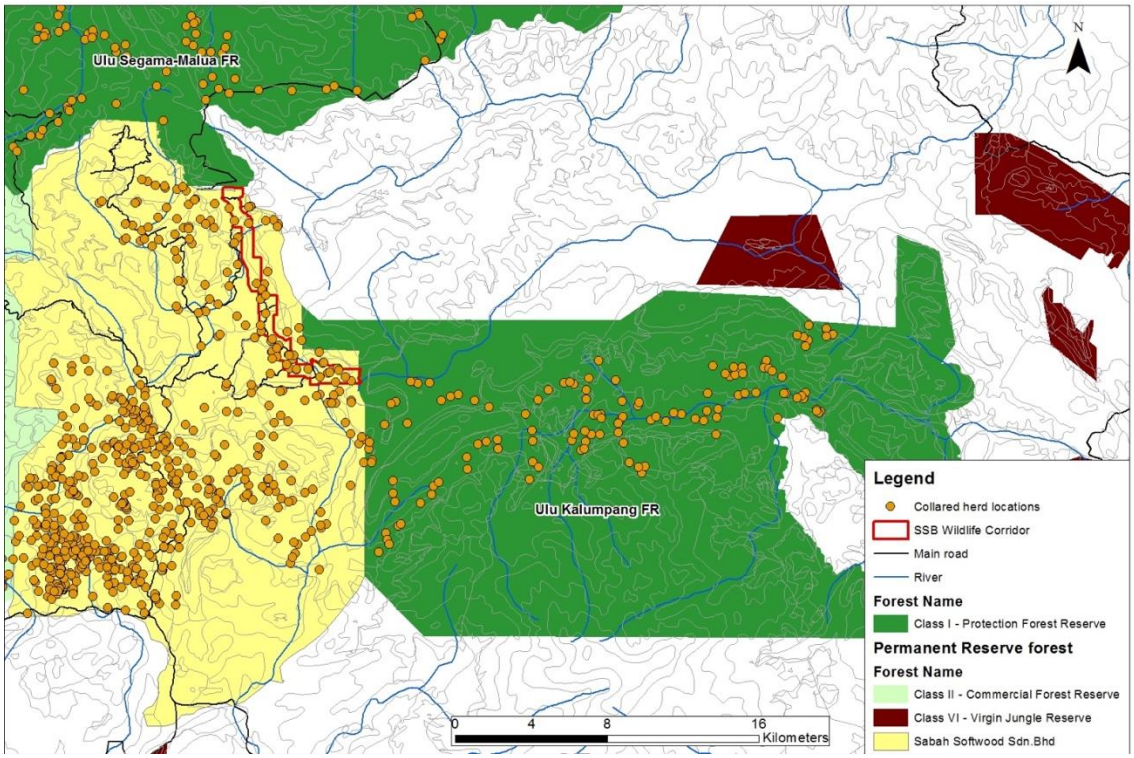


Figure 5.8. Map shows the potential extend or possible home range of collared elephants by monitoring their movement by using satellite tracking from Ulu Kalumpang FR, Sabah Softwood, proposed SSSB wildlife corridor and Ulu Segama forest reserves, Sabah (Source: WWF, Sabah).

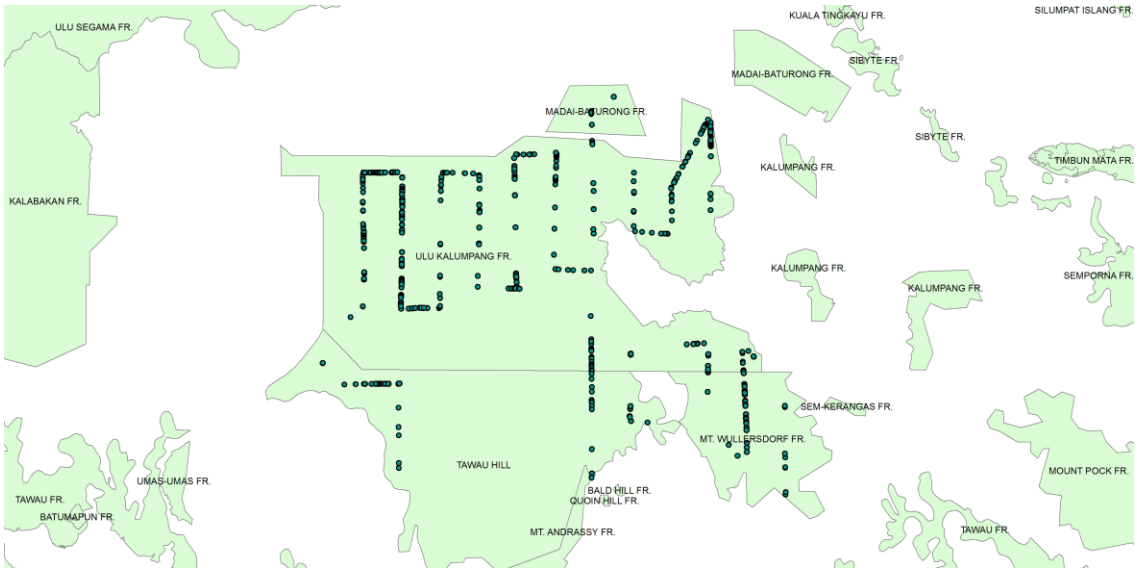


Figure 5.9. Distribution of orang-utan's nest along continuous sampling method along systematic flight lines by helicopter in 2010 (Source: WWF, Sabah).

The rationale for the identification of HCV attribute

The management indicates that Ulu Kalumpang, Mt Wullersdorf and Madai-Baturong forest reserves are categorised as HCV 2 due to their location to form part of continuous forested landscape to support high conservation value species in Sabah **(Figure 5.10).**

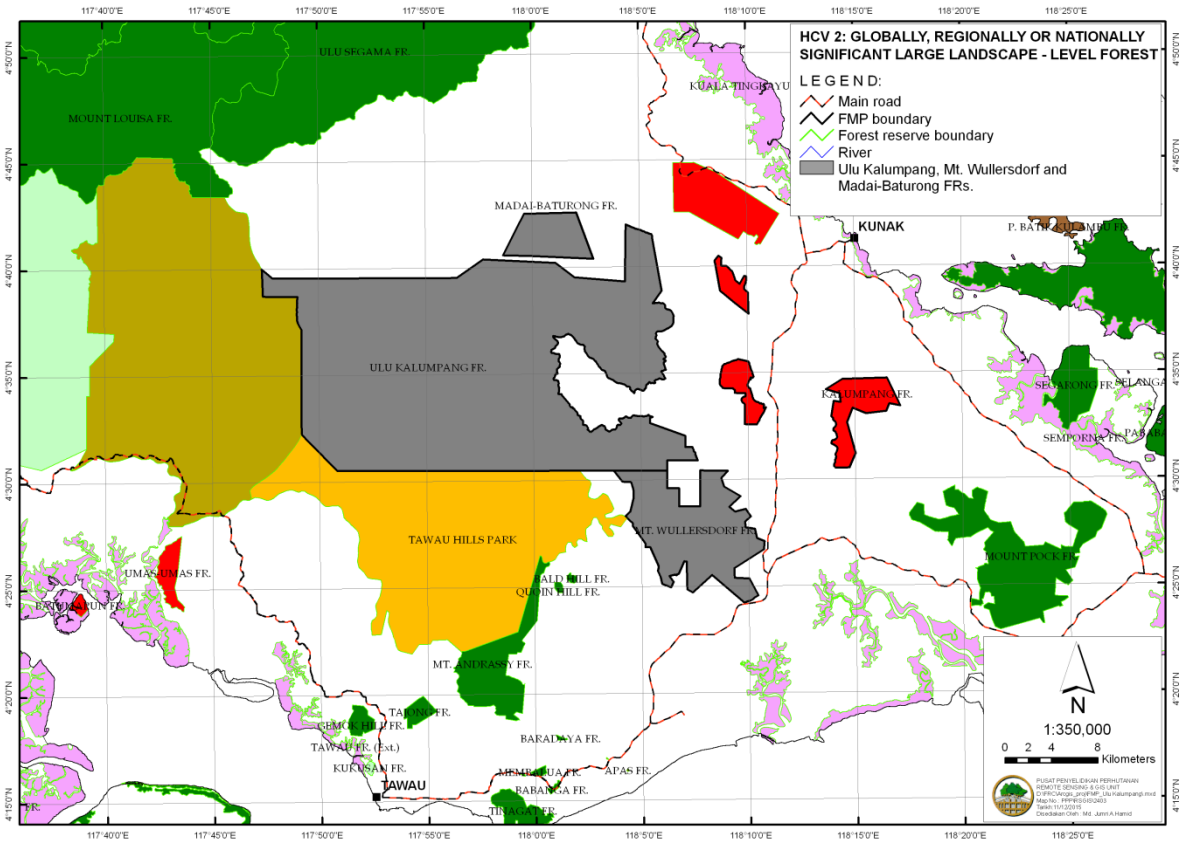


Figure 5.10. Map showing Ulu Kalumpang, Mt Wullersdorf and Madai-Baturong forest reserves categorized as HCV 2 for Ulu Kalumpang Forest Wullersdorf Sustainable Forest Management Project Area.

5.2.3 HCV 3 Forest areas that are in or contain rare, threatened or endangered ecosystems

Definition

Forest areas that is in or contains rare, threatened or endangered ecosystem. Any forest area that contains an ecosystem/habitat type identified as a priority for protection by National Conservation Strategy (NCS), PERHILITAN Ecosystem Assessment report, Forestry Departments, FRIM or SFC, and/or is confirmed as such by current expert opinion, is HCV 3. Some ecosystems are naturally rare, but some others are becoming increasingly threatened by pressure from human activities. Due to rapid changes, existing data may be outdated and some particularly threatened ecosystems may already need to be considered Priority 1. A good example of this would be Lowland

Dipterocarp Forests, Peat Swamps Forests and Limestone Habitats. Always refer to current expert opinion for confirmation.

Site perspective

Based on the HCV assessment, UKW SFM contains seven forest formations, namely lowland mixed dipterocarp, upland mixed dipterocarp, lowland mixed dipterocarp and kerangas, lowland mixed dipterocarp and limestone, lower montane, lowland seasonal freshwater swamp, lowland freshwater swamp and lower montane forest.

In relation to the National Conservation Strategy (NCS) listing, about 27 % of UKW SFM categorised under HCV 3. Both extreme lowland area classified as mixed dipterocarp and freshwater swamp and upland mixed kerangas forest still contain high conservation value flora and fauna as mention earlier in section 4.1–4.2 that could be currently rare elsewhere in the state. In view that NCS has classified this forest type as high priority, there will be a need for a good management practice and monitoring programme to be installed for this particular forest area. Thus giving lowland forest types a high priority for conservation.

The rationale for the identification of HCV attribute

The management indicates that the forested areas below 200 m a.s.l of seasonal freshwater swamp and mixed dipterocarp, including association of limestone vegetation and kerangas forest with the mixed dipterocarp forest within UKW SFM are important forest ecosystem and categorised as HCV 3 **(Figure 5.11)**.

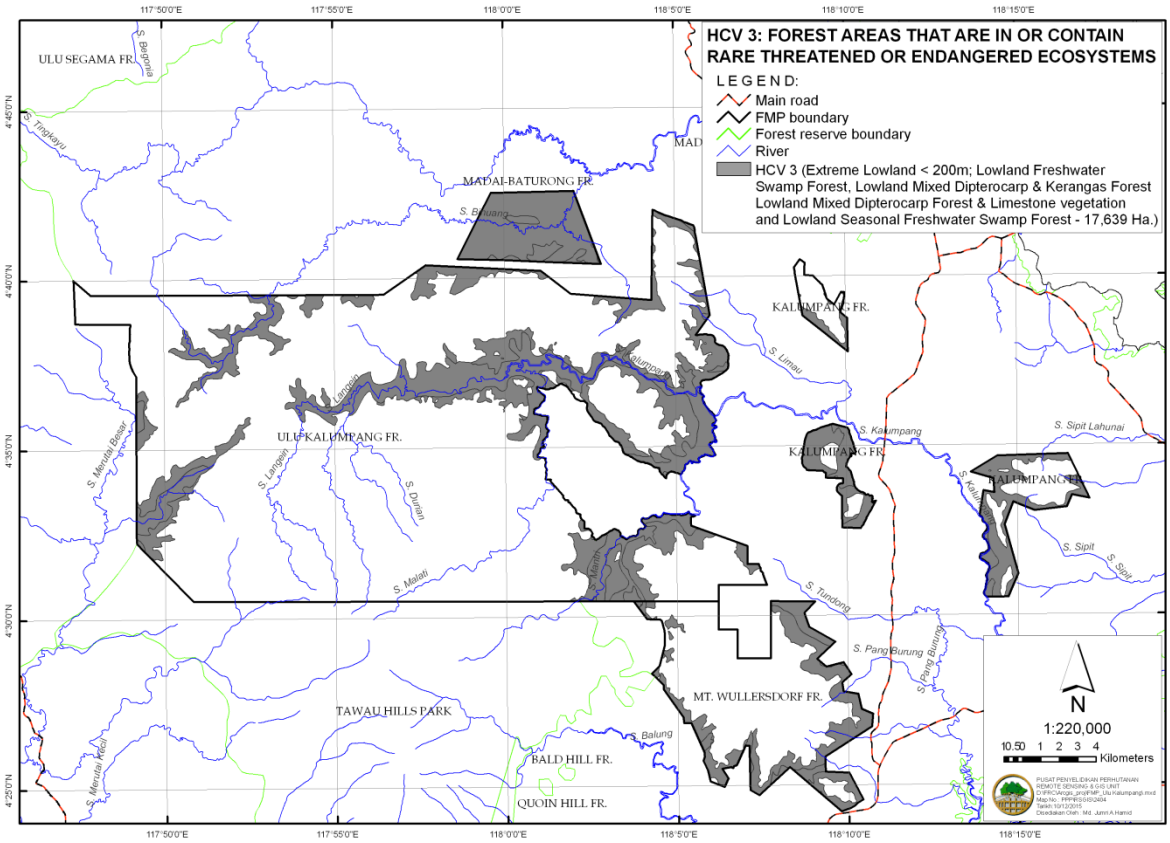


Figure 5.11. The location of extreme lowland forest in areas predominated with mixed dipterocarp forest including association with kerangas forest and limestone vegetation, and also seasonal freshwater swamp and freshwater swamp forest that are categorized as HCV 3 in UKW SFM Project Area.

5.2.4 Service to Nature

5.2.4.1 HCV 4.2 Forests critical to erosion control

Definition

Forest areas that have been legally facetted for soil protection or conservation under federal and state laws e.g. the National Forestry Act 1984 (Peninsular Malaysia), forest areas, situated on slopes over 25 degrees (Sabah), areas classified as Terrain Class 4 in First Schedule: Forest Management Plan, Forest Timber License, and riparian areas covered under the DID (Department of Irrigation and Drainage) guidelines.

Site perspective

In general, past conventional logging activities induced heavy compaction of the soil that results to low water infiltration capacity and increase surface run-off, hence promote soil erosion processes. This compaction also leads to the reduction of vegetation regeneration and establishment that eventually promote lesser forest productivity and diversity. Any area that predominantly having dissected and steep slopes of over 25° is

categorized as critical for erosion control. The management also has designated 30 m wide buffer areas on both sides of the permanent waterways to protect the river bank from being eroded.

The rationale for the identification of HCV attribute

Area predominantly having steep slopes of more than 25° in slope angle and 30 m river buffer are categorised as HCV 4.2 (**Figure 5.12**).

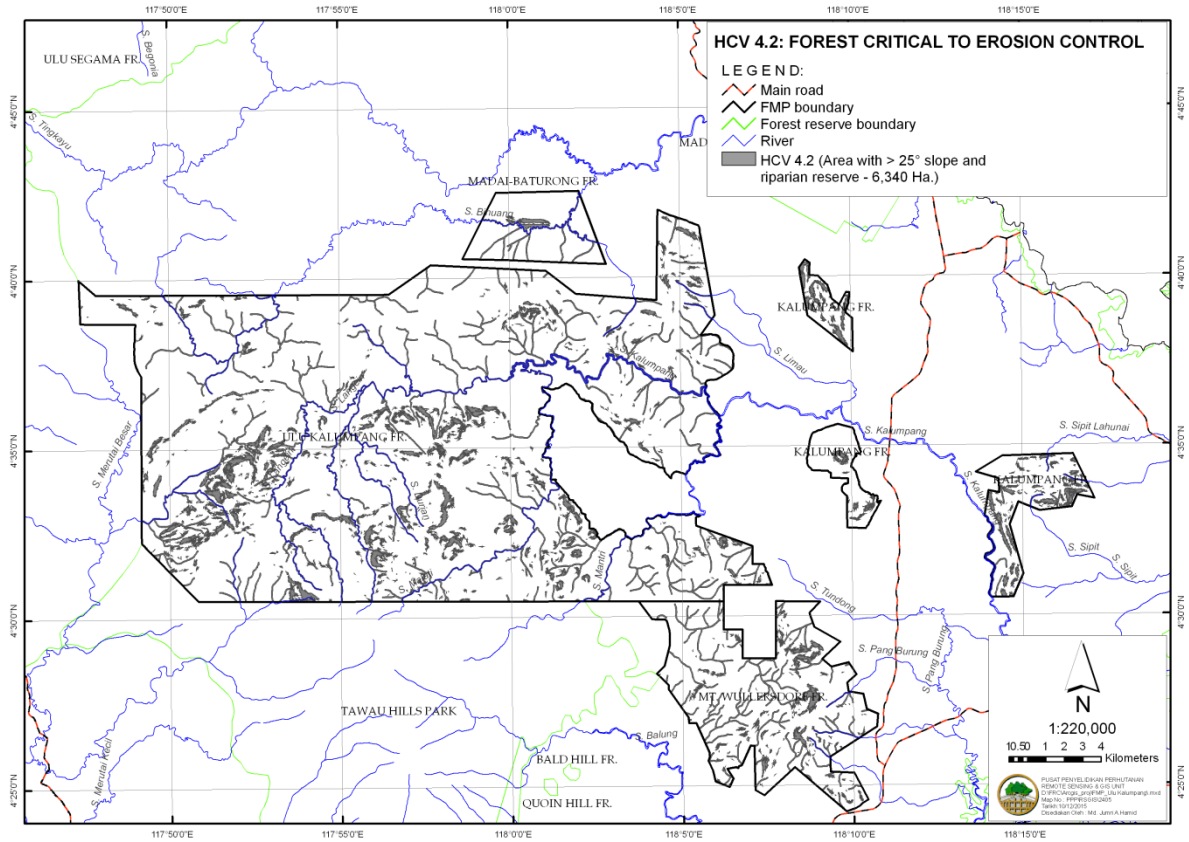


Figure 5.12. The location of HCV 4.2 denoted in grey shades are critical to erosion control in Ulu Kalumpang Wullersdorf Forest Management Project Area.

5.2.4.2 HCV 4.3 Forests providing barriers to destructive fire

Definition

Any specific areas that can act as barriers to provide protection of forests, especially forests with high conservation values, from fire, in areas that are generally fire prone and where the consequences are potentially severe, can be considered HCV 4.3.

Site perspective

All of the reserve within the FMU, except partially Ulu Kalumpang and Mt Wullersdorf, are bordering oil palm estate and only small fraction bordering villages and their mixed crops. Furthermore, secondary vegetation dominates most of the peripheral area of the reserves. It is known that secondary forest is more susceptible to fire in low comparison to pristine forest (Woods, 1989).

The rationale for the identification of HCV attribute

A 100 m band of moderate to high forest structure inside the project area that border local communities land and oil palm estate are categorised as HCV 4.3 (**Figure 5.13**).

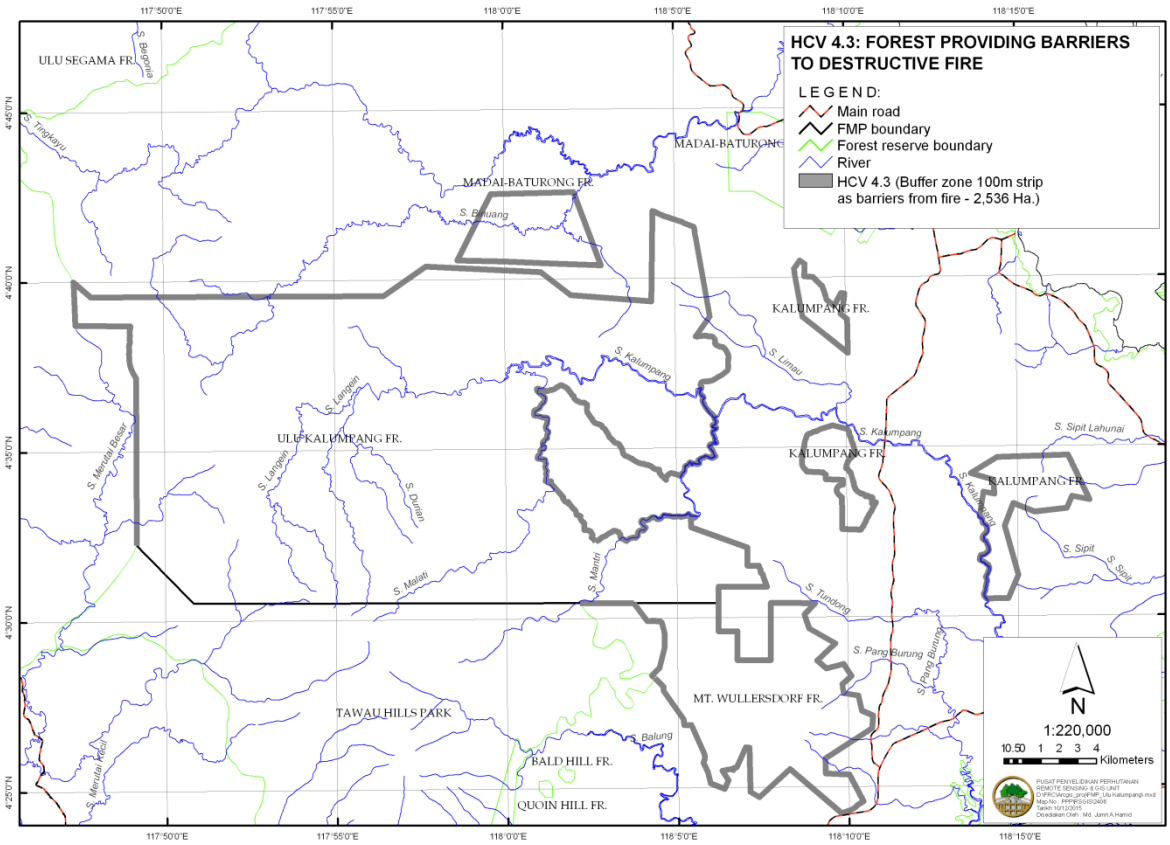


Figure 5.13. The location of HCV 4.3, 100 m band of moderate to high forest structure inside Ulu Kalumpang Wullersdorf Sustainable Forest Management Project boundary providing barriers from fire from adjacent areas.

5.2.5 HCV 5 Forest area is fundamental to meeting basic needs of local communities

Definition

A forest area may be considered HCV 5 if it contains or is adjacent to settlements which depend on produce from that forest for basic subsistence or health needs. Examples include hunting grounds or areas from which minor forest products such as bamboo, rattan and medicinal plants are collected, and are regularly visited by community members for this purpose. The community maybe living either in or adjacent to the forest. However, identification and management of this HCV must always involve participation of the communities themselves.

5.2.5.1 Basic Need 1 - Food Sources

Local communities derive their food sources from both home-grown and purchased sources in different degrees. Carbohydrates, particularly the staple diet of rice, are purchased and supplemented on a much lesser scale with the cultivation and consumption of tapioca. Sources of protein which include chicken, beef, goat and fish are mainly bought but also supplemented by home reared produce. Fruit sources are almost entirely derived from home-grown sources. Vegetables are both bought and also augmented with home-grown produce with the exception of Kg Checkpoint where it is entirely home-produced. None of the communities in the study obtain food from the forests and hence, the HCV assessment for Basic Need 1 (food sources) is non-existent (HCV=0) for all the study sites.

5.2.5.2 Basic Need 2 - Building Materials

Building materials, particularly sawn timber and plywood are generally purchased from local suppliers although early homes at Kg Balung Cocos and Kg Sri Bahagia were constructed with wood from trees felled during the clearing of forested areas during the conversion to large-scale cultivation of cash crops. Most homes were built from the 1960s to the early 1990s when wood was considered to be affordable and freely available. Therefore the HCV assessment values for Basic Need 2 (building materials) would remain non-existent (HCV=0) for all the communities in the study.

5.2.5.3 Basic Need 3 – Fuel

All villages enjoy access to a 24-hour electricity mains supply provided by Sabah Electricity Sdn Bhd (SESB) while cooking fuel is bought in the form of gas canisters. Firewood collected from surrounding land is very rarely used as fuel. Similar to Basic Needs 1 - 2, HCV 5 assessment values for Basic Need 3 (fuel) would remain non-existent (HCV=0) for all the study sites.

5.2.5.4 Basic Need 4 – Medicines

The study sites have good access to medical care at local hospitals and clinics at Kunak and Balung with distances ranging from 2 - 14 km (Table 5). On a much lesser scale, traditional medicines are still being cultivated and administered by local communities. None of the communities studied derive their medicines from the forest and hence, the

HCV assessment for Basic Need 4 (medicines) for all the villages, could be valued at HCV=0 or non-existent.

5.2.5.5 Basic Need 5 – Water

Only the communities of Kg Airport Batu 10 and Kg Balung Cocos received facilities for piped water supply by Sabah State Water Department (SSWD) in 2014. Prior to this, Kg Airport Batu 10, obtained their main supply from rain water but during severe drought, the villagers derive their water supplies from the Kalumpang River. Currently the village is served by the SSWD's plant in Kunak that treats water from the Kalumpang River whose headwaters and tributaries originate from Ulu Kalumpang FR and Tawau Hills Park (THP) south of UKFR. Similarly for Kg Balung Cocos in the recent past, rain water is supplemented by river water from the Kalumpang via Bukit Tajam although it was highlighted by the focus group that the river has not only shrunk but is also heavily affected by sedimentation.

Water supply to the village is provided by the SSWD's Balung water treatment plant which is fed by Sg Kawa whose headwaters stem from THP. The other two villages, Kg Sri Bahagia and Kg Checkpoint, are entirely reliant on natural sources such as rain, river and underground water and would consequently experience insufficiencies during the drought season. The former, rarely relies on water from a shallow stream that runs through the village whose source originates from within Mostyn Estate. Kampung Checkpoint obtain their main water source from rain water supplemented either way by underground/well water as well as a host of rivers originating from Mount Wullersdorf FR in the UKW-SFM Project area.

The Ulu Kalumpang Wullersdorf SFM Project area is a vital watershed for not only the study villages but also the entire district of Kunak and certain parts of Semporna through the water treatment plant (WTP) at Kunak. Similarly, Kg Balung Cocos and the whole of Apas-Balung area is currently being served by the Kawa River through the SSWD's water treatment plant. Therefore the HCV assessment for Basic Need 5 (water sources) differs for each village, ranging from non-existent (HCV=0) for Kg Sri Bahagia, HCV=3 relating Mount Wullersdorf for Kg Checkpoint, and HCV=4 relating to Ulu Kalumpang and Tawau Hills Park for Kg Airport Batu 10 and Kg Balung Cocos respectively.

5.2.5.6 Basic Need 6 – Cash Incomes

None of the communities in the HCV assessment derive cash incomes from the forest or forest products as the majority of them eke out a living farming crops such as small-scale oil palm and on a lesser scale, tapioca, fruit trees, vegetables and animal husbandry such as chickens, goats and cows as well as aquaculture. Moreover, a small proportion is employed by government departments and private companies and similarly, run small businesses such as cottage industries, convenience shops, food and refreshment stalls, and canteens. Similar to the values of Basic Needs 1-5, the HCV assessment for Basic Need 6 (cash incomes) would therefore be considered non-existent (HCV=0) for all the communities concerned.

5.2.6 HCV 6 Forest area is critical to local communities' traditional cultural identity

Definition

A forest area may be considered HCV 6 if it is important for a local (particularly indigenous) community's cultural, ecological or religious activities. The community may be living either in or adjacent to the forest. Example of such sites within a forest would include burial grounds or sacred areas which cannot be replaced with alternatives and/or would cause drastic cultural change within the community. Identification and management of this HCV must always involve participation of the communities themselves.

5.2.6.1 Basic Need 7 – Cultural & Spiritual Needs

The focus groups revealed that they do not recognize any sacred burial sites that are located within the UKW-SFM Project area. All funerals for Kg Sri Bahagia and Kg Checkpoint are held at designated Islamic burial grounds at Kg Lormalong. Similarly, Kg Airport Batu 10 hold their burials at a site at the adjacent Bongalio Estate at a small charge of RM200 per lot for funerals of current employees. Whereas, Kg Balung Cocos conduct their funeral rites at old burial grounds at the Sungei Balung Estate (Sawit Kinabalu Sdn Bhd). It can be concluded that there are no burial grounds or sacred sites within the forest reserves that are integral to local communities and it can therefore be deduced that the UKW-SFMP area has no direct or indirect association with the cultural identity of the communities in the assessment of HCV 6.

PART VI – MANAGEMENT PRESCRIPTIONS

6.1 Management Objectives

The long-term objective is to manage the forest areas for conservation to support watershed management for Kunak and Tawau districts. This also includes the need to maintain the natural forest for a high degree of species and structural diversity that will support biodiversity and habitat to maintain viable wildlife populations. Another key objective is to protect the forest from encroachment and restore the forest for carbon sequestration to combat global warming.

To meet the objectives of forest resource conservation, habitat, and combating global warming, the management of the project will focus on removing oil palm from encroached areas, rehabilitate areas planted in oil palm and protect the area from continual encroachment and illegal activities.

6.2 Forest Zoning

The entire area of UKW SFM has been gazetted as Totally Protected Areas (TPA) with the main function is to protect and conserve the forest ecosystem for biodiversity conservation and provision of environmental services i.e. watershed. Logging is not permitted in these areas.

6.3 Forest Restoration and Rehabilitation

6.3.1 Silvicultural treatments

One of the main management objectives is to enhance the value of forest biodiversity and environmental functions. Therefore, the mild silviculture treatment continued to be carried out in UKWSFM but limited to vines, lianas and bamboos cutting. Vines and climbers can have significant impact on tree growth. Removing them can stimulate increase in tree growth. However, instead of blanket prescriptions, vines cutting will be carried out selectively to avoid excessive removal as they are also important components of tropical forest ecosystems and critical for biodiversity maintenance. These activities will continue to be carried out as per scheduled and area to be treated will be identified during the field operation. **Table 6.1** showed the total area to be treated from 2016 to 2020.

Table 6.1: Area allocated to be treated from 2016 to 2020

Year	Area (ha)
2016	500.00
2017	1000.00
2018	1100.00
2019	1200.00
2020	1200.00

6.3.2 Restoration Planting

Restoration activities in this project area are an ongoing effort for enhancing the density of desired tree species in degraded areas and improve habitat quality to support wildlife. The main objective is to replant areas that have been encroached to restore the forest structure, ecological functions and biodiversity. The HCV assessment has also recommended the restoration planting to be carried out along the boundary to provide barriers from fire from adjacent areas. Thus, in current planning, the planting target is about 600 ha per year and the area to be planted will be identified during the field operation. **Table 6.2** showed total area to be restored from 2016 – 2020.

Table 6.2: Area allocated to be restored from 2016 to 2020

Year	Area (ha)
2016	300
2017	250
2018	300
2019	300
2020	300

6.3.3 Demolishment of illegally cultivated Oil Palm

Since 2010, a total of illegally planted oil palm areas in Ulu Kalumpang and Kalumpang FR of approximately 3,774 ha as mentioned in Part II, Table 2.3. The demolishment of illegally cultivated oil palm will be continued to be carried out. These areas will be determined during the field operation. These areas will be rehabilitated through forest restoration with indigenous species or any species approved by the Director of Forestry.

6.4 HCVs Management and Monitoring

1) Protection of critical values

- All designated HCV areas are managed under natural forest management and no conversion of forest is permitted.
- Demarcation of HCV boundaries on the ground for all designated HCVs is not required since 100 % overlaps occurred among element.
- Conduct periodic patrolling and surveillance in all accessible HCV areas to curb illegal activities such as encroachment and poaching.
- Establish a long term biodiversity monitoring system for critical forest ecosystem, flora and fauna (HCV 1.2, 1.3 and 3).
- Migratory pathway of key wildlife species, i.e. Bornean pygmy elephant, tembadau and other keystone species on accessible roads, along streams or wildlife trails in the project area should be marked on the map. In addition, clear signage should be installed on strategic location to inform road, trail and river users to ensure wildlife are able to use them for movement within and between forest reserves (HCV 1.2, 1.3 & 2).
- No major infrastructure development on erosion risk area (HCV 4.2).
- The Forest Fire Management Plan has to be updated periodically (HCV 4.3). Identification of low vegetation structure that is susceptible to catch fire, i.e. grasslands and shrubs along the 100 m band inside the FMU boundaries is crucial. The identified vegetation will be planned for restoration activities.

2) Modifications or constraints on operations

- Any threats to the HCVs, especially related to HCV 1.2 & 1.3, that may be posed by operations or other activities in the forest will need to be identified and documented. Furthermore, the operations constraints in managing HCV areas and also addressing potential threats to the HCVs should also be examined.
- The decision to adopt any particular operation must be made based on the precautionary approach whereby sufficient data and analyses should be carried out to maintain critical values.

3) Enhancement efficiency and effectiveness

- Field staffs are required to attend training courses on plants and wildlife to further enhance their botanical and wildlife knowledge on species that are currently listed in the threatened, endemic and forestry prohibited lists to ensure they do not harvest or damage and also for monitoring purposes (HCV 1.2 & HCV 1.3).
- Update current biodiversity conservation status to the FMUs team of the upgrade or downgrading of threat status locally and globally (HCV 1.2 & HCV 1.3).

4) Restoration

- Forest restoration of indigenous tree species as part of the remedial action to increase forest structural diversity and mitigate any forest fire incidence spreading into the FMUs core area (HCV 4.3).

5) Community Engagement and Outreach

- Community outreach should be conducted with regularity by the District Forest Officer (DFO) and ground staff. Additionally, the engagement process is not limited to local leaders but also with ordinary members of the community.

6) Communication and Consultation

- Improved communication through regular community outreach, engagement and consultation.

7) Environmental Awareness

- The introduction of awareness programmes on community level could create a deeper understanding regarding forest management activities. These measures could be undertaken as talks and workshops at community level:
    - Environmental awareness programmes covering areas such as forest conservation,
    - restoration and rehabilitation programmes;
    - Watershed conservation and management;
    - Importance of stakeholder partnerships for watershed protection;
    - Improve awareness of forest management operations in forest reserves;
    - Increasing the awareness of the forest enactment;
    - Increasing awareness of wildlife laws and pest management.

6.5 Water quality and Soil Protection

Soil erosion occurs naturally even in areas of undisturbed forest cover. The disturbance on the natural forest by humans both planned and unplanned, however, amplifies the natural soil erosion process. Since the area is under conservation the impacts to soil and sedimentation of streams and rivers should be minimal. The main outflow points of the river system of Ulu Kalumpang should be monitored annually for verification of water quality. Periodic water quality assessment should be carried out to support better management of the watershed and also to monitor the health of the ecosystem. The seven (7) water sampling points as indicated in **Part IV – Table 4.1** will be assessed periodically following the methodology as prescribed in **Appendix 1.**

All road construction must follow the road specifications. Similarly, riparian reserves of 30 m wide on each side of all permanent watercourse must be established and protected. However, there may be limited land preparation activities in areas being cleared from oil palm and restored that can impact water quality.

6.6 Wildlife management

6.6.1 Wildlife protection

UKW SFM area will continue to provide shelter for wildlife and habitat integrity. The wildlife management and monitoring system is already in place and being implemented

in UKW SFM. These include wildlife monitoring and protection against illegal poaching and hunting.

6.6.2 Wildlife Monitoring

As mentioned in item 4.2.1, camera trap, recce walk, opportunistic sighting and monitoring of indicator bird species are the techniques used for monitoring of wildlife. Monitoring will be conducted by using combination of these techniques throughout the project areas, continuously.

Signboards will be installed in strategic areas to warn all forest visitors on the prohibition of hunting and poaching activities, fish poisoning and bombing, and penalties imposed. The SFD will set up security gates on all access roads leading into the Forest Reserves. Steps are also to be taken to monitor the area against poaching for local hunters and conduct monitoring according to Procedure 6.

6.7 Forest Protection

6.7.1 Control of Boundaries

Ulu Kalumpang & Mt Wullersdorf shares a common boundary with Tawau Hills Park that results in a large tract of natural forest suitable for wildlife populations. The North and Eastern sides of Ulu Kalumpang shares boundaries with oil palm plantations and Sabah Softwoods on the western side. These are the most sensitive areas where forest encroachment by the local communities has occurred and may occur again. Therefore, an important requirement of conservation management is the security of the forest reserves. In this respect, the SFD will need to keep a close surveillance on any possibilities of future forest encroachment, especially for sensitive areas. SFD enforcement officers will be responsible for monitoring and reporting illegal encroachment and poaching activities.

6.7.2 Forest Encroachment by Local Communities

There are no human settlements within the UKW SFM area. The nearest villages to this project area are Kg. Sri Bahagia, Kg. Airport Batu, Kg. Checkpoint and Kg. Balung Cocos, which located within 2 – 7 km radius from the boundary of UKW SFM area. Employment opportunities for the local communities in forest operations particularly in forest rehabilitation and silviculture programmes should be provided. By incorporating the local community into the forestry activities, the SFD hopes to secure their coorperation in preventing future encroachments in UKW SFM (Procedure 12 – Communication & Dispute Resolution). SFD will also collaborate with the local authority especially in awareness programme to prevent forest encroachments by the local communities. SFD must develop a control access system in all access point and conduct regular patrolling especially in high risk areas.

6.7.3 Fire Protection

SFD has formal procedures for resource protection that include fire management (Procedure 8 – Resource Protection).

A Forest Fire Management Plan should be developed for the conservation forest reserves to protect the resource from encroachment and conversion. The plan should be designed to protect the forest from fires, which may occur due to land clearing by the local communities and/or by the oil palm areas adjacent to the reserve. Amongst others, the plan will specify the following:

- Fire Management Map with a scale 1: 50,000;
- Fire Prevention Plan;
- Fire Preparedness Plan;
- Fire Management Zones - access routes by vehicle, road and track network;
- Location of existing water points that can be used during drought conditions;
- Equipment resources statement and specifications for procurement of new equipment; and
- Fire Management Organization

6.8 Community engagement

i) Customary Use Rights

As stated earlier, there is no settlement or customary site found in UKW SFM project area. The finding of HCV 5-6 assessment as prescribed in previous chapter will be useful to support the above statement. In case any dispute pertaining to customary claim by local communities, the Forest Enactment 1968 shall apply.

ii) Employment Rights

Local communities shall be given preference, wherever practical, when it comes to employment and contract opportunities. Any shortfall encountered on skills and competency will be overcome by training. Proper health and safety equipments and practices will be given in line with the National Health and Safety regulations.

iii) Environmental awareness

Landuse activities by the forest management unit and also the large estate and smallholder oil palm developers and local communities residing around the UKW SFM may give an impact to the integrity of the forest ecosystem, especially at the forest edge. There should be an effort to make these public aware of the importance to protect and conserve the forest reserves. Therefore, where appropriate, awareness and community will be implemented with the collaboration with the communities and stakeholders.

PART VII – INFRASTRUCTURE MANAGEMENT

7.1 Roads

In general, the present basic road network in Ulu Kalumpang is not accessible, except for areas around the Landau village. SFD wants to limit access to the FMU that can result in increased encroachment and illegal activities such as hunting, poaching, etc. There is also the concept of monitoring the area and prevention of fire. Since the area is mainly a natural tropical moist forest, the area should not be a high risk for wildfires. However there are areas that have been planted with oil palm that could become a risk following removal of the palm followed by the invasive growth of weeds, grasses and pioneer species. Without proper access, control of wildfires will be very difficult as there is no means to mobilize firefighting equipment and staff quickly to minimize the damage that can be caused from uncontrolled forest fire.

7.2 Infrastructure

7.2.1 Buildings and basic facilities

Currently the SFD facilities include a small base camp located on the west side of Ulu Kalumpang FR. The development of an additional site office and accommodation near Sungai Mantri is planned to provide a second station to monitor the forest area against encroachment and illegal activities.

7.2.2 Quarries

There is one limestone quarry located within Mt Wullersdorf Forest Reserve (GPS N04^0 26’ 28” E118^0 10’ 48”) that is licensed to Teck Guan Industries Sdn Bhd (License # JP(TW) Quarry 01/98 and Permit # JP(TW) OP03/98). The limestone quarry was established in the mid 1990’s that was developed for agricultural lime production and currently occupies an area of 18.78 ha. Occupation permits are renewed annually.

PART VIII – MONITORING

8.1 Monitoring

Monitoring will mostly focus on activities associated with forest protection as well as environmental aspects and wildlife populations. Monitoring will include activities related to management activities such as removal of oil palm and forest restoration along with fire prevention; illegal logging; hunting, poaching, trapping of wildlife and encroachment. SFD will also promote research through collaboration with universities, local NGOs, and international organizations. SFD has developed a formal procedure for monitoring activities under Procedure 6 (Monitoring).

8.2 Operational Monitoring

The District Forestry Officer (DFO) is responsible for the implementation of the activities as prescribed in the FMP and is further described in the Annual Work Plan (AWP). The DFO is also responsible to submit progress reports to the Head Quarter once in three months.
Regular internal monitoring and control of all forest operations will be carried out by the DFO to ensure compliance and early recognition of problems and to take meaningful corrective action immediately. This is an essential practical aspect of forest management that forms the basis for compliance and transparent accountability of operational activities. Procedures for monitoring have been developed by SFD to provide a guideline for monitoring activities of contractors such as clearing oil palm and restoration planting.

8.3 Reporting

The information generated by the monitoring system is to be reported to Head Quarters regularly by the DFO. Reporting should be both written and oral, so that specific problems, unexpected situations, or any other management aspects can be discussed and necessary action can be taken quickly. The DFO should summarize each periodic report and transmit the findings and recommendations to Head Quarters.

8.4 Management Plan Review

This medium-term FMP is subject to a review by the year 2015. The review process provides an opportunity to update the resource situation, to refine the forest zoning scheme and management prescriptions, and to respond to new information or changes in the SFD and/or government policies, management approach, as well as changes in technology and market conditions.
During the mid-term review, the following aspects shall be considered:

- Comparison between the targets and actual achievements of all management activities carried out;
- Assessment of the degree of improvement on forest resources through the evaluation of growth data from permanent sample plots (PSPs) and other data;
- Evaluation of the forest conservation approach in terms of species diversity, soil, water and wildlife protection; and
- Evaluation of the results of Wildlife and watershed monitoring.
- Assessment of any major changes in the environmental and social conditions.

PART IX – RESEARCH & DEVELOPMENT (R&D)

9.1 Research Activities

Many commitments in the SFD strategic directions outline the need for greater scientific knowledge and technological innovation in the forest sector. In particular, the SFD must increase its understanding of the impacts of human and natural disturbances on forest ecosystems, develop appropriate forest management tools and techniques, and enhance the forest sector's international competitiveness. Structuring research and development in this way, enables experts from diverse disciplines, to focus on complex problems and supports the development of more integrated techniques and approaches to resource management. This process brings in various disciplines in the natural and social sciences, as well as, traditional knowledge.

Ecological management of the forest develops and applies understanding of how forest ecosystems sustain themselves over long periods of time. It involves examination of growth, development, and the inherent disturbances that underlie the ecological integrity, dynamics, biological diversity and resilience of forest ecosystems. The knowledge enables the SFD officers to develop approaches that work with, rather than against, the processes that underlie forest ecosystem sustainability.

The Forest Research Centre (FRC) in Sepilok, University Malaysia Sabah, along with foreign universities and international research centers should look at a wider spectrum of issues associated with conservation management such as:

i. Wildlife populations and habitat requirements
ii. Survival and growth performance of planted trees based on forest restoration activities;
iii. Biodiversity - plants and animals, forest quality, stand *structure, etc.;*
iv. Ecotourism potentials of the FMU areas.

9.2 Permanent Sample Plots (PSP)

An essential part of forest management is the permanent monitoring of the growing stock by repeated inventories or by the use of permanent plots. The SFD has established 44 PSP of 15 m radius PSP to monitor growth in the 4 strata (**Table 9.0**). The main purpose of this activity is to compare the actual development of the growing stock in each quality strata. PSPs can also be used to evaluate restoration activities of Climber Cutting and Enrichment Planting.

Table 9.0 Location of Permanent Sample Plots (15 m radius)

Forest Reserve	Plot No	Geographical Location	Altitude (m)	Soil Association	Original Vegetation	Distur-bance	Vegetation Status
Ulu Kalumpang	UK 01	N 4° 36' 35.6"; E 118° 01' 01.1"	166	Brantian	MDF Type A + Riparian;	High	Disturbed lowland mixed dipterocarp forest; riparian; severely logged surrounding area
Ulu Kalumpang	UK 02	N 4° 31' 35.6"; E 118° 02' 28.7"	168	Brantian	MDF Type A;	High	Disturbed lowland mixed dipterocarp forest; severely logged surrounding area
Ulu Kalumpang	UK 03	N 4° 30' 54.9"; E 118° 02' 32.8"	184	Brantian	MDF Type A;	High	Disturbed lowland mixed dipterocarp forest; severely logged surrounding area; UKW FMU team
Ulu Kalumpang	UK 04	N 4° 32' 23.3"; E 118° 01' 43.4"	209	Tinagat	MDF Type A + Riparian;	High	Disturbed lowland mixed dipterocarp forest; riparian; severely logged surrounding area
Ulu Kalumpang	UK 05	N 4° 32' 37.4"; E 118° 01' 54.3"	304	Tinagat	MDF Type A;	Low	Disturbed lowland mixed dipterocarp forest; severely logged surrounding area
Mt Wullersdorf	WD 01	N 4° 29' 27.3"; E 118° 05' 54.4"	231	Wullersdorf	MDF Type D;	Low	Disturbed lowland mixed dipterocarp forest
Mt Wullersdorf	WD 02	N 4° 29' 30.8"; E 118° 05' 55.4"	263	Wullersdorf	MDF Type D;	Low	Disturbed lowland mixed dipterocarp forest
Mt Wullersdorf	WD 03	N 4° 26' 13.0"; E 118° 07' 05.5"	124	Wullersdorf	MDF Type D	Moderate	Disturbed lowland mixed dipterocarp forest
Madai-Baturong FR	MB 01	N 4° 41' 53.5"; E 117° 59'	116	Brantian	MDF Type A;	Moderate	Disturbed by past logging and also illegal felling of Belian trees; Lowland

		20.3"					MDF Parashorea malaanonan & Belian
Madai-Baturong FR	MB 02	N 4° 41' 51.8"; E 117° 59' 51.7"	101	Brantian	MDF Type A;	Moderate	Disturbed by past logging and also illegal felling of Belian trees; Lowland MDF Parashorea malaanonan & Belian
Kalumpang VJR 107D	KLP 1	N 4° 34' 24.7"; E 118° 14' 53.8"	279	Gumpal	MDF Type D	Moderate	Disturbed by past logging and also illegal felling of large trees; Lowland MDF Rubroshorea & Dipterocarpus forest in the past. Present dominated by Shorea multiflora, Vatica oblongifolia
Kalumpang VJR 107C	KLP 2	N 4° 33' 48.0"; E 118° 09' 48.8"	186	Tinagat	MDF Type A;	High	Disturbed by past logging and also illegal felling of trees; Lowland MDF Parashorea malaanonan
Kalumpang VJR 107C	KLP 3	N 4° 34' 04.4"; E 118° 09' 27.1"	127	Tinagat	MDF Type A;	Moderate	Disturbed by past logging and also illegal felling of trees; Lowland MDF Parashorea malaanonan
Kalumpang VJR 107D	KLP 4	N 4° 34' 38.0"; E 118° 14' 48.0"	153	Gumpal	MDF Type D	Moderate	Disturbed by past logging and also illegal felling of large trees; Lowland MDF Rubroshorea & Dipterocarpus forest in the past. Present dominated by Shorea fallax, Dipterocarpus palembanicus

Monitoring of forest strata development using PSP should be carried out as a routine management activity either annually or every 2 years. An important benefit of continuously updating inventory data will serve to provide reliable growth data on each forest quality strata will not be necessary to carry out a major inventory for the entire FMU for every new planning period. Monitoring of permanent sample plots will support the quantity of carbon present in the forest strata and additional carbon sequestered by restoration activities and growth of the residual stand required for certification.

PART X – BUDGET AND PROJECT COST

10.1 Introduction

The State Government fully funds the forest operational activities in Ulu Kalumpang, Madai Baturong, Mt Wullersdorf & Kalumpang FR. The total budget allocated during the first five years is RM 18.9 million. An initial allocation of RM 3 million has been spent in 2008 and 2009, mostly on clearing oil palm and planting of trees. An additional allocation of RM 18.0 million is required to meet the operational costs over the next 10 years until 2020, and this will be applied for in the 11th Malaysia Plan.

10.2 Manpower Requirement

Ulu Kalumpang, Mt Wullersdorf, Madai Baturong, & Kalumpang FRs will be managed by the Kunak District Forestry Office under the supervision of Deputy Director (Development).

SFD will use local contractors in forest restoration, silviculture, and other field operations, for greater efficiency. Therefore, the SFD will continue to contract work to qualified contractors on selected activities. The contractors are required to give priority in recruitment of labor from local communities living around Kunak & Tawau. These contractors would only be allowed to source labor from elsewhere if suitable manpower around the area proves to be inadequate.

Table 10.0: Staff of Kunak District Forestry Office:

Staff	**Number of Staff**
DFO	1
ADFO	2
Forest Ranger	0
Forester	14
Administration	4
Driver	3
PRAs	9

Table 10.1: Manpower Requirement in Ulu Kalumpang Wullersdorf Sustainable Forest Management Project for the period of 2011 to 2020

Forest Activities	Position	Year									
		1	2	3	4	5	6	7	8	9	10
Forest Management	DFO	1	1	1	1	1	1	1	1	1	1
	ADFO (II)	1	1	1	1	1	2	2	2	2	2
Forest Restoration	Forest Ranger	0	0	0	0	0	1	1	1	1	1
	Forester	8	8	8	8	8	8	8	8	8	8
	General Worker	4	4	4	4	4	4	4	4	4	4
	General Worker	2	2	2	2	2	7	7	7	7	7
Forest Protection	Forest Ranger	0	0	0	0	0	1	1	1	1	1
	Gate Keeper	3	3	3	3	3	6	6	6	6	6
	General Worker	0	0	0	0	0	3	3	3	3	3
R&D	N/A										
Community Forestry	Forest Ranger	0	0	0	0	0	1	1	1	1	1
	Forester	0	0	0	0	0	1	1	1	1	1
Construction and Maintenance – Roads and Bridges	Forest Ranger	0	0	0	0	0	1	1	1	1	1
	Forester	0	0	0	0	0	1	1	1	1	1
	General Worker	0	0	0	0	0	2	2	2	2	2
CFI or PSP	Same set up as in "Silviculture"										
Administration	Forest Clerk	0	0	0	0	0	1	1	1	1	1
	Driver	3	3	3	3	3	3	3	3	3	3
Store: Fuel/Lubricant/ Hardware/Genset/Water Pump	Store Keeper	Will be in the 3 field outpost at Sg. Mantri, Landau and Wullersdorf.									
Total		20	20	20	20	20	36	36	36	36	36

Note: Year 1 starts in 2011

10.3 Budget and Cost Distribution

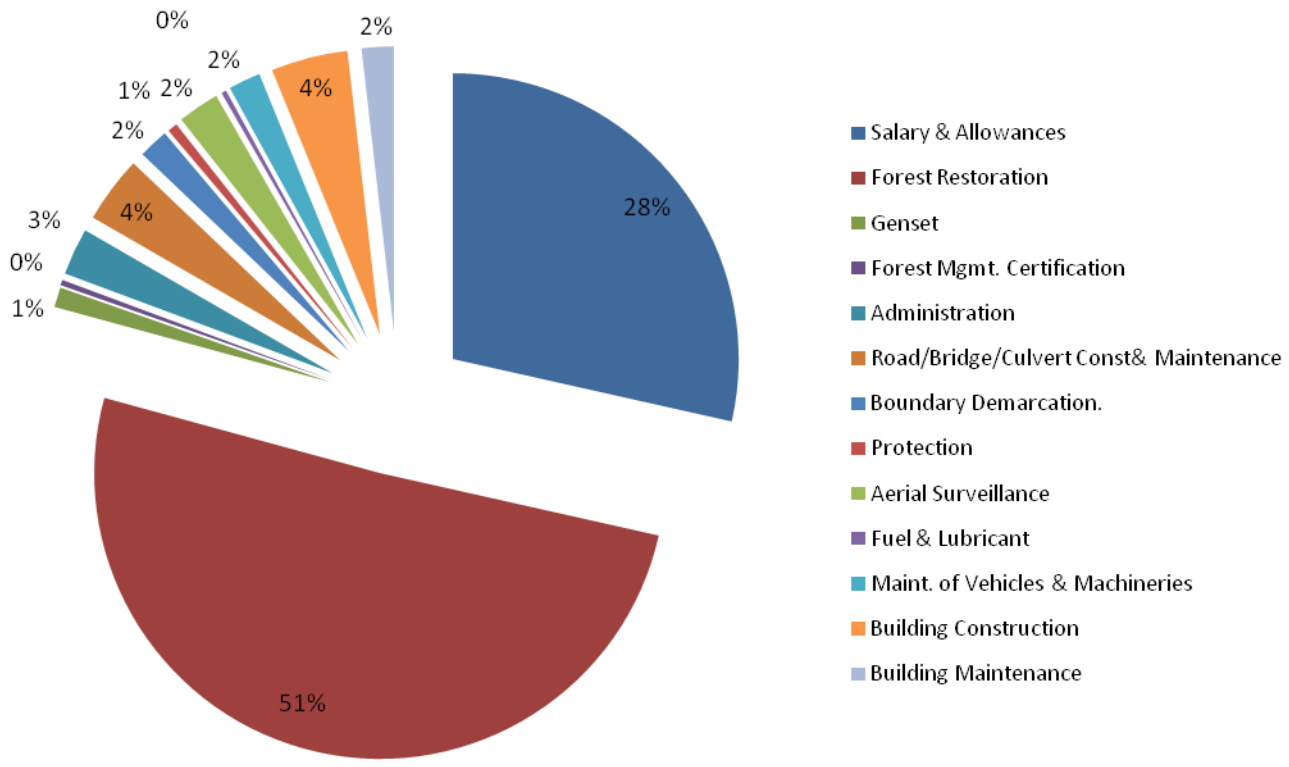
Budget requirements are mainly for capital investments and operational activities. Budget for purchasing the narrow parcel of land between Madai Baturong FR & Ulu Kalumpang FR will be defined following field survey of the boundaries of both reveres to calculate the area to be purchased to combine the two reserves.

A total of RM36 million is required to finance the entire project for the next 10 years. Since there is no logging component within the planning period, the cost centers for most of the activities will be on removal of oil palm and intensive forest restoration (3,000 ha). The breakdown costs for the entire planning period are shown in **Table 10.2 and chart 1.**

Table 10.2: Budget and Projected Cost (2011 – 2020) for Ulu Kalumpang Wullersdorf Sustainable Forest Management Project

COST CENTER	YEAR										TOTAL (RM)	%
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
Salary & Allowances	740,000	740,000	740,000	740,000	740,000	1,295,000	1,295,000	1,295,000	1,295,000	1,295,000	10,175,000	28.51
Forest Restoration	810,500	3,014,000	2,072,000	1,596,000	616,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	18,108,500	50.73
Genset	30,000	30,000	30,000	30,000	30,000	50,000	50,000	50,000	50,000	50,000	400,000	1.12
Forest Mgmt. Certification	0	0	0	0	0	22,000	22,000	22,000	22,000	22,000	110,000	0.31
Administration	89,249	90,000	90,000	90,000	90,000	100,000	100,000	100,000	100,000	100,000	949,249	2.66
Road/Bridge/ Culvert Const& Maintenance	0	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	1,350,000	3.78
Boundary Demarcation.	60,000	150,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	610,000	1.71
Protection	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	200,000	0.56
Aerial Surveillance	20,000	80,000	80,000	80,000	80,000	100,000	100,000	100,000	100,000	100,000	840,000	2.35
Fuel & Lubricant	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	100,000	0.28
Maint. of Vehicles & Machineries	50,000	50,000	50,000	50,000	50,000	80,000	80,000	80,000	80,000	80,000	650,000	1.82
Building Construction	0	0	150,000	0	0	400,000	500,000	550,000	0	0	1,550,000	4.34
Building Maintenance	50,000	50,000	50,000	50,000	50,000	80,000	80,000	80,000	80,000	80,000	650,000	1.82
TOTAL	**1,881,760.00**	**4,384,153.36**	**3,492,154.36**	**2,866,155.36**	**1,886,156.36**	**4,359,016.00**	**4,459,017.00**	**4,459,018.00**	**3,959,019.00**	**3,959,020.00**	**35,680,7490**	**100**

CHART 1: Budget and projected cost (2011-2020) for Ulu Kalumpang Wullersdorf Sustainable Forest Management Project



Appendix 1

Water quality sampling
December 2015

TESTING SERVICES (SABAH) SDN BHD 55203-U

1st Floor, Lot 1, Block N, Bandar Ramai Ramai,

P.O.Box 1146, 90712 Sandakan, Sabah

Tel & Fax: 089 272087 Tel: 089 210431 e-mail: tssblab@yahoo.com

Your Ref: G096-023

Our Ref: TSSB/GLOBAL FORESTRY/W2173-2177/0410 26th April 2010

Date Sample received: 16th April 2010

Sample description: 5 x 1.5L bottle samples said to be **'SURFACE WATER'** were received for analysis.

TOTAL NUMBER OF TEST PARAMETERS/SAMPLE: 08

Test Method References:

DOE - 1995 revision (BOD, COD), Nitrate – APHA 4500-NO_3 B 1995, Ammoniacal Nitrogen – APHA 4500-NH_3 - F

Phosphate,P – Ammonium Molybdate method.

Total Coliform Count & E.Coli Count – Petrifilm / AOAC (998.08 and 991.14)

TEST RESULTS:

Parameters Tested	Sampling Location							NWQSM *
	W1	W2	W3	W4	W5	W6	W7	
Biological Oxygen Demand (BOD in mg/l)	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	1.29	Class I
Suspended Solid (SS in mg/l)	14.0	34.0	6.00	<5.00	<5.00	<5.00	5.00	Class I
Chemical Oxygen Demand (COD in mg/l)	13.1	26.1	124	117	78.4	13.1	65.3	W1,W6:Class I W2: Class IIA W3,W4: Class V W5,W7: Class III
Ammoniacal- Nitrogen (as N_3-N in mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	Class I
Dissolved Oxygen (DO in mg/l)	8.59	7.43	9.48	9.20	8.64	9.18	9.18	Class I
Oil & Grease (mg/l)	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	NA
Total Coliform Count (MPN/100mL)	3500	3500	3500	330	3500	490	1300	Class I
Fecal Coliform Count (MPN/100mL)	1300	1100	230	170	700	230	490	W1,W2,W4,W7: Class IIB W3,W4,W6: Class I
pH value	7.09	6.41	6.96	6.38	6.01	7.49	7.64	W1,W2,W3,W4,W6,W7: Class I W5: Class IIA

Appendix 2

National Water Quality Standards for Malaysia

PROPOSED NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA

		Classes					
Parameters	Unit	I	IIA	IIB	III	IV	V
Ammoniacal-N.	mg/l	0.1	0.3	0.3	0.9	2.7	>2.7
BOD	mg/l	1	3	3	6	12	>12
COD	mg/l	10	25	25	50	100	>100
DO	mg/l	7	5-7	5-7	3-5	<3	<1
pH		6.5-8.5	6-9	6-9	5-9	5-9	-
Colour	TCU	15	150	150	-	-	-
Elec. Cond*	µmhos/cm	1000	1000	-	-	6000	-
Floatables		N	N	N	-	-	-
Odour		N	N	N	-	-	-
Salinity*	%	0.5	1	-	-	2	-
Taste		N	N	N	-	-	-
Tot. Diss. Sol.*	mg/l	500	1000	-	-	4000	-
Tot. Susp. Sol.	mg/l	25	50	50	150	300	>300
Temperature	°C	-	Normal± 2	-	Normal± 2	-	-
Turbidity	NTU	5	50	50	-	-	-
F. Coliform**	counts/100 ml	10	100	400	5000 (20000)ε	5000 (20000) ε	-
Total Coliform	counts/100 ml	100	5000	5000	50000	50000	>50000

N = No visible floatable material / debris,

or No objectionable odour,

or No objectionable taste.

* = Related parameters, only one recommended for use

** = Geometric mean

ε = Maximum not to be exceeded

	Classes						
Parameters	Unit	I	IIA / IIB	III[@]		IV	V
A1	mg/l		-	-	(0.06)	0.5	
As	mg/l		0.05	0.4	(0.05)	0.1	
Ba	mg/l		1	-	(0.001)	-	
Cd	mg/l		0.01	0.01	(0.05)	0.01	
Cr(Vi)	mg/l		0.05	1.4		0.1	
Cr(III)	mg/l		-	2.5		-	
Cu	mg/l		1	-		0.2	
Hardness	mg/l		250	-		-	
Ca	mg/l		-	-		-	
Mg	mg/l		-	-		-	
Na	mg/l		-	-		3 SAR	
K	mg/l		-	-		-	
Fe	mg/l		0.3	1		1 (leaf) 5 (others)	
Pb	mg/l	N	0.05	0.02*	(0.01)	5	L
Mn	mg/l	A	0.1	0.1		0.2	E
Hg	mg/l	T	0.001	0.004	(0.0001)	0.002	V
Ni	mg/l	U	0.05	0.9*		0.2	E
Se	mg/l	R	0.01	0.25	(0.04)	0.02	L
Ag	mg/l	A	0.05	0.0002		-	S
Sn	mg/l	L	-	0.004		-	
U	mg/l		-	-		-	A
Zn	mg/l	L	5	0.4*		2	B
B	mg/l	E	1	-	(3.4)	0.8	O
Cl	mg/l	V	200	-		80	V
Cl_2	mg/l	E	-	-	(0.02)	-	E
Cn	mg/l	L	0.02	0.06	(0.02)	-	
F	mg/l		1.5	10		1	IV
NO_2	mg/l		0.4	0.4	(0.03)	-	
NO_3	mg/l		7	-		5	
P	mg/l		0.2	0.1		-	
Si	mg/l		-50	-		-	
SO_4	mg/l		250	-		-	
S	mg/l		0.05	-	(0.001)	-	
CO_2	mg/l		-	-		-	
Gross-α	Bq/l		0.1	-		-	
Gross-β	Bq/l		1	-		-	
Ra-226	Bq/l		<0.1	-		-	
Sr-90	Bq/l		<1	-		-	

* = At hardness 50 mg/l $CaCo_3$
@ = Maximum (unbracketed) and 24-hr average (bracketed) concentrations

		Classes					
Parameters	Unit	I	IIA/IIB	III[@]		IV	V
CCE	µg/l	N	500	-		-	-
MBAS/BAS	µg/l	A	500	5000	(200)	-	-
O & G (mineral)	µg/l	T	40;N	N		-	-
O & G (emulsified edible)	µg/l		7000;N	N		-	-
PCB	µg/l	L	0.1	6	(0.05)	-	-
Phenol	µg/l	E	10	-		-	-
Aldrin / Dieldrin	µg/l	V	0.02	0.2	(0.01)	-	-
BHC	µg/l		2	9	(0.1)	-	-
Chlordane	µg/l	O	0.08	2	(0.02)	-	-
t-DDT	µg/l	R	0.1	1	(0.01)	-	-
Endusulfan	µg/l		10	-		-	-
Heptachlor / Epoxide	µg/l	A	0.05	0.9	(0.06)	-	-
Lindane	µg/l	B	2	3	(0.4)	-	-
2,4-D	µg/l	S	70	450		-	-
2,4,5-T	µg/l	E	10	160		-	-
2,4,5-TP	µg/l	N	4	850		-	-
Paraquat	µg/l	T	10	1800		-	-

N = Free from visible film, sheen, discoloration and deposits
@ = Maximum (unbracketed) and 24-hr average (bracketed) concentrations

CLASS USES

I represents water body of excellent quality. Standards are set for the conservation of natural environment in its undisturbed state. Water bodies such as those in the national park areas, fountainheads, and in high land and undisturbed areas come under this category where strictly no discharge of any kind is permitted. Water bodies in this category meets the most stringent requirements for human health and aquatic life protection.

IIA/IIB represents water bodies of good quality. Most existing raw water supply sources come under this category. In practice, no body contact activity is allowed in this water for prevention of probable human pathogens. There is a need to introduce another class for water bodies not used for water supply but of similar quality which may be referred to as Class IIB. The determination of Class IIB standard is based on criteria for recreational use and protection of sensitive aquatic species.

III is defined with the primary objective of protecting common and moderately tolerant aquatic species of economic value. Water under this classification may be used for water supply with extensive / advance treatment. This class of water is also defined to suit livestock drinking needs.

IV defines water quality required for major agricultural irrigation activities which may not cover minor applications to sensitive crops.

V represents other waters which do not meet any of the above uses.

Appendix 3

Rare, Threatened & Endangered Species List – Mammals

RARE, THREATENED & ENDANGERED SPECIES LIST - MAMMALS

Threatened Species : The following list includes all mammals which are likely to occur in the project area and are rated rated as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) in the 2004 IUCN Red List of Threatened Animals.

- Critically Endangered :

- **Black Shrew** (Suncus ater). (**Endemic** to Malaysia).
- **Horseshoe Bat species** (Rhinolophus convexus).
- **Malayan Roundleaf Bat** (Hipposideros nequam). (**Endemic** to Malaysia).
- **Malayan Water Shrew** (Chimarrogale hantu). (**Endemic** to Malaysia).

- Endangered :

- **Asian Elephant** (Elephas maximus).
- **Banteng** (Bos javanicus).
- **Bornean Tree Shrew** (Tupaia longipes).
- **Borneo Water Shrew** (Chimarrogale phaeura).(**Endemic** to Malaysia).
- **False Serotine Bat** (Hesperoptenus doriae).(**Endemic** to Malaysia).
- **Malaysan Shrew** (Crocidura malayana).(**Endemic** to Malaysia).
- **Mountain Spiny Rat** (Maxomys alticola).(**Endemic** to Malaysia).
- **(Bornean) Orang-utan** (Pongo pygmaeus).
- **Otter Civet** (Cynogale bennetti).
- **Proboscis Monkey** (Nasalis larvatus).
- **Small Spiny Rat** (Maxomys baeodon).(**Endemic** to Malaysia).
- **Summit Rat** (Rattus baluensis).(**Endemic** to Malaysia).

- Vulnerable :

- **Asiatic Black Bear** (Ursus thibetanus).
- **Asiatic Golden Cat** (Catopuma temminckii).
- **Bare-backed Rousette** (Fruit Bat) (Rousettus spinalatus).
- **Bay Cat** (Catopuma badia).
- **Bornean Smooth-tailed Tree Shrew** (Dendrogale melanura).(**Endemic** to Malaysia).
- **Clouded Leopard** (Neofelis nebulosa).

- **Coppery Pipistrelle (Bat)** (Pipistrellus cuprosus).(**Endemic** to Malaysia).
- **Cox's Roundleaf Bat** (Hipposideros coxi).(**Endemic** to Malaysia).
- **Dhole** (Cuon alpinus).
- **Eurasian Otter** (Lutra lutra).
- **Fishing Cat** (Prionailurus viverrinus).
- **Flat-headed Cat** (Prionailurus planiceps).
- **Four Striped Ground Squirrel** (Lariscus hosei).(**Endemic** to Malaysia).
- **Gaur** (Bos frontalis).
- **Hairy-nosed Otter** (Lutra sumatrana).
- **Hose's Palm Civet** (Diplogale hosei).(**Endemic** to Malaysia).
- **Hose's Shrew** (Suncus hosei).(**Endemic** to Malaysia).
- **Jentink's Squirrel** (Sundasciurus jentinki).
- **Kinabalu Ferret-badger** (Melogale everetti).(**Endemic** to Malaysia).
- **Lesser Ranee Mouse** (Haeromys pusillus).
- **Mainland Serow** (Capricornis sumatraensis).
- **Malayan Porcupine** (Hystrix brachyura).
- **Malayan Roundleaf Bat** (Hipposideros nequam).(**Endemic** to Malaysia).
- **Marbled Cat** (Pardofelis marmorata).
- **Northern Pigtail Macaque** (Macaca leonina).
- **Pig-tailed Macque** (Macaca nemestrina).
- **Ranee Mouse** (Haeromys margarettae).
- **Ridley's Leaf-nosed Bat** (Hipposideros ridleyi).
- **Smooth-coated Otter** (Lutra perspicillata).
- **Stumptail Macaque** (Macaca arctoides).

List of Borneon Endemic Species

- **Borneon Yellow Muntjac** (Muntiacus atherodes)
- **Plain Pigmy Squirrel** (Exilisciurus exilis)

-

Appendix 4

Species List - Silviculture

SPECIES LIST - SILVICULTURE

This schedule of species is intended for use in silvicultural activities in the mixed dipterocarp forest, namely in timber stand improvement. It is meant to help the silviculturist to make situational decisions that would favour the establishment of species of known commercial value. Those species not on the list are not neceearily eliminated from managed forests. They merely do not get 'favoured' treatment, and are destroyed only if they interfere directly with selected PCTs.

The *preferred* and *acceptable* species are 2 categories from which PCTs are selected. In the absence of preferred species, acceptable species may be selected as PCTs. Preferred species are those species of generally high value, fast growth, good timber form, and large maximum attainable sizes. The dipterocarps are mainly listed as preferred species. However, species in the genera *Vatica* and *Hopea* are listed as acceptable mainly because of their slower growth and generally smaller maximum attainable diameter compared with the rest of the dipterocarps.

The *protected* species are species neither be removed to favor the growth of PCTs nor should they be specially liberated to promote their own growth. However, those species with dual listings are exceptions. Durian, for instance, is listed as both a protected species and preferred species. Such species may be selected as PCTs and liberated accordingly. The protected species list consists mainly fruit trees important as food sources for wildlife. This category is a technical designation and not a legislative designation enforceable by law. Much remains unknown about the silviculture, ecology and utilization of many tree species. Therefore, this list will need to be reviewed from time to time to incorporate new information.

Preferred Species Forest Improvement

Dipterocarps :

Anisoptera spp.	Pengiran spp.
Dryobalanops lanceolata	Kapur paji
D. keithii	Kapur merah
Dipterocarpus spp.	Keruing
Hopea sangal	Gagil
Parashorea tomentella	Urat mata beludu
Parashorea malaanonan	Urat mata daun licin
Shorea johorensis	Seraya majau
S. macrophylla	Kawang jantung
S. mecistopteryx	Kawang burung
S. parvifolia	Seraya punai
S. leprosula	Seraya tembaga
S. pauciflora	Oba suluk
S. smithiana	Seraya timbau
S. gibbosa	Seraya kuning gajah

S. accuminatissima	Seraya kuning runcing
S. faguetiana	Seraya kuning siput
S. waltonii	Seraya kelabu
S. agami	Melapi agama
S. almon	Seraya kerukup
S. ovalis	Seraya kepong
S. macroptera	Seraya melantai
Heavy Shorea spp.	Selangan batu spp.
S. symingtonii	Melapi bunga
S. argentifolia	Seraya daun mas

Non-dipterocarps :

Azadirachta excelsa	Bawang-bawang/Limpaga
Durio spp.	Durian
Dyera costulata	Jelutong bukit
Lophopetalum spp.	Perupok
Palaquium spp.	Nyatoh spp.
Scaphium spp.	Kembang semangkok
Sindora spp.	Sepetir
Heritiera sp.	Kembang
Eusideroxylon zwageri	Belian

Acceptable species

Hopea spp.	Selangan spp.
Vatica spp.	Resak spp.
Dryobalanops becarii	Kapur merah
Lithocarpus spp.	Mempening
Calophyllum spp.	Bintangor
Catanopsis spp.	Berangan
Dillenia borneensis	Simpoh gajah
Cratoxylum spp.	Geronggang
Koordersiodendron pinnatum	Ranggu
S. multiflora	Banjutan

Protected & Habitat Species

Artocarpus spp.	Tarap
Baucaurea spp.	Tampoi
Durio spp.	Durian
Diospyros spp.	Kayu malam
Koompasia Excelsa	Mengaris
Nephelium spp.	Rambutan Meritam
Euphoria malaiensis	Mata kucing
Intsia spp.	Merbau
Mangifera spp.	Mangga hutan
Burseraceae spp.	Kedondong spp

Fast Growing Local Species

(*Anthocephalus cadamba*),	Laran
(*Octomeles sumatrana*),	Binuang
(*Dryobalanops lanceolata*),	Kapur
(Falcataria moluccana)	Batai
(Duabanga moluccana)	Magas
(Aquilaria sp.)	Gaharu
Terminali copelandii (low lying)	Terminali

Appendix 5

Assessment of High Conservation Values 1 – 6