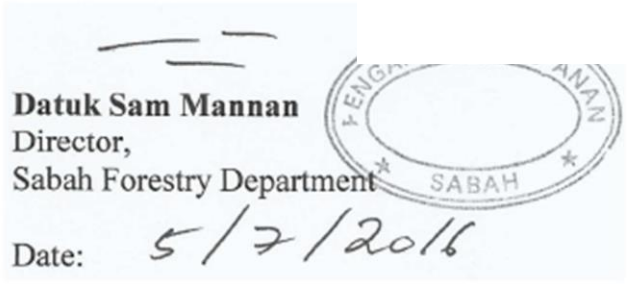
10-YEAR FOREST MANAGEMENT PLAN
For The
TIMIMBANG-BOTITIAN FOREST MANAGEMENT UNIT
(2014-2023)

Sabah Forestry Department

January 2014
(Revised June 2016)

ENDORSEMENT OF
THE DIRECTOR OF FORESTRY

This Forest Management Plan is approved for the period commencing 1st January, 2014 to 31st December, 2023. It was prepared under the Timimbang-Botitian Sustainable Forest Management Project headed by Mr. Fidelis Bajau, Deputy Director, in consultation with all key stakeholders. **This FMP is a revision of an earlier Plan approved in June, 2014, incorporating a summary of management prescriptions and monitoring recommendations for High Conservation Value elements of the Timimbang-Botitian Forest Management Unit (Appendix O).**



Datuk Sam Mannan
Director,
Sabah Forestry Department

Date:

EXECUTIVE SUMMARY

The Timimbang-Botitian Forest Management Unit (FMU) covering 13,610 *ha*, comprises a cluster of 3 forest reserves located in the northeastern portion of Sabah. The management of all these reserves comes directly under the jurisdiction of the Beluran Forestry District of the Sabah Forestry Department. The vegetation of the area is broadly classified as logged-over mixed dipterocarp forest. It was logged between the period 1987 to 2007. Today the forest of Timimbang-Botitian is a mosaic of regenerating forests, relatively intact on the steeper slopes but characterized by pioneer vegetation on the flatter areas where logging was more intense. Nevertheless, the forest still represent an important repository of native biodiversity that is worth protecting. Under a protective management strategy, it can be expected to recover and provide suitable habitat for certain wildlife communities.

This forest management plan (FMP) defines the scope and prescribed activities for the management of the Timimbang-Botitian FMU over a 10-year period beginning from 1st January, 2014 to 31st December, 2023. The Timimbang-Botitian FMU is planned to be managed primarily as a protected area where commercial logging is prohibited. The primary long-term goal of forest management focuses largely on the conservation and protection of wild flora and fauna. Given this focus, direct financial benefits is not an important requirement in the management of this FMU. The main activities for this 10-year planning period focus on wildlife management, forest restoration and protection, and developing opportunities for forest recreation.

The principal goal of wildlife management in Timimbang-Botitian is to maintain and enhance populations of wildlife that are native to the area. This may be done by maintaining and enhancing specific habitats, controlling poaching, and forest restoration. Considerations are also given to forest connectivity. The maintenance of habitat for threatened and endangered species is given special emphasis. Poaching is evident in Timimbang-Botitian, and is the likely cause of low wildlife abundance and diversity in both Botitian and Timimbang, and perhaps poses the biggest immediate threat to wildlife in the area. A key activity during this management planning period is the monitoring of wildlife populations.

Another key goal of this FMP is to ensure the conservation and protection of native flora within the Timimbang-Botitian Forest Management Unit. The main activities prescribed under this FMP are those associated with forest restoration, such as vine cutting, direct planting, and the long-term exclusion of logging. Permanent sample plots will also be established to monitor long-term forest dynamics and recovery.

The demand for recreational opportunities in forest reserves is increasing for numerous reasons. The Forestry Department is expected to allow more regulated use of forest reserves in order to meet this demand. Recreational activities in forests include watching wildlife, fishing, camping, mountain biking, hiking, picnicking, educational excursions, etc. The use of forests for such activities greatly improves the value of forests to society, despite the exclusion of major economic activities such as commercial timber production. Currently, Timimbang-Botitian is not used for any public recreational activity. This FMP prescribes further work to assess the potential of developing Timimbang-Botitian for public recreation.

The conservation status of dipterocarps, birds, and mammals were assessed according to the IUCN Red List, CITES and WCE list of protected wildlife and plants. This is summarized below:

Description	Mammals	Birds	Trees
Family	13	16	1 (Dipterocarp only)
Species (total)	27	161	86
Endemic to Borneo	6	-	16
Threatened (IUCN Red List)	10	44	17
CITES	11	5	-
Wildlife Conservation Enactment (WCE) Sched 1 & 2	14	7	-

Dipterocarps—Eighty six (86) species of dipterocarps have been recorded for the Timimbang-Botitian FMU from two surveys. Twenty eight (28) of these are Bornean endemics. Twenty five (25) species are identified as critically endangered according to the IUCN Red List. One critically endangered Sabah endemic recorded in Timimbang *is Shorea symingtonii*.

Birds—At least 161 species from 38 families of birds are known to occur in Timimbang-Botitian. Of these, 44 species (27.3 %) are classified as Near Threatened, and 3 species are classified as Vulnerable according to the IUCN Red List. Timimbang A appears to support a greater diversity of birds compared to Botitian.

Mammals—Mammals that were recorded and divided into three categories, which are primates, small mammals and large mammals. For primates, 4 known families were identified, 5 families for small mammals, and 4 families for large mammals. Bornean endemic species including *Hylobates mueleri* (Bornean gibbon) and *Pongo pygmaeus* (Orang Utan) are also listed in IUCN, CITES and WCE as threatened and totally protected species.

Areas of High Conservation Value (HCV)

A special assessment of areas of HCV was conducted for Timimbang-Botitian based on the standard HCVF Tool Kit developed by WWF Malaysia. Management prescriptions and monitoring activities are presented in a separate report for six separate HCVs. Only HCVs 1−4 were found to be relevant to Timimbang-Botitian. However, HCV # 5 and #6 which concerns community and cultural needs were not identified as critical aspects of management.

CONTENTS

1. Introduction

1.1 Background *1*

1.2 Purpose and scope of plan *1*

1.3 Management Policies and Development Goals *2*

1.4 Legal Framework *3*

2. General Description of the management area *5*

2.1 Location & Access *5*

2.2 History & Past Management *5*

2.3 Rainfall & Temperature *5*

2.4 Compartment Delineation *6*

2.5 Physical Environment *7*

Soils *7*

Topography & hydrology *7*

2.6 Vegetation 8

2.7 Settlements & Socio-Economic Environment 8

2.8 Infrastructure *10*

Buildings *10*

Roads *11*

3. Forest Conservation *13*

3.1 Introduction *13*

3.2 The Forest of Timimbang-Botitian *13*

Post-Harvest Silvicultural Treatments *13*

Restoration Planting *14*

3.3 Timber Resource Assessment *16*

Standing Timber Stock *17*

Potential Crop Trees & Prospects for Harvesting *17*

Vine Loads *17*

3.4 Botanical Inventory *18*

The Dipterocarps *18*

Other Important Canopy Trees *18*

3.5 High Conservation Value Forests *19*

3.6 Prescribed Activities *20*

4.1 Wildlife Management *22*

4.1 Introduction *22*

Management Goals *22*

4.2 Wildlife Assessment Methodology *22*

4.3 Habitat Quality *23*

Botitian Forest Reserve *23*

Timimbang Forest Reserve *24*

4.4 Primates *24*

Orang Utan *24*

Other Primates *25*

4.5 Large Mammals *27*
4.6 Small Mammals *27*
4.7 Birds *27*
4.8 Management Threat & Opportunities *27*
Poaching *27*
Forest Restoration & Enrichment With Selected Fruit Trees *28*
Wildlife Monitoring *28*
Improving Nesting Opportunities *28*
4.9 Prescribed Activities 28

5. Recreation *29*
5.1 Introduction *29*
5.2 Assessment of Recreation Potential *29*
Accessibility *29*
Visitor use potential *29*
Scenic Overlooks *30*
Fishing *30*
Camping Facilities *30*
5.3 Prescribed activities 30

6. Prescribed Activities & Implementation *31*
6.1 Prescribed Activities & Implementation Schedule *31*
6.2 Documentation & Reporting *32*
6.3 Forest Certification *32*
6.4 Environmental Impact Assessment *32*
6.5 Standard Operating Procedures & Guidelines *32*
6.6 Budget *33*
6.7 Staffing & Manpower *33*

References *35*

Appendices
Appendix A: Topography Map of the Timimbang-Botitian FMU *36*
Appendix B: A Map of Timber License Coupes issued from 1987 to 2007 *39*
Appendix C: Senarai Lesen Dalam HS Timimbang (1989-2007) *40*
Appendix D: Slope Classification of the Timimbang-Botitian FMU *42*
Appendix E: Oil palm estates directly adjacent to the Timimbang-Botitian FMU *43*
Appendix F: Post Harvest Silvicultural Treatment Carried out in Timimbang-Botitian *44*
Appendix G: Aerial photograph of Botitian Forest Reserve captured in 2008 *45*
Appendix **H**: **SPOT 2.5 m Satellite image of Timimbang A and Botitian FR** *46*
Appendix **I: SPOT 2.5 m Satellite image of Timimbang B** *47*
Appendix J: Key outcome of a stakeholder consultation workshop held on 20-22 May, 2013, at the Forestry Training Institute, Telupid *48*
AppendixK: Dipterocarp checklist of the Timimbang-Botitian FMU *49*
Appendix L: Bird species observed in the Timimbang-Botitian FMU *52*
Appendix M: Conservation Status of Mammals Found in Timimbang-Botitian *56*
Appendix N: Silvicultural & Timber Stand Inventory Methodology *58*
Appendix O: HCV elements in the Timimbang-Botitian FMU and the management and monitoring recommendations for each HCV *60*

1 INTRODUCTION

1.1. Background

The Timimbang-Botitian Forest Management Unit (FMU) covering 13,610 *ha*, comprises a cluster of 3 forest reserves located in the northeastern portion of Sabah (see Figure 1.1). At the time of the preparation of this forest management plan (FMP), Timimbang A and B were legally designated as Class II Commercial Forest, whereas Botition Forest reserve is a Class I Protection Forest (Forest Enactment 1968). The management of all these reserves comes directly under the jurisdiction of the Beluran Forestry District of the Sabah Forestry Department.

Efforts to bring the FMU under sustainable management began in earnest in 2007. This was made possible with a special initial allocation of RM 5 million from the State's Community Forestry Development Fund. As part of this effort, the formulation of a forest management plan was commissioned. Both Timimbang A and B have since been reclassified as Class I Protection Forest in December, 2014. Therefore, for the purpose of this FMP, the entire Timimbang-Botitian FMU is treated as a Protection Forest whereby management emphasizes the protection of ecosystem functions, and prohibits all forms of destructive human disturbance (such as commercial logging and mining).

1.2 Purpose and scope of Plan

This forest management plan (FMP) defines the scope and prescribed activities for the management of the Timimbang-Botitian FMU over a 10-year period beginning from 1st January, 2014 to 31st December, 2023. This is to ensure that all management activities are carried out in a systematic and efficient manner. The main activities for this 10-year planning period (2014-2023) focus on developing opportunities for forest recreation, biodiversity conservation, protection, and wildlife management.

Although the stated planning horizon is 10 years, the FMP seeks to optimize socio-economic and environmental benefits to the State, and other key stakeholders, over and beyond the current planning period. This FMP is scheduled to be reviewed in year 5. Any major revisions to the FMP will have to be approved by the Director of Forestry. The Beluran District Forestry Officer is responsible for the implementation of this management plan.

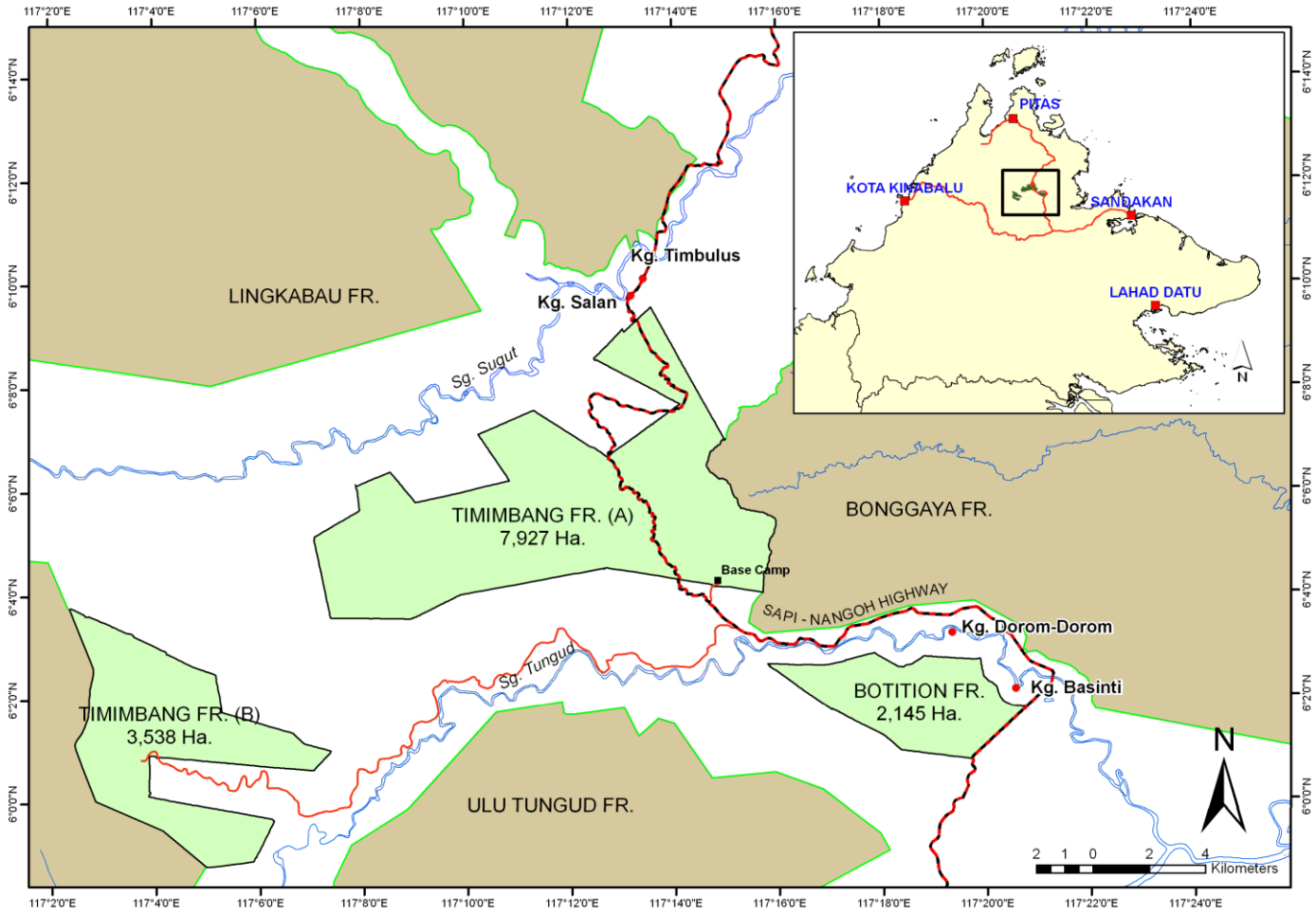


Figure 1.1: The Timimbang-Botitian FMU is made up of three fragments, and is generally accessbile from the Sapi-Nangoh Highway

1.3 Management Policies and Development Goal

The Sabah Forestry Department is a state government agency entrusted with the sustainable management of Sabah's forest resources, namely on lands legally classified as forest reserve. As such, the Department is committed to managing Timimbang-Botitian in accordance with the principles of sustainable management as prescribed by the Forest Stewardship Council (FSC) and 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 Timimbang-Botitian FMU is planned to be managed mainly as a Class I Protection Forest where commercial logging is prohibited. The primary long-term goal of forest management provides for the non-destructive use of forest resources, focusing largely on the conservation and protection of wild flora and fauna. Given this focus, direct financial benefits is not an important factor in the management of this FMU.

The public is becoming increasingly aware of the importance of forest conservation. Therefore, it is important that the management of public lands like forest reserves is seen as serving the demands of society.

In achieving the stated management goals and objectives, the Forestry Department subscribes to the following policies and strategies:

Management of the area ensures the sustainable management of forest resources over the long-term in such a way as to optimize socio-economic benefits to the state;

All field operations give due consideration to environmental protection so as to minimize any negative impact on the natural environment;

The FMU shall be protected from fire, illegal felling, illegal settlements, and other unauthorized activities;

High conservation value forests (HCVF) are maintained and enhanced;

Third party certification of forest management under an accredited scheme would be a desirable objective to aim for;

All contractors working within the FMU must also comply with the Principles, Criteria, and Indicators of responsible management under which scheme the management is certified;

Research and educational opportunities aimed at improving the management of the FMU are given due attention;

Preferences in employment and service contracts are given to local/rural communities wherever possible.

1.4 Legal Framework

Forest management activities are governed and regulated by various laws and regulations. The following are Sabah's legal instruments and guidelines as they relate to the management of the Timimbang-Botitian Management Area:

State Forest Policy;
Forest Enactment, 1968;
Forest Rules, 1969;
Environmental Protection Enactment, 2002;
Environmental Protection Enactment (Prescribed Activities), 2005;
Wildlife Conservation Enactment, 1997;

Land Ordinance, 1930;
Water Resources Enactment, 1998;
Cultural Heritage (Conservation) Enactment, 1997;
Biodiversity Enactment, 2000;
Environmental Quality Act, 1985;
Sabah Labour Ordinance;
Occupational Safety and Health Act,1994;
International Agreements:

- Convention on Wetlands of International Importance, 1971;
- Convention on the International Trade in Endangered Species of Wild Flora and Fauna, 1973;
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity, 2000;
- International Tropical Timber Agreement, 1994;
- United Nations Convention on Biological Diversity, 1992;
- United Nations Framework Convention on Climate Change, 1992;
- United Nations Declaration of the Rights of Indigenous Peoples, 2007;
- The Kyoto Protocol to the Convention on Climate Change, 1997.

2. GENERAL DESCRIPTION OF THE MANAGEMENT UNIT

2.1 Location & Access

The Timimbang-Botitian FMU is located within the Beluran Forestry District (Figure 1.1). Timimbang A and Botitian is readily accessible from the Sapi-Nangoh Highway. Timimbang B, however, has to be accessed through private oil palm estates belonging to Malsa Corporation and Tungud Plantations, where the road is unpaved. Telupid is the nearest rural town where key government administrative offices are located.

The Timimbang-Botitian FMU is generally surrounded by private oil palm estates, the largest being that owned by Malsa Corporation and Tungud Plantations (Appendix E, p 43). Boundary demarcation on the ground has been completed and approved for Timimbang A, but is yet to be gazetted. Ground demarcation has also been completed for both Timimbang B and Botitian, and approval given by the Lands and Surveys Department in 2010.

2.2 History and Past Management

The Timimbang-Botitian FMU was gazetted as forest reserves in 1984. Logging was first initiated in Timimbang in 1987. Appendix C (p 39) provides a list of logging permits issued in Timimbang over a 20-year period from 1987 to 2007. During this period, Timimbang-Botitian has never been actively managed for any other purpose apart from commercial timber extraction. Botitian was a Class II Commercial production forest before it was reclassified as a Class I Protection Forest Reserve in 1992.

Since 2008, the entire area of Timimbang A and B totaling some 10,000 has received post-harvest silvicultural treatment in the form of vine cutting (see Appendix F, p 44). This, however, has not been carried out for Botitian. Apart from this, about 69 *ha* of encroached area in Compartment 43 have been cleared and planted with various native species, including binuang, gaharu, pulai, and laran.

2.3 Rainfall & temperature

Records obtained from the Drainage and Irrigation Department weather station in Beluran shows a mean annual rainfall of 3,593 *mm* over the last 10-year period, and recorded 197 rain-days per year for the same period. December and January are generally the wettest months, while April is usually the driest. The mean daily temperature is about 27^{o} C, with a mean daily minimum of 23^{o}C and a daily maximum of 31^{o}C. An electronic weather monitoring station was set up in Botitan in 2013.

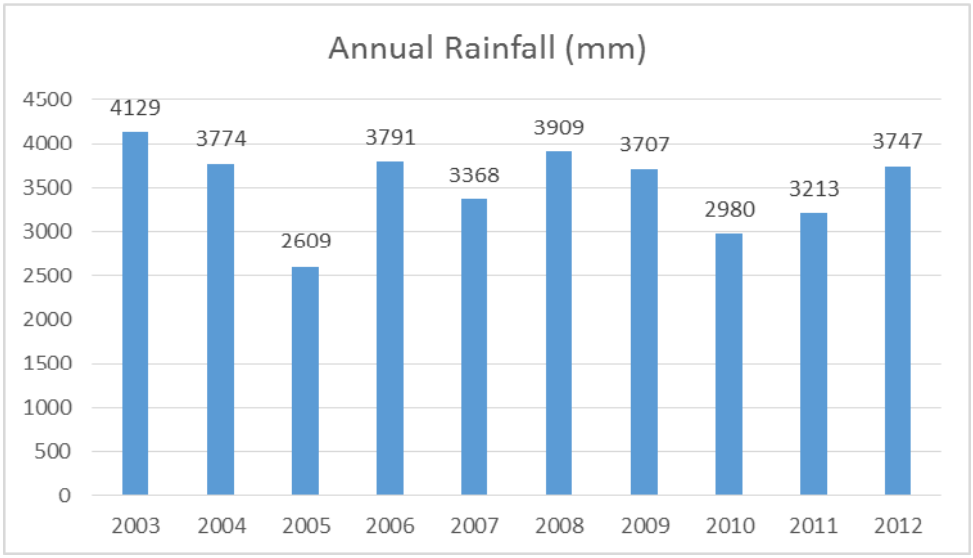


Figure 2.1: Rainfall (*mm*) for the period 2003−2012 recorded at the Beluran town (Source: Drainage & Irrigation Department

2.4 Compartment Delineation

For the purpose of management planning, the Timimbang-Botitian FMU is divided into 46 compartments ranging in size from 69 *ha* to 826 *ha* (Figure 2.2). Compartment boundaries are largely delineated according to natural features (ridges and rivers) and roads.

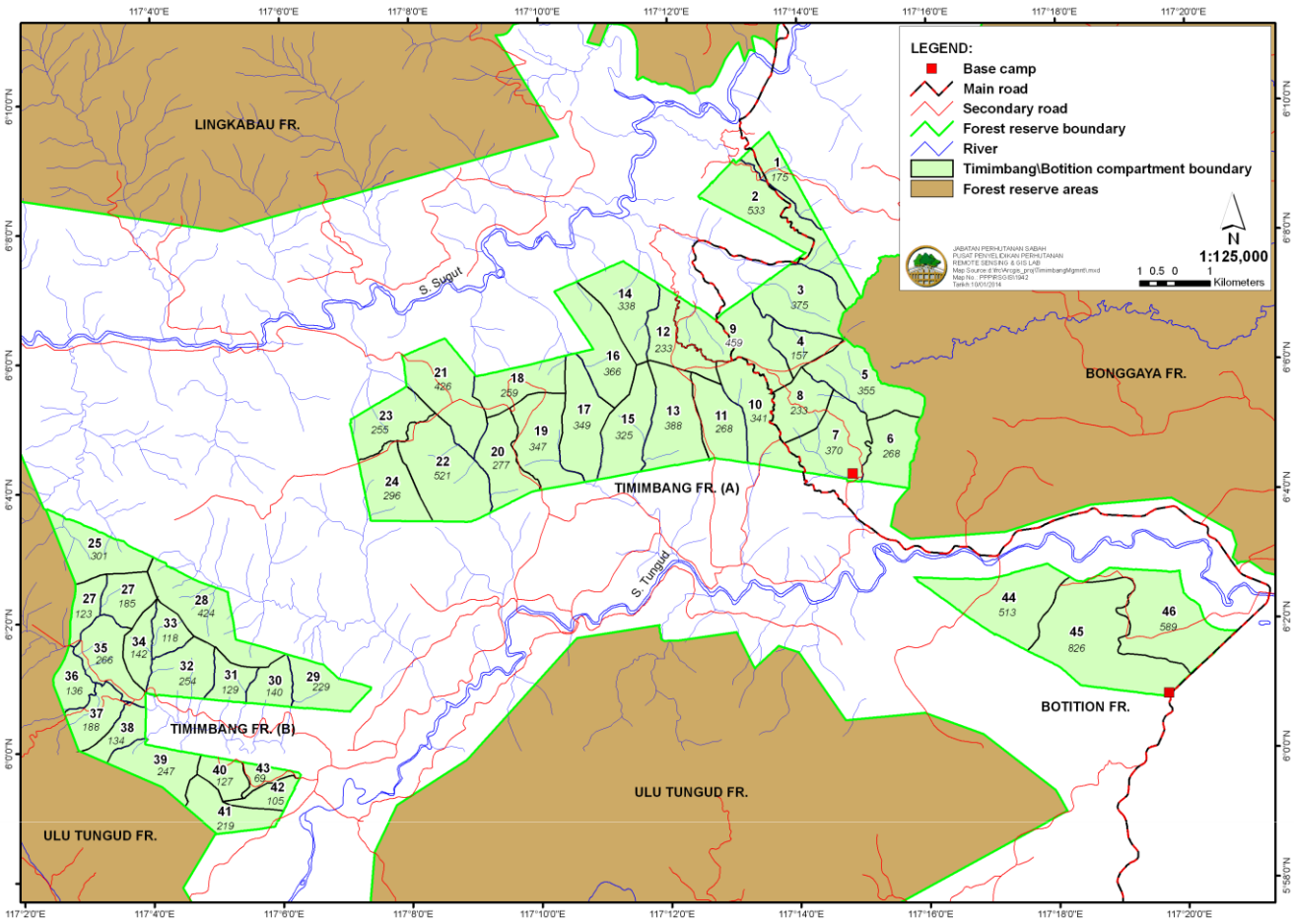


Figure 2.2: Compartment delineation for Timimbang-Botitian FMU

2.5 Physical Environment

Soils

Botitian −The Dalit soil association covers about 50 % of Botitian, with the Crocker and Lokan Associations covering the remaining 41 % and 9 % of the area respectively (Figure 2.3). Both soil associations are derived from mudstone and sandstone parent materials, where orthic acrisols are the dominant soils. Crocker, Dalit and Lokan are rated as marginal in terms of agricultural potential (Acres & Folland, 1975).

Timimbang A & B – The soil of Timimbang A is entirely made up of the Crocker Association, whereas Timimbang B is a combination of Crocker (65 %) and Lokan (35 %).

Topography and hydrology

The topography of Timimbang-Botitian is generally heterogeneous. High hills and steep slopes feature prominently in all three fragments, particularly in Timimbang A and B (Figure 2.4; Appendix D, p 42). The lowest point in the area is about 30 *m* above sea level, while the highest point is about 750 *m*, located in Compartment 25 in Timimbang B (Appendix A). About 42.8 % of the area has slopes below 8^0, whereas 20 % of the area is between 8^0 and 15^0, and about 31 % falls between slopes greater than 15^0 (Appendix D, p 42). An estimated 12.5 % of the area is considered inoperable, i.e. $\geq 25^0$. Streams originating from the FMU flow into two major rivers, namely Sg, Tungud in the south and S. Sugut in the north. Most of these streams are unnamed.

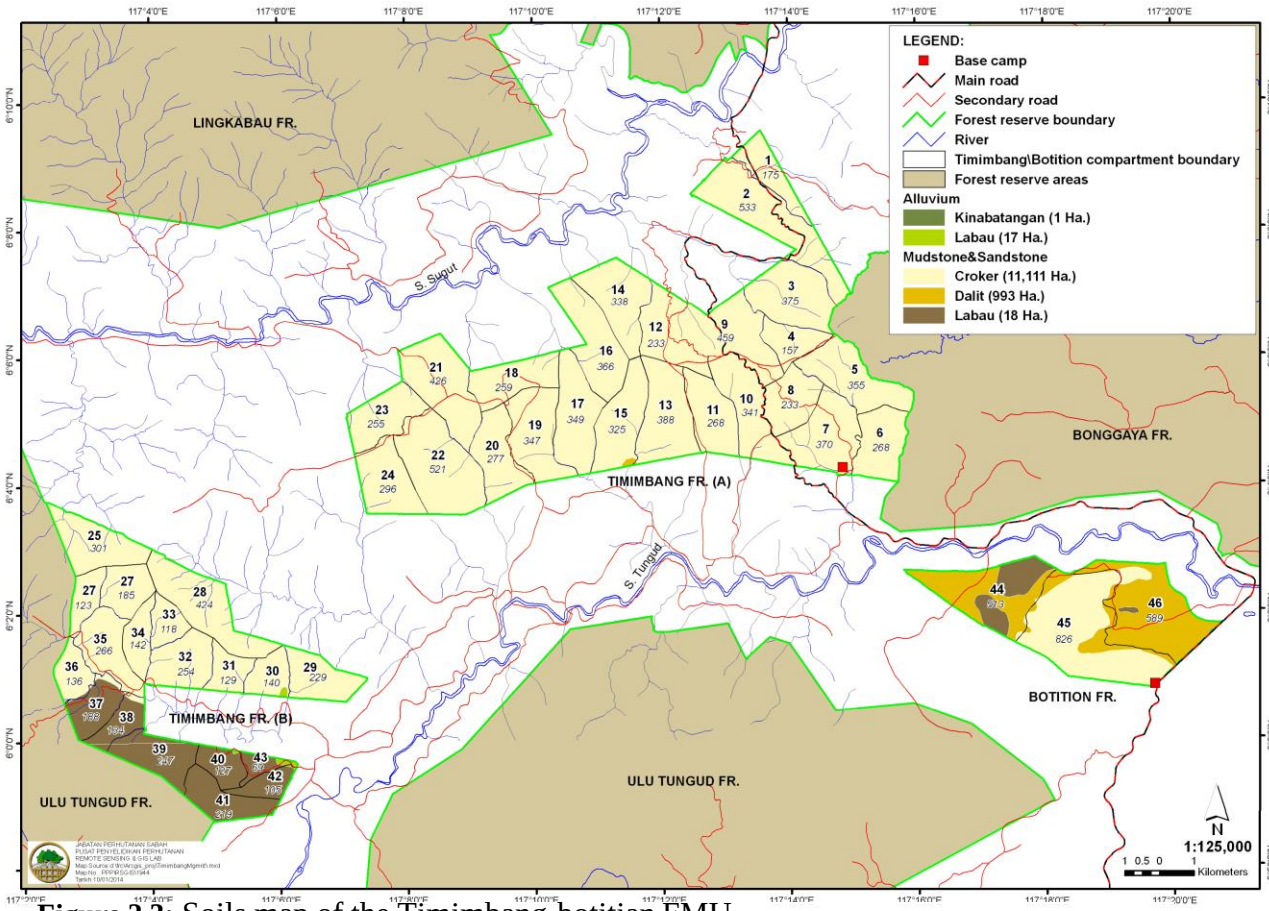


Figure 2.3: Soils map of the Timimbang-botitian FMU

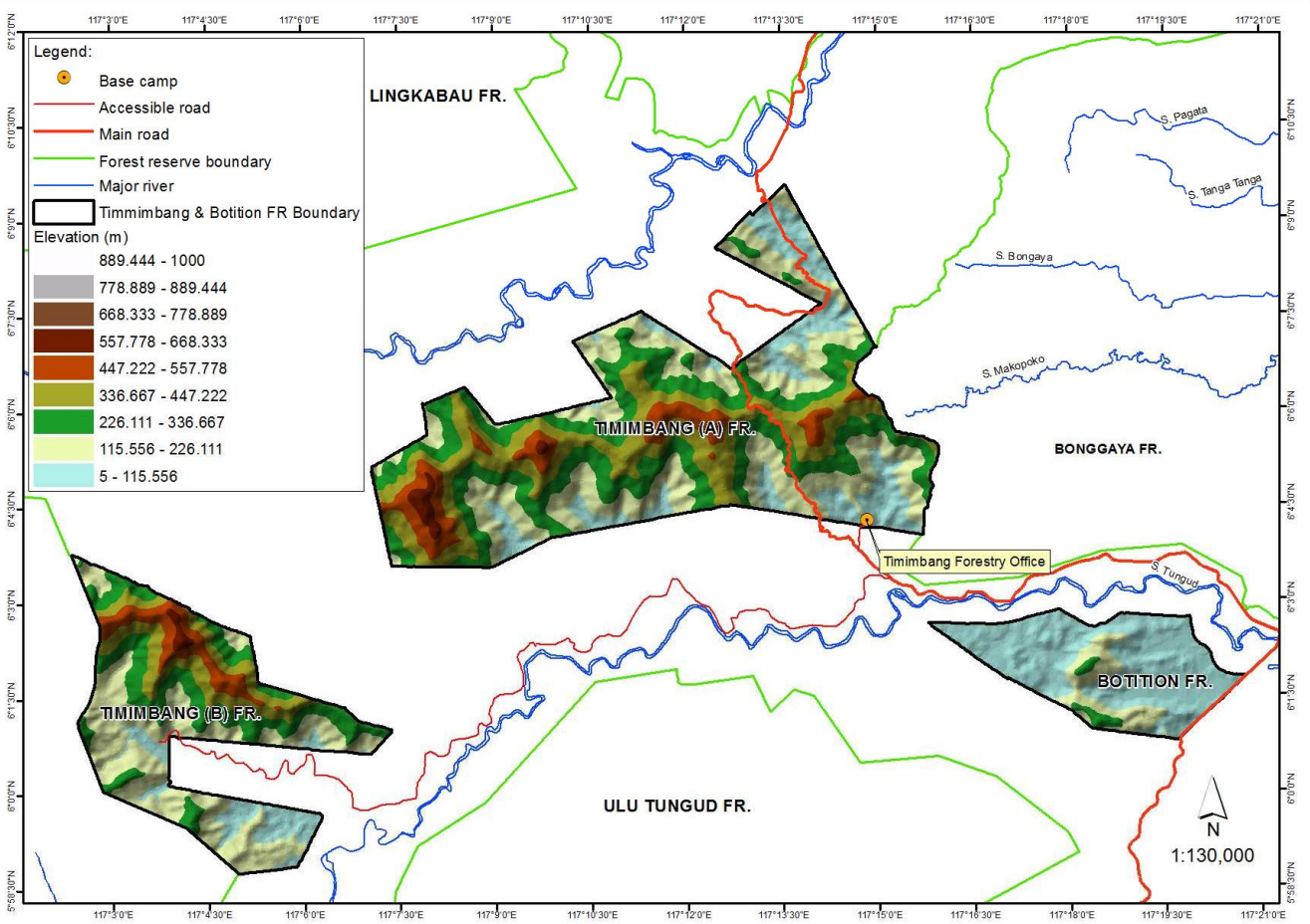


Figure 2.4: Elevation map of the Timimbang-Botitian FMU

2.6 Vegetation

The current vegetation of the Timimbang-Botitian FMU is largely logged-over lowland mix dipterocarp forest. Botitian generally supports better quality forests owing to its status as a Protection Forest. During a forest inventory carried out in 2009, a total of 36 species of dipterocarps were recorded for the FMU – 32 in Botitian and 28 in Timimbang. Among the common species recorded are *Dipterocarpus caudiferus*, *Dryobalanops lanceolata*, *Parashorea tometella, Shorea argentifolia, S. almon, S. fallax, S. johorensis, S. parvifolia, S. leprosula*. *S. macroptera,* and *S. Agamii* (see Appendix I). Pioneer species of commercial value, such as *Neolamarckia cadamba* (laran) and *Octomeles sumatrana* (binuang) are found in gregarious stands all over the FMU.

2.7 Settlements & Socio-Economic Environment

The area around Timimbang-Botitian is generally sparsely populated. There are four settlements in close proximity to the area, and all are located along the Tungud River and Sugut River (Figure 1.1), their locations perhaps explained by the fact that river transport was the only means of access to the area until the late 1990s. Kg Timbulus is the largest village,

with a population of 232 (Table 2.1). Kadazan-Dusun and Sungai are the two main ethnic groups inhabiting these villages. Apart from Kg Salan, the populations in these villages are largely Christians. Oil palm is the main agricultural crop surrounding the villages, and on which most of the local communities depend on for their livelihood. Apart from the discovery of a few animal traps during field work in 2007, there is no evidence to suggest that local communities depend on the forest of Timimbang-Botitian for any form of subsistence. This was also established from interviews with villagers from Kg. Basinti near Botitian. All other communities in the area are purely worker settlements within large oil palm estates (Plate 1).

With the improvement in road access and the large scale cultivation of oil palm in the area, the population around the Timimbang- Botitian FMU is expected to grow.

Table 2.1: Profile of village settlements located in close proximity to the Timimbang-Botitian FMU based on a survey conducted by the Sabah Forestry Department in 2010.

	Kampung	Number of families	Population	Predominant religion	Public Amenity
1	Salan	25	137	Islam	road access, gravity piped water, balai raya, church, handphone network, power supply from communal generator.
2	Timbulus	48	232	Christianity	road access, gravity piped water, balai raya, church, handphone network
3	Dorom-Dorom	40	219	Christianity	road access, gravity piped water, balai raya, church, handphone network
4	Basinti	23	105	Christianity	road access, water source from rain & river, balai raya, church, handphone network, power supply from communal generator

Plate 1: A worker settlement within the Nangoh Enterprise Estate, located near Compartment 44, Botitian Forest Reserve.

In May 2013, the Forestry Department invited key stakeholders, including local village communities and representatives from the adjacent oil palm plantations for a two-day consultation workshop in Telupid (Plate 2). During the workshop, participants were briefed on the management of Timimbang-Botitian, including prohibited activities within forest reserves and fire prevention awareness. An important outcome of the workshop was the formation of two committees to represent the interests of village communities and the oil palm estates, respectively. Resolutions from this workshop and the membership of these two committees are summarized in Appendix J (p 48).

Plate 2: a) Workshop in progess; b) workshop participants.

2.8 Infrastructure

Buildings

Apart from buildings occupied by the Forestry Department, no other buildings exist within the Timimbang-Botitian FMU. At present, electricity supply for these buildings is from diesel powered generators. However, connection to the power grid is expected in the near future. The main office complex is located in Compartment 7, Timimbang A (Plate 3b). An outpost was constructed in 2011 in Compartment 43, Timimbang B (Plate 3c), at a site where tree planting was initiated in 2009 to restore some 69 hectares of encroached forest. Other major buildings include a rest house and the staff quarters.

a

b

c

d

Plate 3

a) Forestry Station along the Sapi-Nangoh Highway at the Botitian Forest Reserve;

b) The main office complex located within Compartment 7 of Timimbang A;

c) Forestry Outpost in Compartment 43 Timimbang B;

d) Staff quarters in Timimbang A. Completed in December 2013.

e) Six-bedroom rest house completed in 2012

e

Roads

There are 40 *km* of permanently accessible roads within the Timimbang-Botitian FMU, including the section of the Sapi-Nangoh Highway that traverses Timimbang A. Of these, 19 *km* are maintained by five private companies via occupation permits (Figure 2.4). These roads are used largely to transport oil palm fruit bunches from privately owned estates. The revenue from these occupation permits (paid on a yearly basis @ RM 250 ha^{-1}) in 2013 was RM 10,000. Access to Timimbang B is via a privately owned oil palm estate.

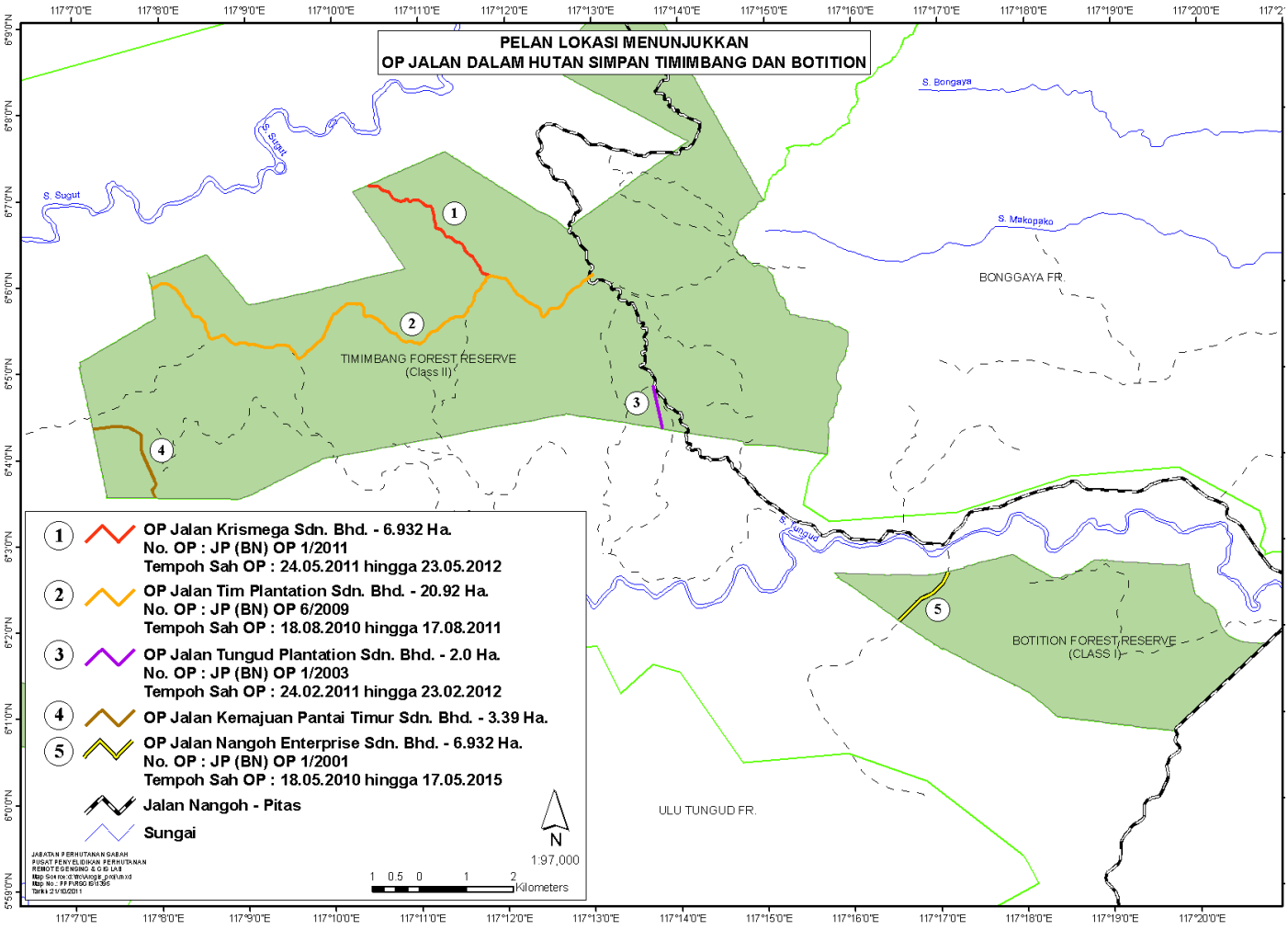


Figure 2.4: Roads within Timimbang-Botitian maintained by private companies through the issuance of Occupation Permits,

2.9 Benefits of forest management

Despite having been exploited for its timber resources, the Timimbang-Botitian FMU remains and important repository of lowland biodiversity, including various endemic and rare species. Apart from this, the FMU provides for other ecosystem services, such as carbon sequestration, clean water, and landscape beauty. By virtue of their topography, Timimbang A and B serve as important water catchments for the Sugut and Tungud rivers, providing clean water to nearby villages. The Sapi-Nangoh highway that bisects Timimbang A offers scenic views of the surrounding forest. Managing the FMU as a conservation area, free from timber exploitation, ensures that these attributes are maintained and enhanced.

3. FOREST CONSERVATION

3.1 Introduction

The Forestry Department plays a key role in the sustainable management and conservation of Sabah's natural forests. Whereas parts of Sabah's Permanent Forest Estate are designated for timber production, a large part is set aside for biodiversity conservation and the protection of other ecosystem services. A key goal of this FMP is to ensure the conservation and protection of native flora within the Timimbang-Botitian Forest Management Unit. This may be done by assisted natural regeneration through silvicultural treatments, direct planting, and the exclusion of logging. Although Timimbang-Botitian has largely been logged, the fact that forest is a renewable resource, offers opportunities for systematic management.

3.2 The Forest of Timimbang-Botitian

The natural forest of Timimbang-Botitian can be broadly classified as lowland dipterocarp forest and upland dipterocarp forest (≥500 *m* ASL). In its pristine form, dipterocarp forests attain canopy heights of about 60 *m* dominated by trees of the dipterocarp family, with emergents towering up to 80 *m*. The dipterocarp forests of Borneo is one of the most biologically diverse ecosystems in the world.

Timimbang was logged over a period of 20 years, i.e. from 1987 to 2007. Production figures put yield estimates at 80−95 m^3ha^{-1}. Botitian was turned into a Class I Protection Forest in 1992, and was also logged prior to this reclassification. Today the forest of Timimbang-Botitian is a mosaic of regenerating forests, relatively intact on the steeper slopes but characterized by pioneer vegetation on the flatter areas where logging was more intense. Nevertheless, the forest of Timimbang-Botitian still represent an important repository of native biodiversity that is worth protecting. Given sufficient time and the appropriate management regime, the forest can be expected to recover.

Post-harvest Silvicultural Treatments

Post-harvest silvicultural treatments were first carried out in Timimbang A in 2008, and continued as an annual prescribed activity since then. Treatment took the form of vine cutting. This include both herbaceous and woody vines up to a DBH of 5 *cm*. An upper limit of 5 cm was set because certain species of large woody vines also serve as an important food source for wildlife.

The cutting of vines is founded on the notion that they impede tree regeneration and growth once established in large quantities (Plate 3.1). The growth and proliferation of vines, including climbing bamboo, are promoted by an increase in canopy opening such as that caused by logging and fire (Wong 1991; Pinard and Putz 1994). Their habit of twining around and scrambling over surrounding vegetation has also been observed to cause stem deformities in the saplings and poles of trees.

As of December 2013, vine cutting had been completed for Timimbang covering an area of more than 10,000 *ha* at a cost of RM 350 per *ha*. Appendix E (p 42) shows the area treated by compartment and year over the period 2008 to 2013. Botitian is scheduled to be treated in 2014.

Plate 3.1: **a)** Climbing bamboo infestation is particularly serious where areas have been heavily disturbed by logging, creating forest conditions that are open and suitable for the proliferation vines such as bamboo; **b)** Vines ascend to the canopy by using trees as support.

Restoration planting

About 260 *ha* of the Timimbang-Botitian FMU have been encroached by the illegal cultivation of oil palm by neighbouring estates. In 2008 the Forestry Department destroyed about 69 *ha* of illegally planted oil palm in Compartment 43 (Timimbang B), and initiated restoration measures soon after, with the planting of a mix of native species (e.g. laran, binuang, and gaharu). In 2013, a second encroachment area in compartments 22 and 24, involving about 200 *ha* was cleared of oil palm to make way for forest restoration.

(Left)Forest restoration of an encroached area in Compartment 43, using binuang to establish forest cover quickly due to its fast growth.

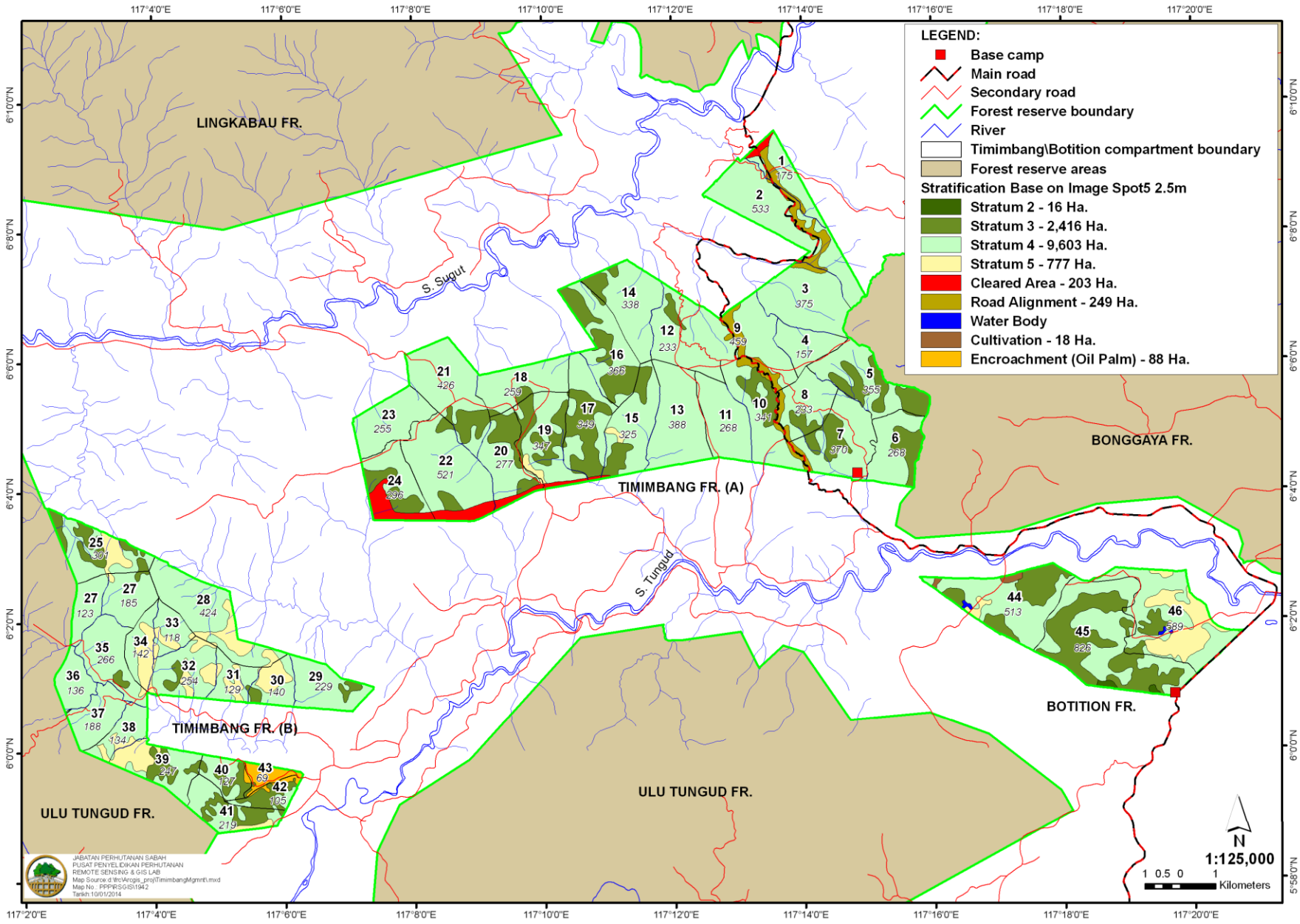


Figure 3.1: Forest stratum map for the Timimbang-Botitian Forest Management Unit

3.3 Timber Resource Assessment

Prior to the decision to change its management in favour of total protection, the Timimbang FR was intended for the sustainable production of timber. As such, a timber resource assessment based on field inventory was actually carried out for Timimbang in 2009 (see Appendix J, p 45 for methodology). The results of this inventory are summarized in tables 3.1 and 3.2. Although this information may not be directly relevant to current management goals, it does provide an idea of forest quality.

Table 3.1: Overall density of trees (ha^{-1}) by species group and diameter class for the entire Timimbang, regardless of form or bole quality.

Species group	10-20	20-30	30-40	40-60	60-80	> 80
Dipterocarp	22.8	7.2	4.8	7.4	2.6	0.8
Commercial non-dipterocarps[1]	8.3	3.8	9.1	5.4	1.4	0.3
Pioneers[2]	18.1	15.4	7.1	3.9	-	-
Others[3]	87.2	18.2	7.2	9.0	1.9	1.2
Total	**136.4**	**44.6**	**28.2**	**25.7**	**5.9**	**2.3**

Footnote:
[1] Includes laran, binuang, & magas
[2] Includes *Macaranga* spp. & *Homalantus* spp.
[3] Non-commercial species, including fruit trees, & prohibited species

Table 3.2: Overall basal area (m^2ha^{-1}) by species group and diameter class for the entire Timimbang, regardless of form or bole quality.

Species group	10-20	20-30	30-40	40-60	60-80	> 80	Total
Dipterocarp	0.34	0.40	0.68	1.46	0.90	0.37	**4.15**
Commercial non-dipterocarps	0.33	0.33	0.88	1.67	0.32	0.21	**3.74**
Pioneers	0.32	0.63	0.89	0.82	-	-	**2.66**
Others	1.62	0.85	0.89	1.69	0.84	0.44	**6.33**
Total	**2.61**	**2.21**	**3.34**	**5.64**	**2.06**	**1.02**	**16.88**

Standing Timber Stock

Timimbang is extremely poor in commercial trees greater than 60 *cm* DBH (Table 3.1). Current standards in natural forest management require a minimum of about 8 harvestable trees ≥ 60 *cm* DBH ha^{-1} for an economic cut, whereas the commercial stocking of Area B presently stands at 3.2 trees in this size class. Therefore, by current cutting limits there is limited commercial volume to be extracted from the area. Most trees are in the 10–20 *cm* size class. Dipterocarps account for only 21 % in this size class.

Overall stand basal area of trees ≥ 10 *cm* DBH is about 17 m^2ha^{-1}. This is considered very low when compared to a pristine forest, where basal area usually ranges 30–38 m^2ha^{-1}. Pioneer trees (mainly *Macaranga* spp.) and other non-commercial species make up about 53 % of the total basal area.

Potential Crop Trees & Prospects For Harvesting

At 32 % (stocked plots), overall PCT stocking is considered very low. There are 31 PCTs ha^{-1}, 23 (or 68 %) of which fall below 20 *cm* DBH, whereas the remaining are largely between 20–30 *cm* DBH. The distribution of PCTs towards the lower size classes means that the time required for the area to reach commercial maturity will be longer. About 24% of plots were found to be actually devoid of trees.

Growth projections were made for Timimbang based on the inventory data and PCT stocking. At current cutting limits prescribed for natural forest management, the projections show that on the average the area is not expected to yield an economic cut until about 25 years, if left alone to regenerate naturally. The earlist harvest can be expected in year 15.

Vine Loads

In Timimbang, about 73 % of all trees ≥ 5 *cm* DBH were found to carry either climbing bamboo or woody vines. Such a high level of vine occupancy on the boles and crowns of trees is typical of highly disturbed lowland dipterocarp forests in Sabah. In terms of vine density, the area also showed relatively high levels of vine density, when compared with an old growth close-canopy forest. At 438 clumps ha^{-1}, climbing bamboo abundance was particularly higher in Area B than in an old growth forest. The two climbing bamboo species found commonly in Area B are *Dinochloa scabrida* S. Dransf. and *D. trichogona* S. Dransf. (Dransfield, 1992).

Table 3.3: Vine abundance (density ha^{-1})) for both climbing bamboo and woody vines. Vine abundance from a study in the close-canopy old growth forest of Sepilok is given for the purpose of comparison.

Vine type	Timimbang (heavily disturbed forest)	Sepilok (old growth forest)
Climbing bamboo	328 clumps	53 clumps
Woody vines	416 stems	310 stems

3.4 Botanical Inventory

Two known botanical inventories have been documented for the Timimbang-Botitian FMU. Both were carried out by the Forest Research Centre in Sandakan. The first was in Botitian in 2010, where trees were sampled along five 500-*m* transects. The second field inventory was conducted over a one-week period in November 2013. The results of these inventories are not presented in detail here, but is expected to be reported in greater detail in the HCV assessment report to be prepared in late 2014.

The Dipterocarps

The MDF are confined to the Asian tropics, particularly in South-east Asia, where they form the main vegetation type. Although mainly a lowland element, certain dipterocarp species may be found up to 1,300 *m asl*. Some 500 species of dipterocarps from 17 genera occur worldwide. Of these, 13 genera and some 470 species of dipterocarps are documented for Asia, while 267 species from 9 genera are recorded for Borneo (Ashton 2004). This makes Borneo the centre of dipterocarp diversity. Sabah alone has a record of 183 species of dipterocarps. Bornean endemics account for 93 species or about 35 % of the Bornean dipterocarps**.**

While the MDF is recognized as one of the most biologically diverse forest ecosystems in the world, they also represent the principal source of commercial timbers from the native forests of Southeast Asia. Due to their tremendous commercial importance, most of Borneo's MDFs have been exploited for their valuable timbers, leaving large tracts of degraded MDFs of little commercial value. In addition, the fertile soils on which these forests are generally found, encourage the large scale conversion of MDFs to agricultural crops, such as oil palm. These factors combine to pose a serious threat to the conservation of the MDFs on the Island of Borneo, including in Sabah.

A one-week botanical expedition carried out by the Forest Research Centre recorded eighty six (86) species of dipterocarps in the Timimbang-Botitian FMU (Appendix I, p 47). Twenty eight of these are Bornean endemics. Common dipterocarps found in the FMU are *Shorea pauciflora, S. macroptera, S. artrinervosa, and Dipterocarpus caudiferus.* One species that is endemic to Sabah, and is also considered critically endangered is *S. symingtonii.* In addition, the expedition also recorded a total of 238 plant species endemic to Borneo, 33 species of which are known to occur only in Sabah.

Other Important Canopy Tree Species

Although the dipterocarps make up the major commercial timber group, the non-dipterocarps also produce valuable timbers. Some of the key species found in Timimbang-Botitan are *jelutong, nyatoh, merbau, sepetir, kembang semangkok*, and *kayu malam*. Many of these species are today listed as threatened, endangered, or vulnerable to extinction due to habitat loss. Other canopy non-dipterocarps observed in Timimbang-Botitian are *Koompassia excelsa*, *Alstonia* sp., *Dialum indum* and *Pentace adenophora.* Three individuals of gaharu (*Aquilaria malaccensis*) were recorded in the Botitian Forest Reserve along a 500-m transect. Seventeen different species of palms The single stem palm *Pholidocarpus maiadum (*serdang*)* appear to be very common in Botitian. This palm is endemic to Borneo, and sometimes used in ornamental planting.

3.5 High Conservation Value Forests (HCVF)

The term HCVF as used in the context of this FMP is adopted from the HCVF Tool Kit for Malaysia (WWF Malaysia, 2009) and is summarized in Table 3.4. Considering that Timimbang-Botitian is being managed entirely as a protected area, an HCVF assessment of the area is considered not critical. Nevertheless, consistent with FSC requirements for certification (Principle #9), an HCVF assessment was carried out for Timimbang-Botitian based on the six set values, and is reported in detail separately (Appendix O, p 60). Evaluated against these set values, HCVsfor the project area is generally 'low' where it concerns local community needs and cultural importance (HCV #5 and #6). Biodiversity related values (HCV #1, 2, and 3) are marginal, considering the area has been intensively logged in the past. Mitigating measures for environmental impact is not a major issue, since no logging is prescribed, thereby making the designation of riparian buffers irrelevant. All prescribed activities are likely to have a positive impact on biodiversity.

Table 3.4: HCVF in the context of this FMP is defined as those having one or more of the following 6 values. A more comprehensive HCVF assessment has been prepared and is summarized in Appendix O.

HCV	Element	Remarks
1	**Biodiversity values**: Forest area contains globally, regionally, or nationally significant biodiversity values (e.g. endemism, endangered species, sites of critical temporal use)	Overall, current forest conditions of Timimbang-Botitian are considered degraded, but is largely intact in terms of forest cover. The best quality lowland mix dipterocarp forest is in Compartment 45, Botitian. At least twenty eight dipterocarps found in Timimbang-Botitian are Bornean endemics. The long-term monitoring of both wildlife populations and forest recovery will be put in place.
2	**Landscape-level forest**: Forest area contains or is part of a globally, regionally, or nationally significant large landscape level forest where viable populations of most, if not all naturally occurring species exist in natural patterns of distribution.	The Timimbang A and Botitian is considered fragmented and isolated from any large tracts of native forests. Timimbang B is connected to the relatively large Ulu Tungud Forest Reserve.
3	**Ecosystems**: Forest area contains or is part of a threatened or endangered ecosystem	Sabah has lost about 70 % of its lowland mixed dipterocarp forests ($\leq$ 300 *m asl*). As such, the lowland MDF is considered an endangered ecosystem. About 65 % of Timimbang-Botitian is below 300 *m asl*. With the exclusion of logging , and the enrichment of degraded areas by the planting of native tree species, the natural forest is expected to recover over time.
4	**Environmental services**: Forest area provides basic services of nature in critical situations (e.g. watershed protection, erosion control, fire breaks)	Commercial logging is excluded from the FMU. All access roads currently in use are existing roads, and no new roads are planned. Many small streams flow from Timimbang and feed into the Sugut and Tungud Rivers. Therefore, Timimbang is an important watershed, by virtue of its topography, i.e. characterized by high hills.

Table 3.4… ***continued***

5	**Basic needs of local communities**: Forest area is fundamental to meeting basic needs of local communities	Local communities do not depend on the FMU for their basic needs or livelihood. Most actually depend on small oil palm plantations as the primary means of livelihood. It is not likely that forestry operations would adversely affect local communities.
6	**Cultural identity of local communities**: Forest area is critical to local communities' traditional cultural identity.	There are no settlements within the FMU. The FMU has no cultural significance to the surrounding local communities.

3.6 Prescribed Activities

Vine cutting

Vine cutting remains to be carried out for Botitian. This has been scheduled for 2014, and is planned to be completed within the year. There is not expected to be any more vine cutting during the remaining planning period. Any further vine cutting will be based on an assessment of need.

Establishment of permanent plots

Permanent sample plots (PSP) are useful in monitoring long-term forest dynamics, including growth, mortality, and recruitment. They are also helpful in monitoring the influence of climate change on floristic composition and ecological processes. In this planning period, PSPs will be established in selected areas based on forest stratum. This will be done within the first two years of the planning period, with the help of the Forest Research Centre in Sandakan. The PSPs will take the form of circular plots with a radius of 20 *m*.

Establishment of a long-term phenological observation programme

The monitoring of flowering and fruiting of trees is of great importance in the study of natural regeneration, as well as providing information of wildlife food availability. Seeds collected may also be used for forest restoration. A long-term phenological observation programme will be established in Timimbang-Botitian for this purpose. For a start, this is perhaps best carried out in Botitian, where access and forest quality is better. Observations should also give emphasis to those species that are rare or endangered.

Further botanical Inventories

The current botanical knowledge of Timimbang-Botitian is insufficient to provide a complete picture of the conservation status of many tree species. Timimbang, in particular has not been adequately assessed for this purpose. Therefore, it is recommended that more botanical surveys be carried out in Timimbang during this planning period. This will likely take the form of short term botanical expeditions by various experts. Surveys should emphasize species that are endemic or considered endangered.

Restoration Planting

About 150 *ha* encroached by the illegal cultivation of oil palm have yet to be planted up. This should be carried out as a matter of priority. Species used in the restoration effort should be trees that are native to the area. A good practice would be to include important wildlife trees (such as wild fruit trees) in the mix of planted species. Some of the important wild fruit trees include *Lithocarpus* spp., *Dracontomelon dao*, *Diospyros* spp. and *Artocarpus* spp.

Apart from those encroached areas, restoration or enrichment planting should also be considered in the most degraded areas, such as Compartments 44 and 46 in Botitian, and Compartments 41, 42, and 44 in Timimbang B.

Fire Prevention

Fire may pose a threat to forest conservation during periods of prolonged drought. Fire risks will be monitored closely during such periods. In addition, fire prevention awareness campaigns will be conducted as a pre-emptive measure. The Timimbang-Botitian field operations crew is well-equipped and trained for fire fighting.

Certain measures will have to be taken to reduce the risk of fires. This includes maintaining an understorey of green vegetation consisting of ferns and soft weeds. Roads will be maintained, not just to provide access for fire fighting, but also to serve as fire breaks. Field supervisors will be trained in fire prevention and control.

The likelihood of fire outbreaks is expected to be highest during prolonged drought periods. A fire danger rating system as shown in Table 3.5 has been adopted. The system will follow the Keetch-Byram Drought Index (KBDI) as a standard practice of the Forestry Department. Rainfall monitoring will be monitored in the project area. The KBDI will be evaluated daily at 1500 hrs for the purpose of fire danger rating. These are based on dry bulb temperature and precipitation. Fire danger is rated as 'moderate' for continuous no-rain periods of 2 to 4 weeks. Fire danger is 'high' when dry days extend beyond 4 weeks. Specialised fire fighting equipment such as water pumps and knapsack pumps are stored at the field office in Timimbang A. Table 3.5 also shows the measures to be taken to prevent and control fire outbreaks. In the case of a fire outbreak, the field supervisor will monitor the ground situation and organize fire-fighting operations in the project area.

Table 3.5: Fire danger rating and prevention activities

Danger Rating	Prevention Activities
Low	None
Moderate	Notify all nearby communities & contractors regarding fire danger and precautionary measures
High	Regular patrolling of block boundaries for early detection Firefighting machinery & equipment to be on site Form firefighting crews Notify all relevant agencies Stop all forms of open burning Identify water sources, e.g. ponds and rivers in close proximity

4. WILDLIFE MANAGEMENT

4.1 Introduction

Wildlife, including birds, represents a form of biodiversity that is readily appreciated by the public, particularly large mammals like the orang utan, sun bear, and deer. The Forestry Department views its role in wildlife management as an important aspect of forest conservation, as well as its public image. Therefore, the systematic management of wildlife is a key component of the management of Timimbang-Botitian.

Management goals
The principal goal of wildlife management is to maintain and enhance populations of wildlife that are native to the area. This may be done by maintaining and enhancing specific habitats, controlling poaching and the illegal trapping of wildlife. Considerations are also given to forest connectivity. The maintenance of habitat for threatened and endangered species is given special emphasis.

4.2 Wildlife Assessment Methodology

Wildlife assessments for the Timimbang-Botitian Management Unit were carried out using methods listed in Table 4.1. Two assessments have been carried out thus far. One was by HUTAN, a local NGO specializing in wildlife management and research. The second was by the Sabah Forestry Department in 2014. For more complete details of these assessments and their results, one may refer to the reports by Ancrenaz et al. (2007 & 2008) and Bili (2014).

Field work in Botitian FR was carried out during the period 3−12 December, 2007, whereas for Timimbang, field work was conducted between 12 and 22 April, 2008. In addition to ground assessments, an aerial survey was carried out on March 20th, 2009, for Timimbang, Botitian, and Bonggaya FRs. This was conducted primarily to get an estimate of orang utan population by nest-counting from a helicopter. The aerial survey included the adjacent Bonggaya FR due the known occurrence of orang utans in the area, and the possible impact of the current clearing and development of the area to oil palm and forest plantations by a private companies. It is important to note that the field surveys did not cover Timimbang A and B evenly due to poor access and steep terrain.

Table 4.1 : Field methods used in the assessment of wildlife communities in Timimbang-Botitian

	Sampling/Survey method	Target species
1	Aerial survey	Orang utans
2	Recce walks	Orang-utans and other primates, mammals, diurnal birds, rapid forest assessment
3	Live trapping	Terrestrial small mammals (diurnal and nocturnal)
4	Opportunistic sightings	All
5	Interviews	All
6	Night spotting	Nocturnal species

4.3 Habitat Quality

Botitian Forest reserve

The Botitian forest was assessed for its quality as a wildlife habitat. It is relatively flat compared to Timimbang. The forest in Compartment 45 is relatively intact, but where it is flatter, such as areas within Compartments 44 and 46, the forest is characterized by frequent gaps and forests of low stature, comprising pioneer trees (e.g. *Macaranga* spp. and *Mallotus* spp.). Woody vine loads are high in these areas. The poor forest in these two compartments is attributed to intense logging activities in the past. Waterlogged areas are usually covered with ferns and grasses.

Although not abundant, tree species considered as important sources of food for wildlife (e.g. *Lithocarpus* sp., *Diospyros* sp. *Dracontomelon dao*, and *Neolamarckia cadamba*) were present. However, fig trees were surprisingly scarce. Figs are considered a major keystone food source for primates and other fruit-eating animals. Large woody climbers are abundant in Botitian. This group of plants (namely *Spatholobus, Uncaria, Lopphospyxis, Bridelia,* and *Entaeda*) also serve as an important food source, particularly for the orang utan. No salt licks were found in Botitian.

Due to the variety of habitat types and the availability of key food resources, Botitian can potentially harbor a diverse wildlife community typical of lowland habitats found in Sabah. But unlike Timimbang, Botitian is isolated from any large tract of forest. Over the long-term, isolated populations are more sensitive to poaching, diseases, fire, genetic drift, and inbreeding. In its current condition, Botitian cannot sustain viable populations of most native mammals, particularly large mammals. No salt licks were found in Botitian.

Timimbang Forest Reserve

Timimbang A is adjacent to Bonggaya FR (Figure 1.1), a much larger tract of forest reserve that is currently being cleared for the development of oil palm and industrial tree plantations. Bonggaya and its surrounding areas support an estimated population of 150−200 wild orang utans, based on an aerial recce carried out in 2008. Ancrenaz (2008) recommended the maintenance of natural forest corridors 250 *m* in width along both sides of all major rivers flowing within Bonggaya, and 100 *m* along major tributaries. He recommended that these forest corridors ultimately connect to all major forest fragments including Timimbang A in the west. In the process of developing Bonggaya, Timimbang A is expected to become an important wildlife refuge. It is unfortunate that the Nangoh-Pitas Highway bisects Timimbang A, such that a large part of it on the far right is cut off.

Owing to its rugged topography, steep slopes, and high hills, both Timimbang A and B are not considered optimal wildlife habitats, particularly for large mammals. This condition is further exacerbated by degraded forest conditions brought about by heavy logging in the past. Forests on the steep slopes remain relatively intact, whereas the flatter areas are occupied largely by pioneer tree cover. Important wildlife food sources are present, but generally scarce and unevenly distributed. Like Botitian, fig trees were low in abundance. No salt licks were found in Timimbang.

4.4 Primates

Orang utans

Being a flag ship species, Orang utans are given special attention in the management of Timimbang-Botitian. Overall, orang-utans are scarce throughout the area, and densities are all below 0.2 ind./km^2 at all sites (Table 4.2). The highest density was recorded at Timimbang B, which makes this forest block an important focus for conservation efforts of orang-utan population. There were no signs of orang utans recorded during the field survey of Botitian. However, four nests were spotted during the aerial survey, indicating that at least one individual was present at the time of the survey in 2008.

Bonggaya and its surrounding areas are estimated to support a population of 150−200 wild orang utans, based on an aerial recce carried out in 2008. In order to sustain this orang-utan population as well as other species found in Bonggaya, Ancrenaz (2008) recommended to keep a corridor of natural forests with a minimum width of 250 *m* along both sides of the major rivers that are flowing within the Bonggaya FR, and with a minimum width of 100 *m* along major tributaries. In the process of developing Bonggaya, Timimbang A is expected to become an important wildlife refuge for wildlife, including orang utans. Since the orang utan survey was conducted in 2008, some 5 years ago, it is recommended that another survey be conducted, considering that since then much forests have been cleared in the Bonggaya Forest Reserve.

Table 4.2: Orang utan population estimates based on aerial surveys for the Timimbang-Botitian Management Unit carried out in April 2008

	Area	**Density (individuals km-1)**	**Population estimate**
1	Botitian	?	1−3
2	Timimbang A	0.032	2-5
3	Timimbang B	0.181	6-10
4	Bonggaya	0.38	150-200

Other primates

Botitian—Gibbons were not seen or heard in Botitan. Given the short period of field work, it cannot be concluded for certain that these animals are completely absent from the Botitian. But given that Botitian is not a large parcel of forest, and somewhat isolated from any sizable tracts of forest, the long-term survival of any individuals of the less resilient gibbons can be a problem. Only three primate species were recorded during the field assessment: The two common macaque species *(Macaque fascicularis* and *M. nemestrina*) and the red-leaf monkey (*Presbytis rubicunda*). Macaques are highly adaptable. On the contrary, red-leaf monkeys need continuous forest cover. The two nocturnal primates, the slow loris and the tarsier, were not recorded during the survey. Additional night surveys are required to establish their presence. In conclusion, primates are poorly represented in terms of diversity and abundance in Botitian.

Red-leaf monkeys are arboreal and prefer continuous forest cover. They move around in groups of 8 to 10.

Timimbang—Gibbons were sighted once. Their calls were infrequent, suggesting low abundance, perhaps due to food scarcity. Both long-tail and pig-tail macaques were recorded in Timimbang, but at low densities. One slow loris was spotted during night survey in Timimbang A. Most primates prefer low-lying and flat areas, providing another explanation for the low abundance and diversity of primates in Timimbang.

Table 4.3: Checklist of key mammals found in Timibang-Botitian based on field assessments conducted in 2007 and 2008 (Ancrenaz et. al.) and 2014 (Bili 2014). '?' indicates no direct evidence of presence. However, the surveys were considered too brief to confirm absence. See Appendix K (p 54) for the conservation status of these mammals.

	Species		Timimbang A	Timimbang B	Botitian
	Primates				
1	*Pongo pygmaeus*	Orang utan	√	√	√
2	*Macaca fascicularis*	Long-tailed macaque	√	√	√
3	*Macaca nemestrina*	Pig-talied macaque	√	√	√
4	*Presbytis rubicunda*	Red-leaf monkey	?	?	√
5	*Nycticebus coucang*	Slow Loris	√	?	?
6	*Hylobates muelleri*	Bornean Gibbon	√	√	?
	Small mammals				
1	*Sundamys muelleri*	Mueller's rat	√	√	√
2	*Maxomys rajah*	Brown spiny rat			√
3	*Maxomys baeodon*	Small spiny rat	√	√	√
4	*Maxomys whiteheadi*	Whitehead rat	√	√	√
5	*Niniventer cemoriventer*	Dark-tailed rat	√	√	√
6	*Tupaia tana*	Large treeshrew			√
7	*Callosciurus notatus*	Plantain Squirrel	√	√	√
8	*Callosciurus prevostii*	Prevost's Squirrel			√
9	*Sundasciurus lowii*	Low's Squirrel	√	√	√
10	*Tupai glis*	Common tree shrew			√
11	*Exilisciurus exilis*	Plain Pygmy Squirrel			√
12	*Ratufa affinis*	Giant squirrel	√		√
13		Lesser Tree Shrew	√	√	
14	*Callosciurus adamsi*	Ear spot squirrel	√	√	
15		Horse tail squirrel	√	√	
16	*Mydaus javanensis*	Malay badger	√	√	
17	*Viverra tangalunga*	Malay civet	√		
	Large mammals				
1	*Sus barbatus*	Wild Boar	√		√
2	*Rusa unicolor*	Deer			√
3	*Tragulus napu*	Great mouse deer	√		√
4	*Helarctos malayanus*	Sun bear	√	?	?
5	*Arctictis binturong*	Binturong	√	√	
6	*Neofelis nebolusa*	Clouded Leopard	√		

4.5 Large mammals

Botitian—Large animals, such as elephants, rhinoceros, and tembadau, are completely absent from Botitian. However, game species (e.g. wild boar and deer) are well represented. No sun bear or clouded leopard were recorded during the survey. They may not be completely absent, but occur at a very low abundance.

Timimbang—Game animals, such as wild boar and deer, are the most common large mammals in Timimbang. A lone elephant is known to forage in Timimbang B. Apart from that, there are no records of elephant herds in Timimbang. Sun bear and binturong were recorded in Timimbang A.

4.6 Small mammals

Seventeen species of small mammals comprising rats, tree shrews, and squirrels were recorded for Timimbang-Botitian (Table 4.3). These species are known to be common is degraded forests. The dominance of rats in the small mammal community is consistent with other degraded forests dominated by pioneer vegetation of low stature. Other species seen or heard but not caught were pygmy squirrel (*Exilisciurus exilis*), Prevost squirrel (*Callosciurus prevostii*) and giant squirrel (*Ratufa affinis*).

4.7 Birds

One hundred and sixty one (161) bird species have been identified for Timimbang-Botitian (Appendix L, p 53). This list is not comprehensive of the bird community of Timimbang-Botitian, given the short survey periods. But the relatively small number of species recorded during the ten days is reflective of the relative low diversity and abundance of wildlife in the forests of Timimbang-Botitan. Most species belong to the guilds commonly found in the disturbed forests of Eastern Sabah. However, sightings of the White Crowned hornbill and Great Argus Pheasant show that some patches of forest are still in good condition since these two species are known to thrive in primary or slightly degraded forests only. The five species of hornbills recorded in Timimbang-Botitian are Helmeted, White Crowned, Rhinoceros, Black, and Wrinkled.

4.8 Management Threats & Opportunities

Poaching

Widespread poaching (especially by trapping) was evident during the field assessment conducted in 2007 and 2008. Thirty three spring snares were removed from a 600-*m* hunting trail in Botitian. In 2008, five live pangolins that were being offered for sale were confiscated by Honorary Wildlife Wardens not far from Botitian. In Timimbang, signs of poaching was also evident by the presence of used shotgun shells, abandoned camps, and hunting platforms. Hunting pressure is the likely cause of low wildlife abundance and diversity in both Botitian and Timimbang, and perhaps pose the biggest immediate threat

to wildlife in the area. However, the strong presence of the Forestry Department in the area has greatly reduce poaching activities.

Forest restoration and enrichment with selected fruit trees

Forest restoration aimed at enhancing wildlife habitat is one important measure that should be implemented during this 10-year planning period. As a matter of priority, this is best carried out in the flatter areas where the forest is degraded. Selected fruit trees and figs that are known to be important and reliable food sources for wildlife should be given emphasis in all restoration efforts.

Wildlife monitoring

A wildlife population estimate and monitoring system should be established to determine long-term population trends and distributional changes, particularly in the forest of Timimbang adjacent to Bonggaya. This may be done by various methods elaborated by Ancrenaz (2013), including opportunistic sightings, camera-trapping, and call recognition. In the case of orang utans, aerial nest counting following pre-established transects should be conducted on an annual basis. Emphasis should be given to threatened and endangered species, as well as those that may be vulnerable, such as orang utan, sunbear, and clouded leopard.

An effective monitoring programme requires adequately trained staff. Therefore it is recommended that a team that is dedicated to wildlife monitoring be properly trained in carrying out this task. This team should be supported by professional wildlife managers or biologist. Experts should be encouraged to carry out research and surveys in the area.

Improving nesting opportunities

Artificial nest boxes can be introduced in the forest to improve nesting opportunities for selected birds and wildlife, such as flying squirrels. Hornbills typically nest in cavities located high up on tall canopy trees. Since such trees are scarce in a logged over forests where the largest trees have been removed, such artificial nesting sites can be expected to improve breeding opportunities

(left) Artificial nest boxes improve nesting opportunities for selected birds and wildlife, such as flying squirrels. This can be introduced in Timimbang-Botitian as a means of improving wildlife habitat.

4.9 Prescribed Activities

In order to achieve the goals of wildlife management for Timimbang-Botitain, specific activities related to the above have been identified. These activities and the timeline for their implementation over this 10-year planning period are given in Chapter 6 (p 31). The actual details of these activities and their analyses are beyond the scope of this FMP, but will be worked out separately.

5. RECREATION

5.1 Introduction

The demand for recreational opportunities in forest reserves is increasing for numerous reasons, as it caters to the lifestyle of contemporary society. The Forestry Department is expected to allow more regulated use of forest reserves in order to meet this demand. Recreational activities in forests include watching wildlife, fishing, camping, mountain biking, hiking, picnicking, educational excursions, etc. The use of forests for such activities greatly improves the value of forests to society, despite the exclusion of major economic activities such as commercial timber production. As such, there is a need to explore the potential of developing Timimbang-Botitian for public recreation.

Currently, Timimbang-Botitian is not used for any public recreational activity – unless poaching is considered a recreational activity. There are also no developed sites for recreational use. However, a waterfall in Timimbang A does see occasional use by locals from nearby settlements for bathing.

5.2 Assessment of Recreation Potential

In order to assess the suitability of an area for recreational development potential, various aspects of the area has to be considered, such as accessibility, aesthetics, unique features (e.g. waterfall, pond, stream, picturesque lookout points, historical landmarks).

Accessibility
Timimbang B is not likely to be viable for recreation development due to its remoteness and poor access. Right-of-way is also an issue, given that access is through private oil palm estates. Therefore, for this planning period, Timimbang B is omitted from any consideration. In this respect, Timimbang A and Botitian benefit due to the immediate access provided by the Nangoh-Pitas Highway.

Visitor use potential
Traffic flow along the highway is relatively light. Timimbang-Botitian is also away from the main route taken by tourists. Therefore, visitors that will patronize Timimbang-Botitian for recreational purposes will likely be from the growing local communities around the area. As such, any form of development should cater to the needs of local communities.

Scenic viewpoints
Certain sections along the highway traversing Timimbang A has scenic lookout points that may also serve as a rest stop. Considering that no public rest stops exist along this highway presently, such a development would be considered desirable for this planning period. Two spots in compartments #9 and #10 have been preliminarily identified for this

purpose. By placing information panels, the rest stop may also serve as an opportunity to create public awareness.

Fishing
Fishing is a popular recreational activity, not just for food, but also as a recreational past time. Parts of the lower lying areas in Botitian should be explored for this purpose. This will be mainly to serve local communities. There are existing ponds in compartments 44 and 46 that may be considered regulated use. Alternatively, ponds may be dugged.

Camping facilities
There are several spots in Timimbang A along the road maintained by Tim Plantation that have potential to be developed as campgrounds. Such a facility can cater to students from nearby schools, and ensure that camping is restricted to designated areas only. An assessment of demand should be carried out, particularly from schools.

5.3 Prescribed Activities

The development potential discussed above may require more detail studies. This may be carried out in this planning period as a prescribed activity. If deemed to be viable, and development costs is minimal, some may be carried out during the planning period. A rest stop with a scenic viewpoint is planned along the Sapi-Nangoh highway in Timimbang A.

6. PRESCRIBED ACTIVITIES & IMPLEMENTATION

6.1 Prescribed Activities & Implementation Schedule

The prescribed activities and their implementation schedule for the planning period 2014 2023 are provided in Table 6.1. Generally, all prescribed activities are planned to be carried out in the first half of the planning period. Beyond that, most field activities will be considered part of the routine operating procedures. Routine activities, such as those related to maintenance and enforcement are not part of this FMP.

Table 6.1: Prescribed activities and their implementation schedule over the 10-year planning period.

		Year									
1	**Forest Conservation**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1.1	Carry out vine cutting in Botitian	**x**									
1.2	Establish permanent forest monitoring system	**x**	**x**	**x**							
1.3	Establish a long-term phenological observation programme		**x**								
1.4	Carry out further botanical inventories in Timimbang	**x**	**x**	**x**							
1.5	Carry out restoration planting in encroached areas and other degraded areas (target area ≈ 350 *ha*)	**x**	**x**	**x**	**x**	**x**					
2	**Wildlife Management**										
2.1	Establish a wildlife monitoring system & report findings annually	**x**	**x**	**x**							
2.2	Enrich target habitats with selected fruit trees and figs.	**x**	**x**	**x**	**x**	**x**					
2.3	Carry out a poaching threat assessment & formulate anti-poaching measures as needed	**x**	**x**								
2.4	Prepare a checklist of birds		**x**								
2.5	Conduct baseline assessment of fish diversity for key water courses within the FMU			**x**	**x**	**x**					
3	**Recreation Development**										
3.1	Establish rest stop at scenic lookout point	**x**	**x**								
3.2	Assess recreationalfishing potential			**x**	**x**						
3.3	Assess Timimbang A for camping potential		**x**	**x**							
4	**Social Forestry**										
	Conduct social baseline survey (to update existing information)						**x**				
5	**Management & Administration**										
5.1	Establish computer-based Management & Information System for Timimbang-Botitian		**x**	**x**							
5.2	FMP Review					**x**					

6.2 Documentation & Reporting

Annual Work Plan
An Annual Work Plan (AWP) has to be prepared every year, including details such as activities planned for the year, their schedule for implementation, clear targets for each activity, and budget requirement. The AWP is largely based on activities prescribed in the approved FMP. The AWP will be submitted to the Director of the Forestry Department at the beginning of each year for approval.

Compliance Report
A compliance report has to be prepared at the end of each year. The compliance report provides details on the achievement of each activity stated in the approved AWP. A compliance certificate will be issued by the Director of Forestry if the overall achievement of the AWP meets a set minimum standard requirement.

FMP Review
A mid-term review of the forest management plan is scheduled in the year 2018. This review will take into account the progress of FMP implementation and any changes in management objectives. The FMP may be reviewed and revised as and when needed. However, any major revisions to the FMP will have to be approved by the Director of Forestry.

Compartment Records
All information and records on planting and tending will be documented by compartment. This will serve as a permanent record to monitor growth and yield for each block. These compartment record books will be updated periodically as needed, and maintained systematically so as to facilitate project monitoring and auditing.

6.3 Forest Certification

The Forestry Department intends ultimately to have the Timimbang-Botitian FMU certified under a credible forest certification scheme (e.g. Malaysian Timber Certification Scheme or the Forest Stewardship Council). Such independent third party assessment will ensure that management standards are maintained at a high level.

6.4 Environmental Impact Assessment (EIA)

Any development of forest plantations or reforestation covering an area of 500 *ha* or more is considered a 'prescribed activity' under the Second Schedule of the Environmental Protection Enactment. As such, the proponent for such activities is required by law to carry out an Environmental Impact Assessment (EIA). Since none of the prescribed activities involve the clearing or development of an area of more than 500 hectares, an EIA is considered not necessary. All other activities planned in the FMP are not scheduled as 'prescribed activities' under the Environmental Protection Enactment (2002).

6.5 Standard Operating Procedures & Guidelines

Clearly documented standard operating procedures (SOP) and guidelines have been drawn up to ensure that certain key activities are carried out according to established procedures or guidelines. This will also provide a means to objectively assess compliance to prescribed activities, such as the establishment of monitoring systems, herbicide application, occupational safety, etc.

6.6 Budget

Since 2007, the development and field operations associated with the management of Timimbang-Botitian have been funded by an allocation from the Community Forestry Trust Fund. Since 2007, some RM 7.43 million have been spent on development and operations, out of an allocated budget of RM 9.06 million. The remaining unexpended amount of RM 1.6 million is expected to fund the first three years of FMP implementation. For this planning period, the cost of FMP implementation will be greatest in the first three years. In year 4 onwards, the budget required will largely be to cover routine operational costs. This is estimated at about RM 300,000 annually.

Apart from the annual revenue generated from occupation permits associated with road use, the potential to generate revenue during this planning period is limited. Continued funding from the Community Forestry Trust Fund is uncertain. Therefore, new sources of funding will have to be secured. To a certain extent funds may be committed from the Forestry Department's regular annual supply budget.

6.7 Staffing & Manpower

The officer responsible for the overall implementation of the FMP is the District Forest Officer (DFO)) of the Beluran Forestry District. He is assisted in the field by an Assistant DFO. The current staff strength in the field is shown in Table 6.2. This is considered adequate for the time being. However, considering wildlife monitoring is expected to be one of the key activities during this planning period, capacity building in this field will be required. It is also recommended that a Wildlife Unit be set up within the organization structure.

Table 6.2 : Current staffing of the Timimbang-Botitian FMU

No	Jawatan	Gred	Status			Jumlah
			T	S	K	
1	Pen. Pemelihara Hutan	G27	1			1
2	Renjer Hutan	G 17	1			
2	Pengawas Hutan	G11	7			7
3	Pemandu	R3	2			2
4	PRA	R1		4	3	7
Jumlah			11	4	3	18
Nota: **T : Tetap S : Sementara K : Kontrak**						

Training & capacity buiding

The DFO concerned will strive to ensure that the staff and field workers are duly trained for their designated assignments. Clear job descriptions will be given to workers at all levels so that they have a clear understanding of their responsibilities.

2014 ORGANIZATION CHART FOR THE MANAGEMENT OF THE TIMIMBANG –BOTITIAN FOREST MANAGEMENT UNIT

DISTRICT FOREST OFFICER

FIELD MANAGER

SILVICULTURE UNIT
1 Head
3 Field Assistants
1 Driver

PROTECTION UNIT
1 Head
4 Field Assistants
1 Driver

FORESTY RESTORATION UNIT
1 Head
3 Field Assistants
1 Driver

REFERENCES

ACRES, B.D., BOWER, R.P., BURROUGH, P.A., FOLLAND, C.J., KALSI, M.S., THOMAS, P., and WRIGHT, P.S. 1975. *The Soils of Sabah*. Volumes 1-5. Land Resource Study 20, Land resources Division, Ministry of Overseas Development, Surbiton, Surrey, England.

ANCRENAZ, M., A. SAKONG, & EDDIE AHMAD. 2009. *Wildlife Survey of the Timimbang Forest Reserve:* A Field Report by HUTAN submitted to the Forestry Department. 44 p.

ANCRENAZ, M., A. SAKONG, & EDDIE AHMAD . 2008. *Wildlife Survey of the Botitian Forest Reserve*: A Field Report by HUTAN submitted to the Forestry Department . 25 p.

ANCRENAZ, M. 2013. *Field Manual: Monitoring Large Terrestrial Mammals in Sabah.* Sabah Forestry Department. 153 p.

CHUNG, A.Y.C. 2014. Insect Diversity of the Timimbang-Botitian Forest Reserve: Progress Report. 33 p.

FOREST ENACTMENT 1968. 1969. State of Sabah. 58 p.

PINARD, M.A. and F.E. PUTZ. 1994. Vine infestation of large remnant trees in logged forest in Sabah, Malaysia: biomechanical facilitation in vine succession. *Journal of Tropical Forest Science* 6: 302–309.

PHILLIPPS, Q. and PHILLIPPS, K. 2014. *Birds of Borneo*, 3rd edition. Oxford: John Beaufoy Publishing Ltd.

BILI, R. 2014. *A Preliminary Report on Wildlife Inventories and Assessments in SFM Project Areas: Timimbang-Botitian Forest Reserve.* 57 p

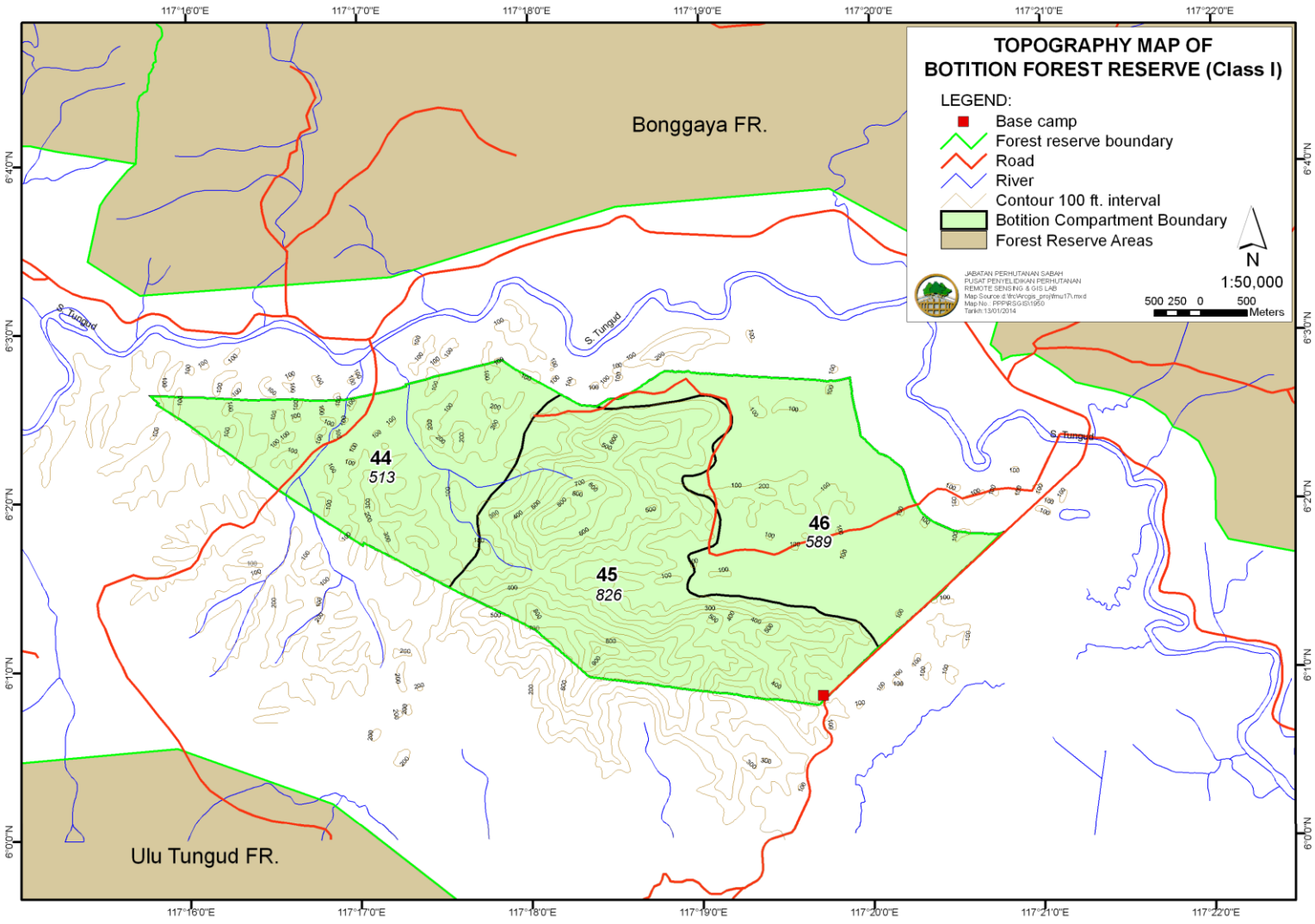
WONG, K.M. 1991. The growth architecture and ecology of some tropical bamboos. *Journal of the American Bamboo Society* 8:43–58.

WWF MALAYSIA. 2009. High Conservation Value Forests (HCVF) Tool Kit For Malaysia: A national guide for identifying, managing, and monitoring High Conservation Value Forests. 84 p.

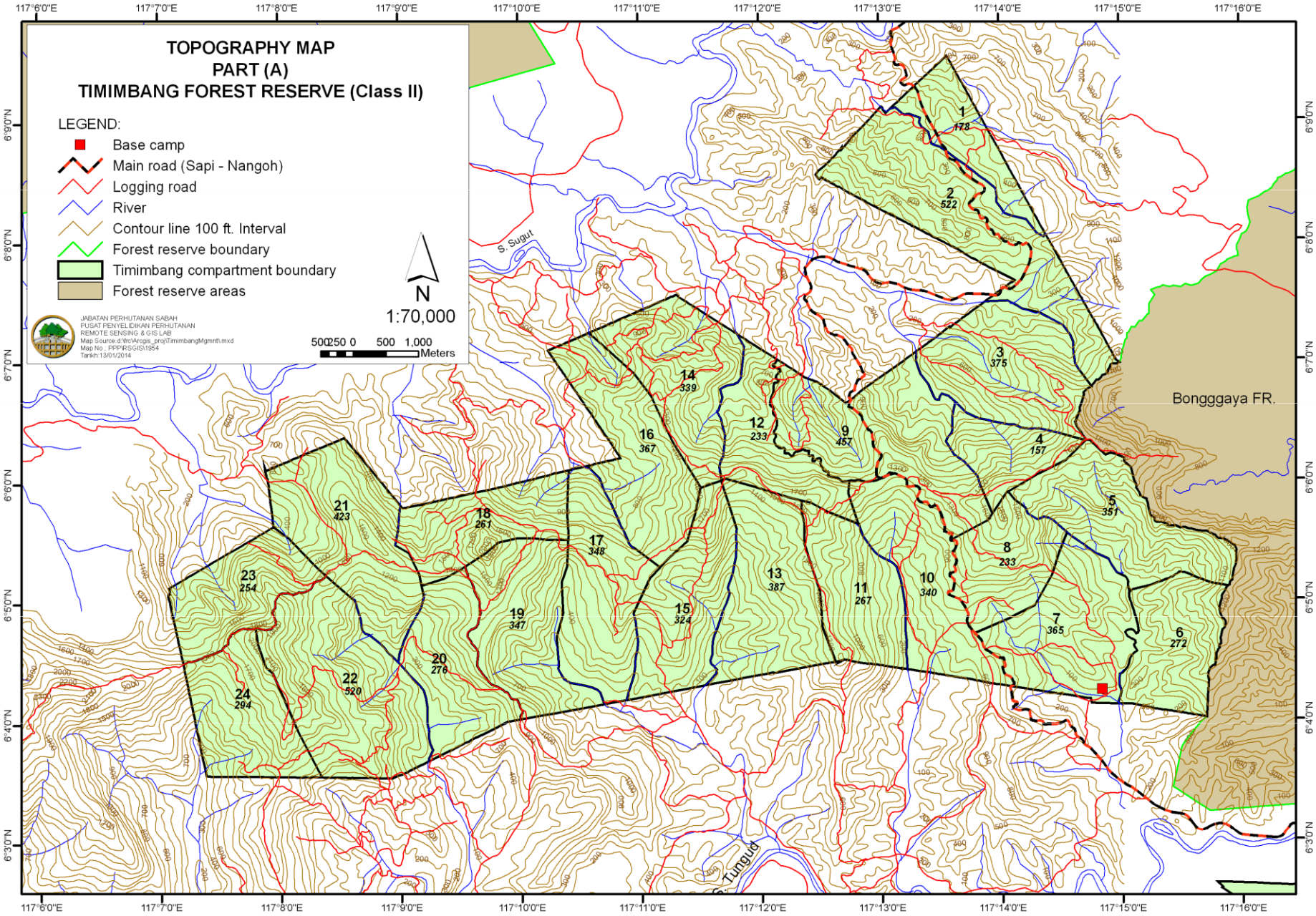
APPENDIX A

Topography Map of the Timimbang-Botitian Forest Management Unit

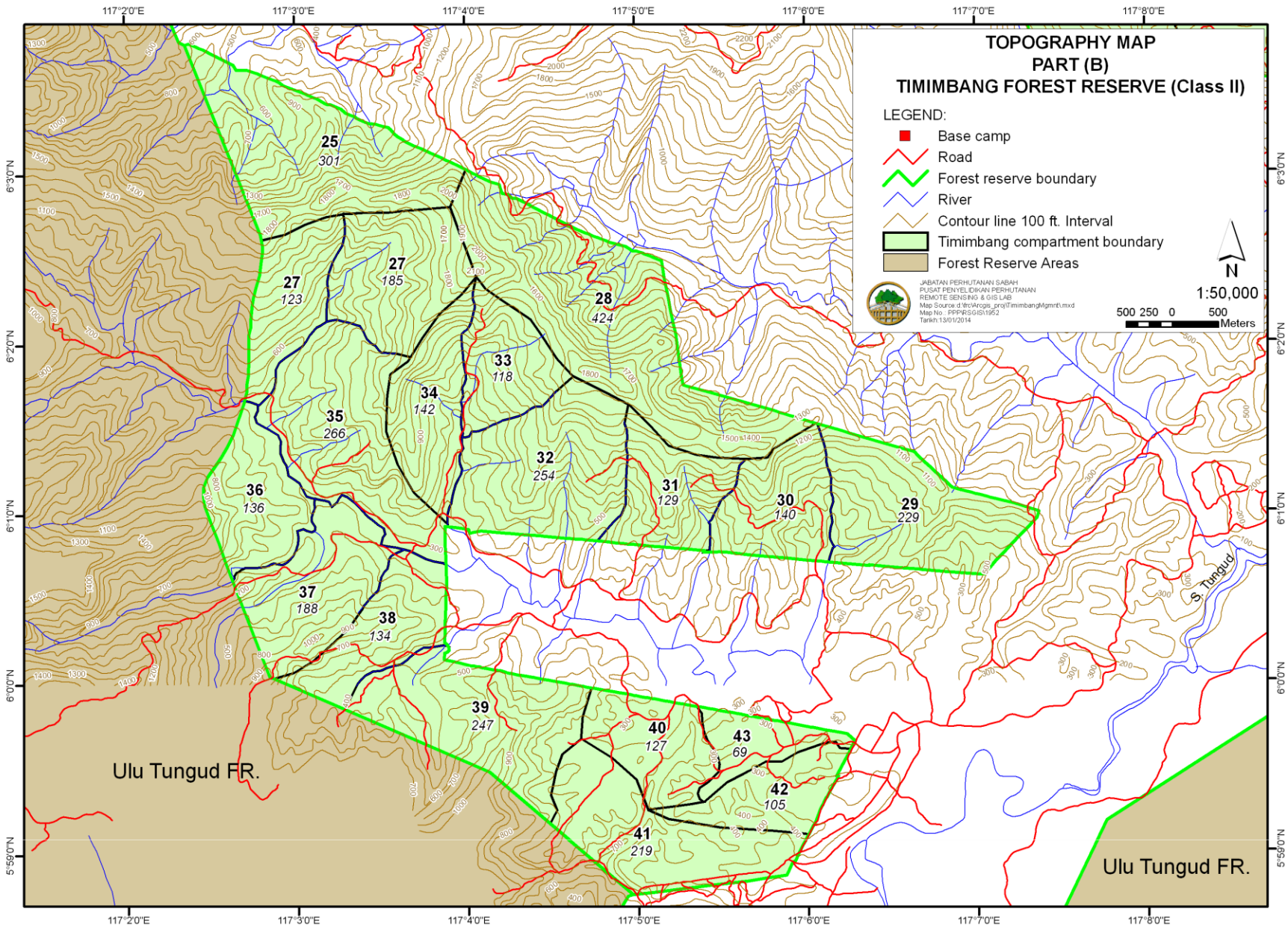
(a) Botitian Forest Reserve



(b) Timimbang FR (A)

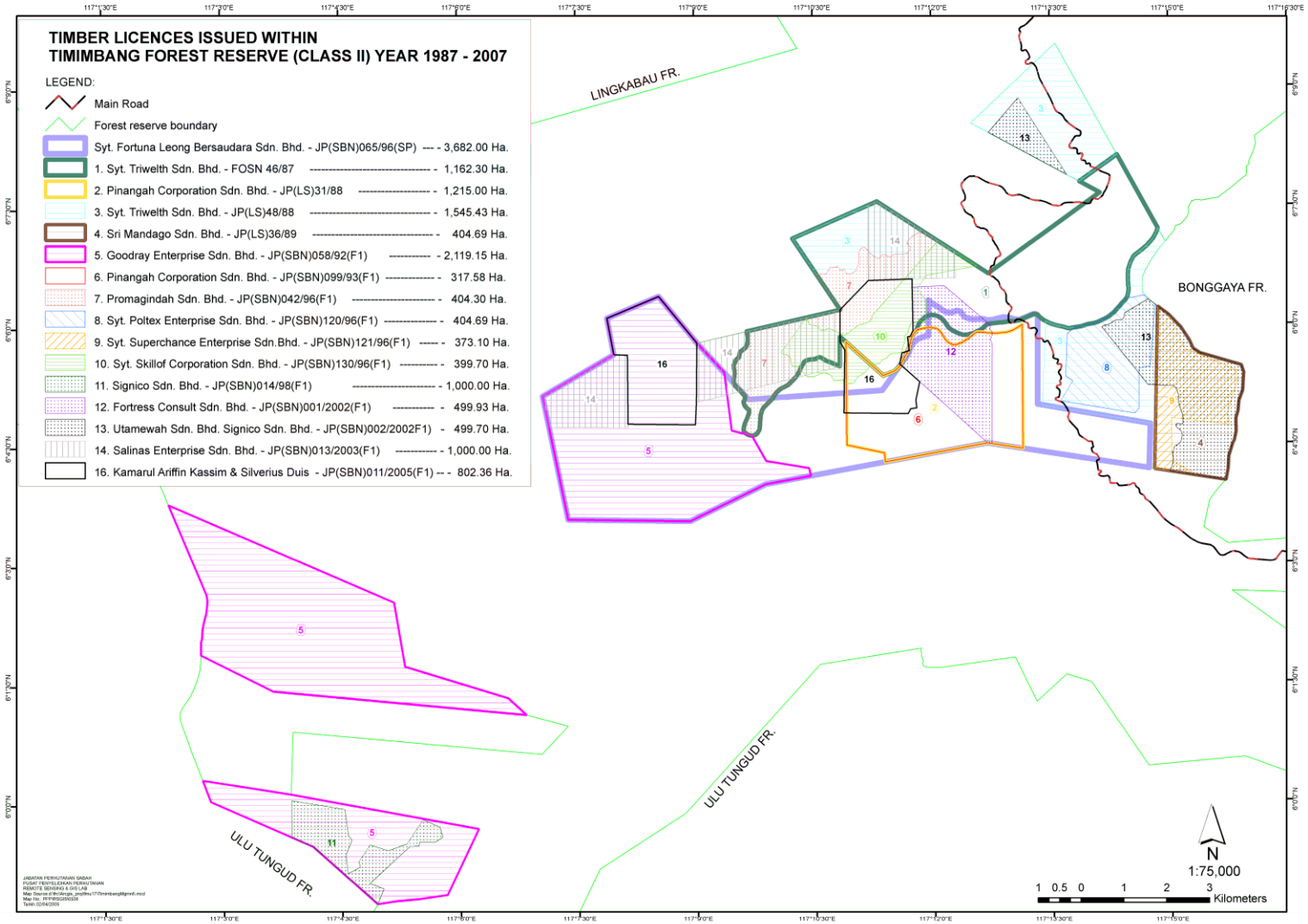


(c) Timimbang FR (B)



APPENDIX B

A MAP OF TIMBER LICENSES ISSUED FROM 1987−2007 IN THE TIMIMBANG FR



APPENDIX C

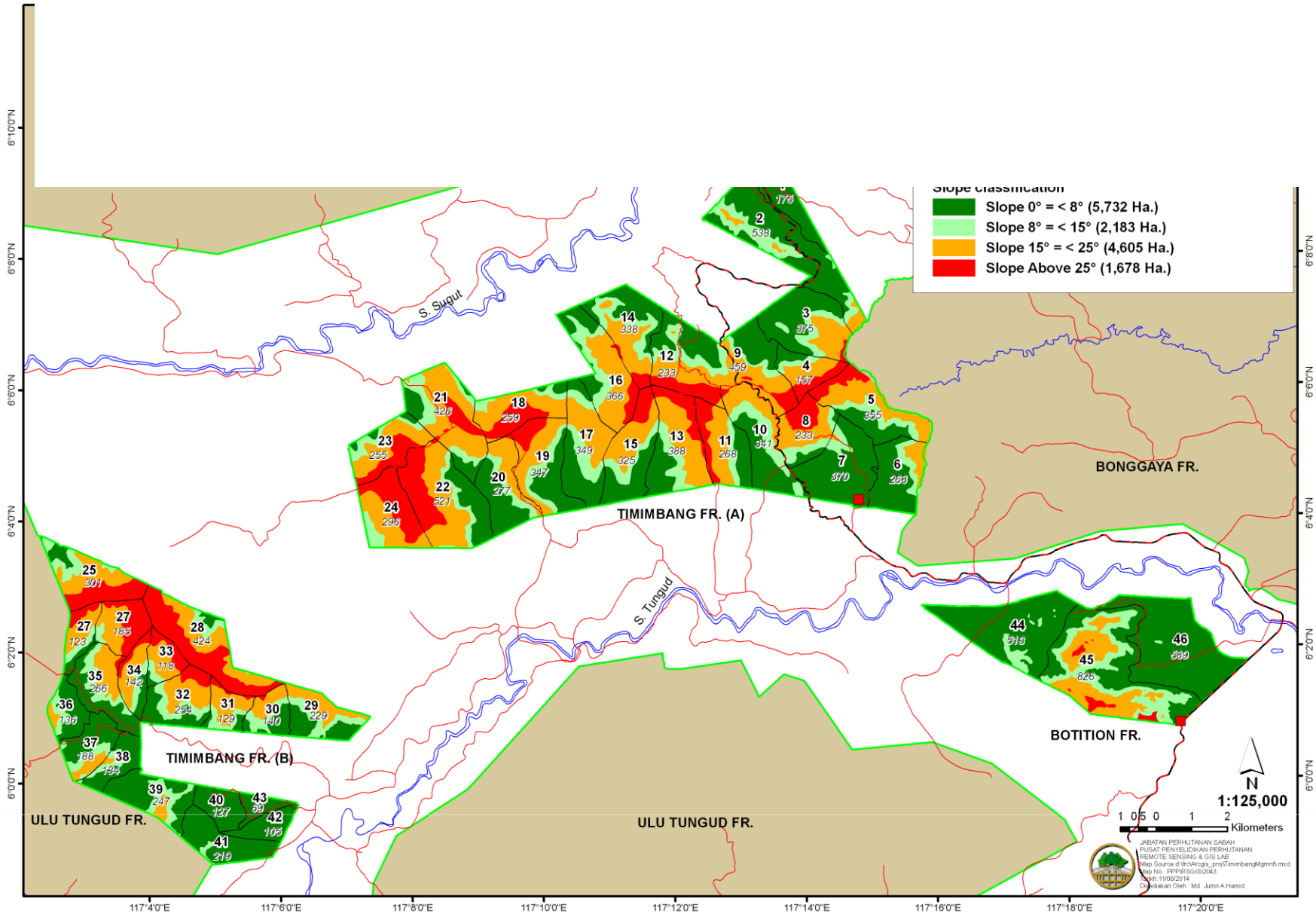
SENARAI LESEN DALAM HUTAN SIMPAN TIMIMBANG (1989-2007)

NO LESEN	PELESEN	LOKALITI	LUAS KAWASAN (ha)	TARIKH MULA	TARIKH TAMAT	ISIPADU (m3)
			404.69			
JP(LS)36/89	Sri Mandago Sdn Bhd	Timimbang FR Class II		11/05/1989	10/05/1990	8,188.42
JP(LS)48/88	Triwealthy Sdn Bhd	Timimbang FR	1,545.43	09/12/1989	09/12/1990	20,243.41
JP(LS)31/88	Pinangah Corporation Sdn Bhd	Timimbang FR	1,215.00	28/02/1991	27/02/1992	10.571.68
FOSN 46/87	Triwealth Sdn Bhd	Timimbang FR	1,162.30	28/02/1991	27/02/1992	17.772.03
JP(SBN)058/92(F1)	Goodray Enterprise Sdn Bhd	Timimbang FR	2,119.15	01/04/1992	31/03/1993	37.203.98
JP(SBN)090/94(SP)	Tungud Timber Sdn Bhd	Sg.Tungud FR,Timimbang FR,Bonggaya FR	23,538.00	01/01/1995	31/12/1999	213,193..14
JP(SBN)099/93(F1)	Syarikat Pinangah Corporation S/B	Sg Tungud (Timimbang FR Class II)	317.58	09/05/1995	08/05/1996	3,844.83
JP(SBN)042/96(F1)	Promagindah Sdn Bhd	Sg,Sugut (Timimbang FR)	404.30	03/05/1996	02/05/1997	14,070.13
JP(SBN)065/96(SP)	Syarikat Fortuna Leong Bersaudara S/B	Sg,Sugut (Timimbang FR Kelas II)	3,000.00	02/07/1996	31/12/1999	NIL
JP(SBN)120/96(F1)	Syarikat Poltex Enterprise Sdn Bhd	Sg.Tungud,Timimbang FR (Class II)	404.69	29/08/1997	31/12/1999	2,548.79
JP(SBN)121/96(F1)	Syarikat Superchance Enterprise S/B	Sg.Tungud,FR (Timimbang FR,ClassII)	373.10	06/05/1997	05/05/1999	3,226.69

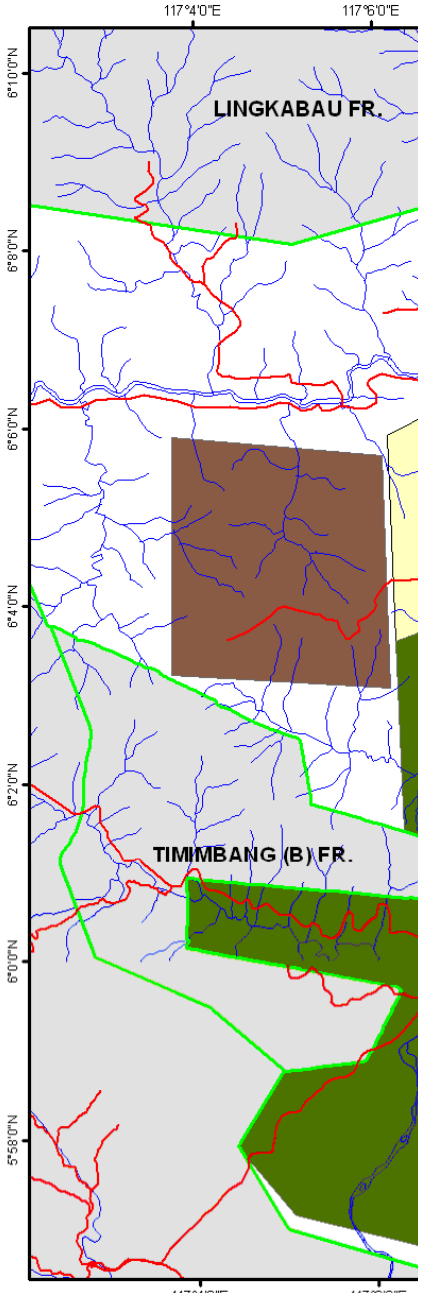
JP(SBN)130/96(F1)	Syarikat Skillaf Corporation Sdn Bhd	Sg. Sugut Timimbang FR	399.70	02/05/1997	01/05/1998	9,644.23
JP(SBN)014/98(F1)	Signico Sdn Bhd	Sg. Tungud (Ulu Tungud & Timimbang FR)	1,000.00	18/02/1998	31/12/1999	5,953.99
JP(SBN)108/98(F1)	H.N Enterprise	Sg. Obah / Sg. Timbang (Sugut FR)	1,000.00	02/03/2000	01/03/2001	1,556.16
JP(SBN)001/2002(F1)	Fortess Consult Sdn Bhd	Sg. Botitian (Timimbang FR) - Class II	499.93	30/01/2002	16/09/2005	6,050.63
JP(SBN)002/2002(F1)	Utamewah Sdn Bhd	Sg. Botitian (Timimbang FR) - Class II	499.70	30/01/2002	16/04/2007	1,542.60
JP(SBN)013/2003(F1)	Salins Enterprise Sdn Bhd	Sg. Sugut, Timimbang FR - Kelas II	1,000.00	26/01/2004	04/12/2006	8,534.91
JP(SBN)004/2005(F1)	Abdukkah Tan	Sg. Puntodong Timimbang FR Kelas II	467.98	01/06/2005	31/03/2006	3,052.45
JP(SBN)011/2005(F1)	Kamarul Arifin Kassim & & Silvelus Duis	Sg. Salilir (Timimbang FR)	802.36	09/01/2006	08/01/2007	6,280.10

APPENDIX D

Slope Classification of the Timimbang-Botitian FMU

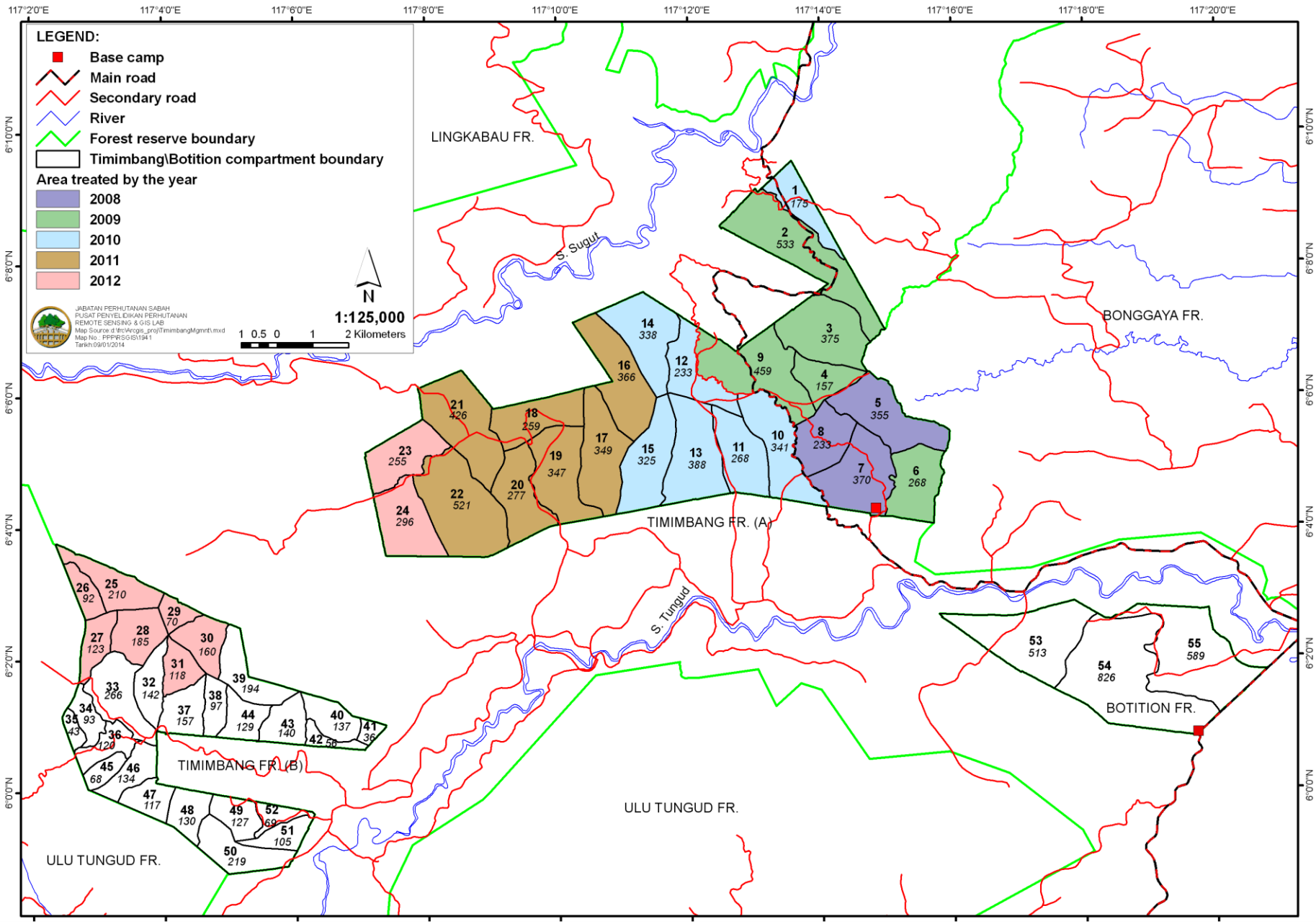


APPENDIX E
Oil Palm Estates Directly Adjacent to the Timimbang-Botitian FMU



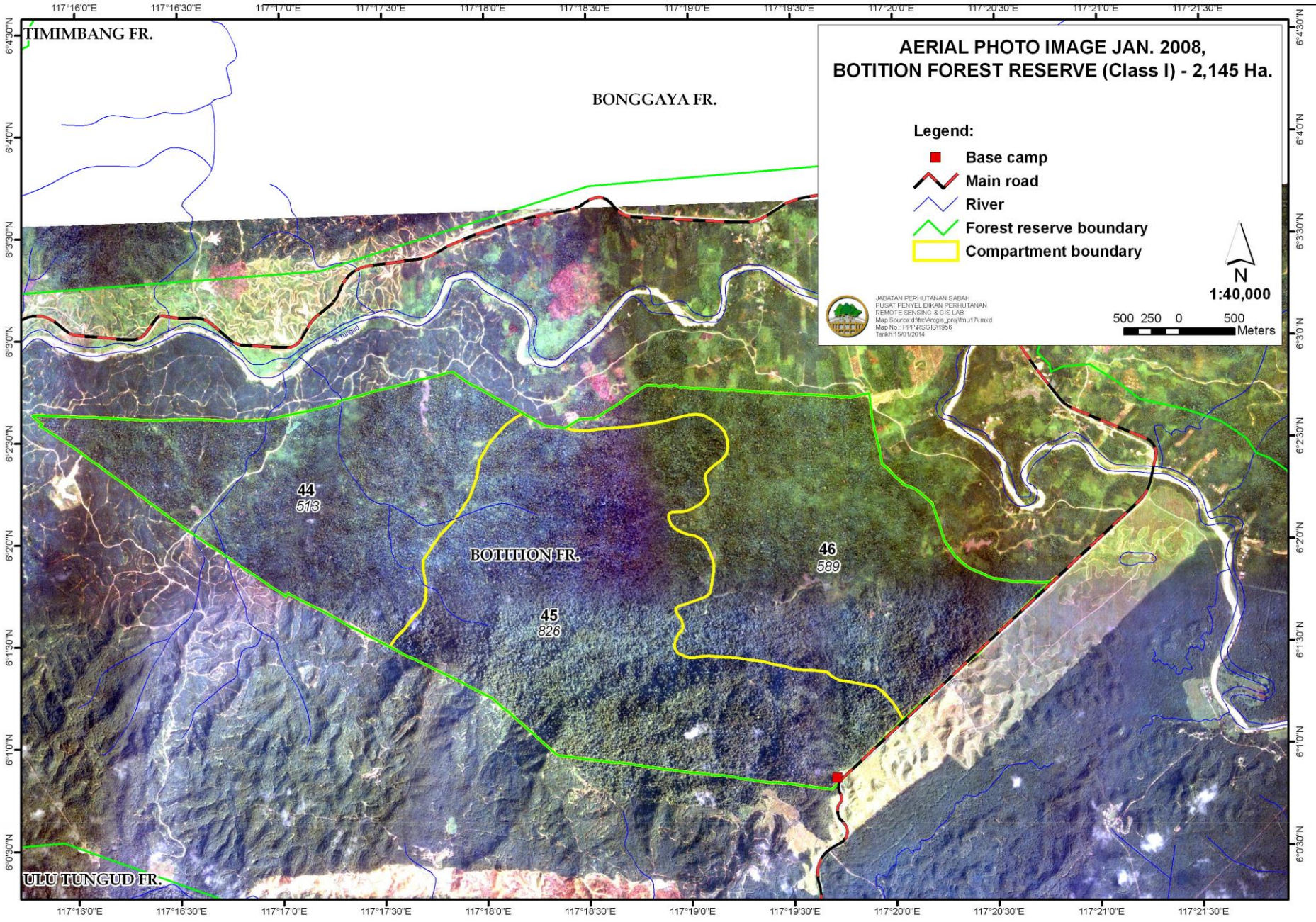
APPENDIX F

Post-harvest silvicultural treatment carried out in Timimbang-Botitian



APPENDIX G

Aerial photograph of Botitian Forest Reserve captured in 2008

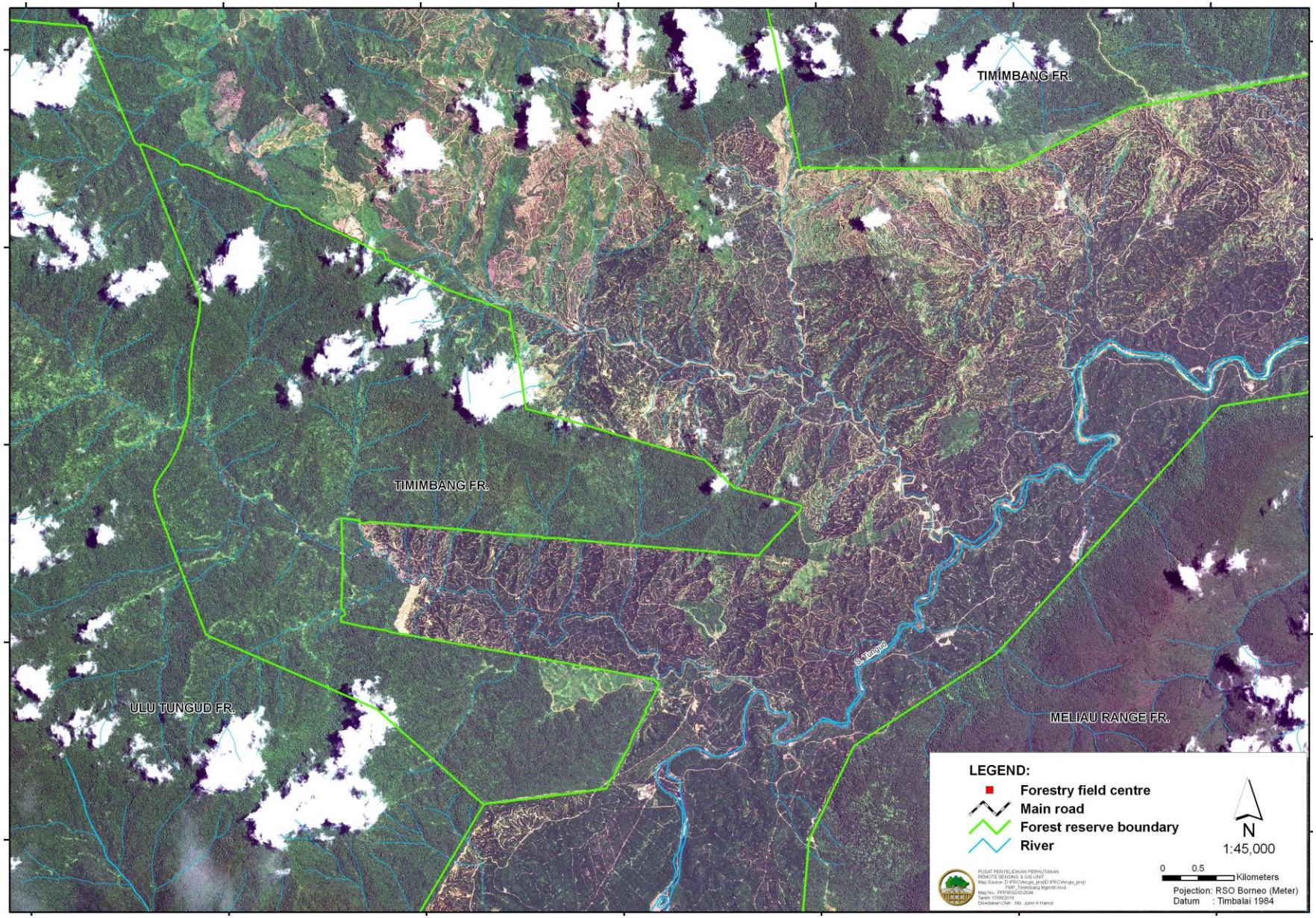


APPENDIX H

SPOT 2.5 m Satellite Image of Timimbang A and Botitian FRs taken in 2014

APPENDIX I

SPOT 2.5 m Satellite Image of Timimbang B taken in 2014



APPENDIX J

Key Outcome of A Stakeholder Consultation Workshop held on 20-22 May, 2013, at the Forestry Training Institute in Telupid

Ahli Jawatankuasa Komuniti

1. Pengerusi	:	En. Jampan B. Bansayan
2. Timbalan Pengerusi	:	En. Kifly Apau
3. Setiausaha	:	En. Ag Mohd Adzrul
4. Bendahari	:	En. Ahmad Dagang

Ahli Jawatankuasa

1. En. Amis @ Jaimmley B. Lampodok
2. En. Nain B. Azis
3. Pn. Jainab B. Bansayan
4. Pn. Jaitih Samsudin
5. Cik Lenny Chong Shiau Yen

Ahli Jawatankuasa Stakeholder

1. Pengerusi	:	En. Rebet Matau
2. Timbalan Pengerusi	:	En. Clarence Madius
3. Setiausaha	:	En. Achong B. Mohamad
4. Bendahari	:	En. Suhaimi Teruby

Ahli Jawatankuasa

1. En. Rijoner Caldo @ Combat
2. En. Beddu Bin Juni
3. En. Wilson Pondosian
4. En. Bedi Maikas
5. En. Yiew Pin Tong

Appendix J….*continued*

RESOLUSI KOMUNITI PROJEK SFM TIMIMBANG – BOTITION

1. Menubuhkan Jawatankuasa di peringkat kampung dan dianggotai oleh penduduk kampung dan Jabatan Perhutanan.

2. Jabatan Perhutanan melatih komuniti kampung di sekitar Hutan Simpan Timimbang – Botition dalam pencegahan dan pengawalan kebakaran hutan.

3. Jabatan Perhutanan menyediakan borang pengawalan hutan kepada komuniti kampung dan borang laporan ini diambil setiap bulan.

4. Jabatan Perhutanan hendaklah mewujudkan buffer zone yang jelas di lapangan antara tanah kerajaan / tanah bermilik dengan hutan simpan.

5. Jabatan Perhutanan hendaklah mengadakan ceramah kepada belia – beliawanis dan penduduk kampung tentang larangan-larangan dalam hutan simpan.

6. Projek SFM Timimbang – Botition memberi keutamaan peluang pekerjaan kepada komuniti kampung.

7. Penduduk kampung memohon supaya dilantik sebagai Renjer Hutan Kehormat bagi membantu Jabatan Perhutanan.

8. Komuniti memohon supaya dilibatkan dalam rondaan mencegah jenayah hutan sebulan atau tiga bulan sekali.

RESOLUSI STAKEHOLDER PROJEK SFM TIMIMBANG – BOTITION

1. Stakeholder membantu Jabatan Perhutanan membuat rondaan di sempadan bersama.

2. Stakeholder ingin mewujudkan kerjasama dengan Projek SFM Timimbang – Botition dalam maklumat, pengalaman dan kepakaran.

3. Menubuhkan jawatankuasa bersama untuk memantau aktiviti pencerobohan dan mengawal kebakaran hutan.

4. Stakeholder akan berfungsi sebagai mata dan telinga Jabatan Perhutanan.

5. Hutan Simpan dikekalkan sebagai kawasan tadahan air, rekreasi dan pusat pembelajaran.

6. Hutan Simpan Timimbang ditukarkan kepada KELAS I.

APPENDIX K

Dipterocarp Checklist of the Timimbang-Botitian FMU

	Species	Common Name	IUCN* Red List
1	*Dipterocarpus acutangulus*	Keruing merkah	
2	*Dipterocarpus caudiferus*	Keruing Putih	NE
3	***Dipterocarpus confertus***	**Keruing Kobis**	**NE**
4	*Dipterocarpus conformis*	Keruing Beludu Kuning	**NE**
5	***Dipterocarpus geniculatus***	**Keruing Tangkai Panjang**	**NE**
6	*Dipterocarpus globosus*	Keruing Buah Bulat	**CR**
7	*Dipterocarpus grandiflorus*	Keruing Belimbing	CR
8	*Dipterocarpus hasseltii*	Keruing Kerukup Kecil	**CR**
9	*Dipterocarpus humeratus*	Keruing Kerukup	**NE**
10	*Dipterocarpus kerrii*	Keruing Gondol	**CR**
11	*Dipterocarpus kunstleri*	Keruing Rapak	
12	*Dipterocarpus stellatus*	Keruing Bulu	
13	***Dipterocarpus pachyphyllus***	Keruing Daun Tebal	
14	*Dipterocarpus tempehes*	Keruing Asam	CR
15	*Dipterocarpus validus*	Keruing Kasigoi	CR
16	*Dipterocarpus verrucosus*	Keruing Merah	NE
17	*Dryobalanops becarii*	Kapur Merah	EN
18	*Dryobalanops Keithii*	Kapur Gumpait	EN
19	***Dryobalanops lanceolata***	**Kapur Paji**	**EN**
20	*Hopea aequalis*		
21	*Hopea beccariana*	Selangan Penak	**CR**
22	*Hopea bracteata*	Selangan	
23	*Hopea cernua*		
24	*Hopea dryobalanoides*	Selangan Daun Kapur	
25	*Hopea ferruginea*	Selangan Mata Kucing	CR
26	*Hopea nervosa*	Selangan Jangkang	CR
27	*Hopea nutans*	Giam	**CR**
28	*Hopea pentanervia*	Selangan Lima Urat	CR
29	*Hopea sangal*	Gagil	CR
30	*Hopea semicuenata*		
31	*Parashorea malanonaan*	Urat Mata Daun Licin	CR
32	***Parashorea parvifolia***	**Urat Mata Daun Kecil**	NE
33	*Parashorea tomentella*	Urat Mata Beludu	
34	*Parashorea smythiesii*	Urat Mata Batu	
35	***Shorea acuminatissima***	**Seraya Kuning Runcing**	**CR**
36	*Shorea altrinervosa*	Selangan Batu Hitam	
37	***Shorea agamii***	**Melapi Agama**	**EN**

38	*Shorea almon*	Seraya Kerukup	CR
39	***Shorea amplexicaulis***		NE
40	*Shorea angustifolia*		NE
41	***Shorea argentifolia***	**Seraya Daun Mas**	**EN**
42	*Shorea atrinervosa*	Selangan Batu Hitam	
43	***Shorea beccariana***	**Seraya Langgai**	
44	*Shorea bracteolata*		
45	*Shorea curtisii*		**LC**
46	*Shorea domatiosa*		
47	*Shorea exelliptica*		
48	*Shorea faguetioides*		
49	*Shorea faguetiana*	Seraya Kuning Siput	EN
50	***Shorea falciferoides* subsp. *glaucesens***		
51	*Shorea fallax*	Seraya Daun Kasar	
52	***Shorea ferruginea***	**Seraya Melantai Kecil**	**NE**
53	*Shorea foxworthyii*	Selangan Batu Bersisik	CR
54	*Shorea gibosa*	Seraya Kuning Gajah	CR
55	*Shorea havilandii*		
56	***Shorea hypoleuca***	**Selangan Batu Kelabu**	**CR**
57	*Shorea inappendiculata*		
58	*Shorea johorensis*	Seraya Majau	CR
59	*Shorea kunstleri*	Seraya Sirap	
60	*Shorea laevis*	Selangan Batu Kumus	LC
58	*Shorea leprosula*	Seraya tembaga	EN
59	***Shorea macrophylla***	**Kawang Jantung**	**VU**
60	***Shorea macroptera***	**Seraya Melantai**	
61	***Shorea mecistopteryx***	**Kawang Burung**	**NE**
62	*Shorea multiflora*	Banjutan	LC
63	*Shorea obscura*		
64	*Shorea ovalis*	Seraya Kepong	NE
65	*Shorea ovata*		
66	*Shorea parvifolia*	Seraya Punai	NE
67	***Shorea parvistipulata***		NE
68	***Shorea patoiensis***		NE
69	*Shorea pauciflora*	Oba Suluk	EN
70	***Shorea pilosa***		NE
71	*Shorea pinanga*		
72	*Shorea scabrida*		
73	*Shorea scrobiculata*		
74	*Shorea seminis*		CR
75	***Shorea smithiana***	**Seraya Timbau**	**CR**
76	***Shorea symingtonii***	**Melapi Kuning**	**CR**

77	***Shorea superba***	**Selangan Batu Daun Halus**	**CR**
78	*Shorea tenuiramulosa*		
79	***Shorea xanthophyla***	**Seraya Kuning Barun**	**CR**
80	***Vatica albiramis***	Resak putih	NE
81	***Vatica dulitensis***		NE
82	***Vatica micrantha***	Resak Bulu	NE
83	***Vatica oblongifolia***		NE
84	*Vatica odorata*		NE
85	*Vatica rassak*		LC
86	***Vatica sarawakensis***		CR

Note: Species in bold are Bornean endemics

IUCN Red List Structure

Extinct (EX)	
Extinct in the Wild (EW)	
Threatened	Critically Endangered (CR)
	Endangered (EN)
	Vulnerable (VU)
Near Threatened (NT)	
Least Concern (LC)	
No Entry (NE)	

APPENDIX L

Bird species observed in Timimbang-Botitian*

*This list is based on a report by Bili (2014) as spotted and identified by Yoktan Julbit

No	Common Name	*Scientific Name*	Family	Comment / Status	IUCN Red List
1	Asian black hornbill	*Anthracoceros malayanus*	**Bucerotidae**	Common resident	NT
2	Asian fairy bluebird	*Irena puella*	**Oriolidae**	Common resident	LC
3	Asian glossy starling	*Aplonis panayensis*	**Sturnidae**	Abundant resident	LC
4	Asian palm swift	*Cypsiurus balasiensis*	**Apodidae**	local resident	LC
5	Asian paradise flycatcher	*Terpsiphone paradise*	**Monarchidae**	Common resident	LC
6	Banded bay cuckoo	*Cacomantis sonneratii*	**Cuculidae**	Common resident	LC
7	Banded broadbill	*Eurylaimus javanicus*	**Eurylaimidae**	Common resident	LC
8	Banded woodpecker	*Picus mineaceus*	**Picidae**	Common resident	LC
9	Bar winged flycatcher shrike	*Hemipus picatus*	**Campephagidae**	Common resident	LC
10	Barn owl	*Tyto alba*	**Strigidae**	local resident	LC
11	Barred eagle owl	*Bubo sumatranus*	**Strigidae**	Scare resident	LC
12	Bat hawk	*Machaeramphus alcinus*	**Accipitridae**	local resident	LC
13	Black and yellow broadbill	*Eurylaimus ochromalus*	**Eurylaimidae**	Common resident	NT
14	Black backed kingfisher	*Ceyx erithaca*	**Alcedinidae**	possible vagrant	LC
15	Black bellied malkoha	*Phaenicophaeus diardi*	**Cuculidae**	local resident	NT
16	Black capped babbler	*Pellorneum capistratum*	**Timaliidae**	Common resident	LC
17	Black headed bulbul	*Pycnonotus atriceps*	**Pycnonotidae**	Common resident	LC
18	Black headed pitta	*Pitta ussherri*	**Pittidae**		NT
19	Black magpie	*Platysmurus leucopterus*	**Corvidae**		NT
20	Black naped monarch	*Hypothymis azurea*	**Monarchidae**	Common resident	LC
21	Black throated babbler	*Stachyris nigricollis*	**Timaliidae**	Common resident	NT
22	Black winged flycatcher shrike	*Hemipus hirundinaceus*	**Campephagidae**	local resident	LC
23	Blue Crowned Hanging Parrot	*Loriculus galgulus*	**Psittacidae**	Common resident	LC
24	Blue Eared Barbet	*Megalaima australis*	**Ramphastidae**	Common resident	LC
25	Blue Headed Pitta	*Pitta baudii*	**Pittidae**	common Bornean endemic	VU
26	Blue Rumped Parrot	*Psittinus cyanurus*	**Psittacidae**	local resident	NT
27	Blue Throated Bee-Eater	*Merops viridis*	**Meropidae**	common nomadic resident	LC
28	Blyth's hawk eagle	*Nisaetus alboniger*	**Accipitridae**	Scarce resident	LC
29	Bronzed drongo	*Dicrurus aeneus*	**Dicruridae**	Common resident	LC
30	Brown barbet	*Calorhamphus fuliginosus*	**Ramphastidae**	Common resident	LC
31	Brown fulvetta	*Alcippe brunneicauda*	**Timaliidae**	local resident	NT
32	Brown wood owl	*Strix leptogrammica*	**Strigidae**	local resident	LC
33	Buff vented bulbul	*Iole olivacea*	**Pycnonotidae**	Scare resident	LC
34	Buffy Fish Owl	*Ketupa ketupu*	**Strigidae**	Common resident	LC
35	Bushy Crested Hornbill	*Anorrhinus galeritus*	**Bucerotidae**	Common resident	LC
36	Cattle Egret	*Bubulcus ibis*	**Ardeidae**	migrant	LC
37	Changeable hawk eagle	*Nisaetus cirrhatus*	**Accipitridae**	Scarce resident	LC
38	Chestnut Backed Scimitar Babbler	*Pomatorhinus montanus*	**Timaliidae**	Scarce resident	LC

Appendix J …..*continued*

39	Chestnut Bellied Malkoha	*Phaenicophaeus sumatranus*	**Cuculidae**	local resident	NT
40	Chestnut Breasted Malkoha	*Phaenicophaeus curvirostris*	**Cuculidae**	Common resident	LC
41	Chestnut Munia	*Lonchura atricapilla*	**Estrildidae**	Common resident	LC
42	Chestnut Naped Forktail	*Enicurus ruficapillus*	**Turdidae**	local resident	NT
43	Chestnut necklaced hill partridge	*Arborophila chloropus*	**Phasianidae**	Common resident	LC
44	Chestnut Rumped Babbler	*Stachyris maculate*	**Timaliidae**	Common resident	NT
45	Chestnut Winged Babbler	*Stachyris erythroptera*	**Timaliidae**	Common resident	LC
46	Common Iora	*Aegithina tiphia*	**Aegithinidae**	Common resident	LC
47	Common Sandpiper	*Actitis hypoleucos*	**Scolipacidae**	Common winter visitor	LC
48	Cream Vented Bulbul	*Pycnonotus simplex*	**Pycnonotidae**	Common resident	LC
49	Crested Fireback	*Lophura ignita*	**Phasianidae**	local resident	NT
50	Crested Goshawk	*Accipiter trivirgatus*	**Falconidae**	local resident	LC
51	Crested jay	*Platylophus galericulatus*	**Corvidae**	Common resident	NT
52	Crested Serpent Eagle	*Spilornis cheela*	**Accipitridae**	Common resident	LC
53	Crimnson Winged Woodpecker	*picus puniceus*	**Picidae**	Scarce resident	LC
54	Dark Throated Oriole	*Oriolus xanthonotus*	**Oriolidae**	Common resident	NT
55	Diard's Trogon	*Harpactes diardii*	**Trogonidae**	lowland resident	NT
56	Dusky Broadbill	*Corydon sumatranus*	**Eurylaimidae**	Scarce resident	LC
57	Dusky Munia	*Lonchura fuscans*	**Estrildidae**	common endamic	LC
58	Emerald Dove	*Chalcophaps indica*	**Columbidae**	Common nomadic resident	LC
59	Eurasian Tree Sparrow	*Passer montanus*	**Passeridae**	Common resident	LC
60	Ferruginous Babbler	*Trichastoma bicolor*	**Timaliidae**	local resident	LC
61	Fiery Minivet	*Pericrocotus igneus*	**Campephagidae**	local resident	NT
62	Finsch's bulbul	*Alophoixus finschii*	**Pycnonotidae**	Scarce resident	NT
63	Fluffy Backed Tit-Babbler	*Macronous ptilosus*	**Timaliidae**	Common resident	NT
64	Glossy Swiftlet	*Collocalia esculenta*	**Apodidae**	Common resident	LC
65	Gold-Whiskered Barbet	*Megalaima chrysopogon*	**Ramphastidae**	Common resident	LC
66	Great Argus	*Argusianus argus*	**Phasianidae**	local resident	NT
67	Greater Coucal	*Centropus sinensis*	**Cuculidae**	Common resident	LC
68	Greater Green Leafbird	*Chloropsis sonnerati*	**Aegithinidae**	Common resident	LC
69	Greater Racquet Tailed Drongo	*Dicrurus paradiseus*	**Dicruridae**	Common resident	LC
70	Green Imperial Pigeon	*Ducula aenea*	**Columbidae**	Common resident	LC
71	Green Iora	*Aegithina viridissima*	**Aegithinidae**	Common resident	NT
72	Grey And Buff Woodpecker	*Hemicircus concretus*	**Picidae**	local resident	LC
73	Grey Capped Woodpecker	*Dendrocopos canicapillus*	**Picidae**	local resident	LC
74	Grey Cheeked Bulbul	*Alophoixus bres*	**Pycnonotidae**	Common resident	LC
75	Grey Chested Jungle Flycatcher	*Rhinomyias umbratilis*	**Muscicapidae**	Common resident	NT
76	Grey Headed Babbler	*Stachyris poliocephala*	**Timaliidae**	local resident	LC
77	Grey Rumped Treeswift	*Hemiprocne longipennis*	**Apodidae**	Common resident	LC
78	Hairy Backed Bulbul	*Tricholestes criniger*	**Pycnonotidae**	Common resident	LC
79	Helmeted Hornbill	*Buceros vigil*	**Bucerotidae**	Scarce resident	NT
80	Hill Myna	*Gracula religiosa*	**Sturnidae**	Common resident	LC

81	Horsfield's Babbler	*Malacocincla sepiaria*	**Timaliidae**	local resident	LC
82	House Swift	*Apus nipalensis*	**Apodidae**	Common resident	LC
83	Indian Cuckoo	*Cuculus micropterus*	**Cuculidae**	Resident and winter visitor	LC
84	Jambu Fruit Dove	*Ptilinopus jambu*	**Columbidae**	Local resident and nomadic	NT
85	Javan hawk cuckoo (Hodgson's hawk cuckoo)	*Cuculus fugax*	**Cuculidae**	local resident	LC
86	Jerdon's Baza	*Aviceda jerdoni*	**Accipitridae**	Scarce resident	LC
87	Large Green Pigeon	*Treron capellei*	**Columbidae**	Scarce resident	VU
88	Large Wood Shrike	*Tephrodornis gularis*	**Campephagidae**	Scarce resident	LC
89	Lesser Coucal	*Centropus bengalensis*	**Cuculidae**	Common resident	LC
90	Lesser Cuckooshrike	*Coracina fimbriata*	**Campephagidae**	Common resident	LC
91	Lesser Fish Eagle	*Ichthyophaga humilis*	**Accipitridae**	Scarce resident	NT
92	Lesser Green Leafbird	*Chloropsis cyanopogon*	**Aegithinidae**	Common resident	NT
93	Little Green Pigeon	*Treron olax*	**Columbidae**	Common nomadic resident	LC
94	Little Spiderhunter	*Arachnothera longirostra*	**Nectarinidae**	Common resident	LC
95	Malaysian Blue Flycatcher	*Cyornis turcosus*	**Muscicapidae**	Common resident	NT
96	Maroon Breasted Philentoma	*Philentoma velata*	**Muscicapidae**		NT
97	Maroon Woodpecker	*Blythipicus rubiginosus*	**Picidae**	Scarce resident	LC
98	Moustached Babbler	*Malacopteron magnirostre*	**Timaliidae**	Common resident	LC
99	Moustached Hawk Cuckoo	*Cuculus vagans*	**Cuculidae**	Common resident	NT
100	Olive Backed Woodpecker	*Dinopium rafflesii*	**Picidae**	Scarce resident	NT
101	Olive Winged Bulbul	*Pycnonotus plumosus*	**Pycnonotidae**	Common resident	NT
102	Orange Backed Woodpecker	*Reinwardtipicus validus*	**Picidae**	Scarce resident	LC
103	Orange Bellied Flowerpecker	*Dicaeum trigonostigma*	**Dicaeidae**	Common resident	LC
104	Oriental Bay Owl	*Phodilus badius*	**Strigidae**	Scarce resident	LC
105	Oriental Darter	*Anhinga melanogaster*	**Pelicanidae**	local resident	NT
106	Oriental Magpie Robin	*Copsychus saularis*	**Turdidae**	Common resident	LC
107	Oriental Pied Hornbill	*Anthracoceros albirostris*	**Bucerotidae**	common resident	LC
108	Pacific Swallow	*Hirundo tahitica*	**Artamidae**	Common resident	LC
109	Pied Fantail	*Rhipidura javanica*	**Monarchidae**	local resident	LC
110	Pink Necked Green Pigeon	*Treron vernans*	**Columbidae**	Common resident	LC
111	Plain Sunbird	*Anthreptes simplex*	**Nectarinidae**	Common resident	LC
112	Plaintive Cuckoo	*Cacomantis merulinus*	**Cuculidae**	Common resident	LC
113	Puff Backed Bulbul	*Pycnonotus eutilotus*	**Pycnonotidae**	Common resident	NT
114	Purple Naped Sunbird	*Hypogramma hypogrammicum*	**Nectarinidae**	Common resident	LC
115	Raffles's Malkoha	*Phaenicophaeus chlorophaeus*	**Cuculidae**	Common resident	LC
116	Red Bearded Bee-Eater	*Nyctyornis amictus*	**Meropidae**	Common resident	LC
117	Red Crowned Barbet	*Megalaima rafflesii*	**Ramphastidae**	Common resident	NT
118	Red eyed Bulbul	*Pycnonotus brunneus*	**Pycnonotidae**	Common resident	LC
119	Red Headed Tailorbird	*Orthotomus ruficeps*	**Sylviidae**	Common resident	LC
120	Red Naped Trogon	*Harpactes kasumba*	**Trogonidae**	lowland resident	NT

Appendix J……*continued*

121	Red Throated Barbet	*Megalaima mystacophanos*	**Ramphastidae**	Common resident	NT
122	Rhinoceros Hornbill	*Buceros rhinoceros*	**Bucerotidae**	Common resident	NT
123	Roulroul (Crested partridge)	*Rollulus rouloul*	**Phasianidae**	Common resident	NT
124	Ruby Cheeked Sunbird	*Anthreptes singalensis*	**Nectarinidae**	local resident	LC
125	Rufous Crowned Babbler	*Malacopteron magnum*	**Timaliidae**	Common resident	NT
126	Rufous Piculet	*Sasia abnormis*	**Picidae**	Common resident	LC
127	Rufous Tailed Shama	*Trichixos pyrropygus*	**Turdidae**	Scarce resident	NT
128	*Rufous Tailed Tailorbird*	*Orthotomus sericeus*	***Sylviidae***	*Common resident*	*LC*
129	Rufous Woodpecker	*Celeus brachyurus*	**Picidae**	Common resident	LC
130	Scarlet Minivet	*Pericrocotus flammeus*	**Campephagidae**	common resident	LC
131	Scarlet Rumped Trogon	*Harpactes duvaucelii*	**Trogonidae**	Common resident	NT
132	Short Tailed Babbler	*Malacocincla malaccensis*	**Timaliidae**	Common resident	NT
133	Silver Rumped Spinetail	*Rhaphidura leucopygialis*	**Apodidae**	Common resident	LC
134	Slender Billed Crow	*Corvus enca*	**Corvidae**	local resident	LC
135	Sooty Capped Babbler	*Malacopteron affine*	**Timaliidae**	Common resident	NT
136	Spectacled Bulbul	*Pycnonotus erythropthalmos*	**Pycnonotidae**	Common resident	LC
137	Spectacled Spiderhunter	*Arachnothera flavigaster*	**Nectarinidae**	Scarce resident	LC
138	Spotted Fantail	*Rhipidura perlata*	**Monarchidae**	local resident	LC
139	Spotted Necked Dove	*Streptopelia chinensis*	**Columbidae**	Common resident	LC
140	Square tailed drongo cuckoo	*Surniculus lugubris*	**Cuculidae**	Common resident	LC
141	Stork Billed Kingfisher	*Pelargopsis capensis*	**Alcedinidae**	Common resident	LC
142	Streaked Bulbul	*Ixos malaccensis*	**Pycnonotidae**	Scare resident	NT
143	Streaky Breasted Spiderhunter	*Arachnothera affinis*	**Nectarinidae**	local resident	LC
144	Thick Billed Green Pigeon	*Treron curvirostra*	**Columbidae**	Local resident and nomadic	LC
145	Velvet Fronted Nuthatch	*Sitta frontalis*	**Pachcephalidae**	Common resident	LC
146	Violet Cuckoo	*Chrysococcyx xanthorhynchus*	**Cuculidae**	Common resident	LC
147	Wallace's Hawk Eagle	*Nisaetus nanus*	**Accipitridae**	Scarce resident	VU
148	Whiskered Treeswift	*Hemiprocne comate*	**Apodidae**	local resident	LC
149	White Bellied Woodpecker	*Dryocopus javensis*	**Picidae**	local resident	LC
150	White Breasted Waterhen	*Amaurornis phoenicurus*	**Rallidae**	Common resident	LC
151	White Breasted Woodswallow	*Artamus leucorynchus*	**Artamidae**	local resident	LC
152	White Collared Kingfisher (Collared kingfisher)	*Todiramphus chloris*	**Alcedinidae**	Common resident	LC
153	White Crowned Forktail	*Enicurus leschenaultia*	**Turdidae**	local resident	LC
154	White Crowned Hornbill	*Aceros comatus*	**Bucerotidae**	Scarce resident	NT
155	White-Crowned Shama	*Copsychus stricklandii*	**Turdidae**	common endemic	unknown
156	Wreathed Hornbill	*Aceros undulates*	**Bucerotidae**	Scare resident	LC
157	Yellow Bellied Bulbul	*Alophoixus phaeocephalus*	**Pycnonotidae**	Common resident	LC
158	Yellow Breasted Flowerpecker	*Prionochilus maculates*	**Dicaeidae**	local resident	LC
159	Yellow Eared Spiderhunter	*Arachnothera chrysogenys*	**Nectarinidae**	Scarce resident	LC
160	Yellow vented Bulbul	*Pycnonotus goiavier*	**Pycnonotidae**	Common resident	LC
161	Zebra Dove	*Geopelia striata*	**Columbidae**	Common resident	LC

APPENDIX M

Conservation Status of Mammals Found inTimimbang-Botitian

Item	Common Name	Scientific Name	IUCN Red List	CITES	WCE
PRIMATES					
Hominidae					
1.	Orang Utan*	*Pongo pygmaeus*	EN	I	1
Cercopithecidae					
2.	Long-tailed macaque	*Macaca fascicularis*	LC	II	2
3.	Pig-tailed macaque	*Macaca nemestrina*	VU	II	2
4.	Red-leaf monkey*	*Presbytis rubicunda*	LC	II	2
Lorisidae					
5.	Slow Loris	*Nycticebus coucang*	VU	I	2
Hylobatidae					
6.	Bornean gibbon*	*Hylobates muelleri*	EN	II	2
SMALL MAMMALS					
Tupaiidae					
7.	Common tree shrew*	*Tupaia glis*	LC	II	-
8.	Large trees hrew	*Tupaia tana*	LC	II	-
9.	Lesser tree shrew	*Tupaia minor*	LC		
Muridae					
10.	Mueller`s rat	*Sundamys muelleri*	LC	-	-
11.	Brown spiny rat	*Maxomys Rajah*	LC	-	-
12.	Small spiny rat*	*Maxomys baeodon*	Data Deficient	-	-
13.	Whitehead rat	*Maxomys whiteheadii*	VU	-	-
14.	Dark-tailed rat	*Niviventer cremoriventer*	VU	-	-
Sciuridae					
15.	Plaintain squirrel	*Callosciurus notatus*	LC	-	-
16.	Provost`s squirrel	*Callosciurus prevostii*	LC	-	-
17.	Low`s squirrel	*Sundasciurus lowii*	LC	-	-
18.	Plain pygmy squirrel*	*Exilisciurus exilis*	Data deficient	-	-
19.	Giant squirrel	*Ratufa affinis*	NT	II	2
20.	Ear spot squirrel	*Callosciurus adamsi*	VU	-	-
Mephitidae					
21.	Malay badger	*Mydaus javanensis*	LC	-	2
Viverridae					
22.	Binturong	*Arctictis binturong*	LC	III	2
23.	Malay civet	*Viverra tangalunga*	LC	-	2
LARGE MAMMALS					
Suidae					
24.	Wild boar	*Sus barbatus*	VU	-	3
Cervidae					
25.	Sambar deer	*Rusa unicolor*	VU	-	3
Tragulidae					
26.	Great mouse deer	*Tragulus napu*	LC	-	3
Ursidae					
27.	Sun bear	*Helarctos malayanus*	VU	I	1

*Bornean endemic

Notes for Appendix M:

IUCN Red List Structure

Extinct (EX)	
Extinct in the Wild (EW)	
Threatened	Critically Endangered (CR)
	Endangered (EN)
	Vulnerable (VU)
Near Threatened (NT)	
Least Concern (LC)	
No Entry (NE)	

CITES - Appendices

Appendix	Description
I	Species that are the most endangered among CITES-listed animals and plants.
II	Species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled.
III	Species that are protected in at least one country that has asked other **CITES** parties for help in controlling trade**.**

Wildlife Conservation Enactment, 1997, Sabah (WCE)

Schedule	Description
1	Totally protected species of animals and plants
2	Protected species of animals and plants (limited hunting and collection under license)
3	Protected species of animals for which hunting license is required

APPENDIX N

Silvicultural &Timber Stand Inventory Methodology

Timimbang is divided into 43 compartments. Two inventory lines traversed each compartment, giving a total of 86 lines. The total length of inventory lines was 10 km. The inventory method used plots arranged continuously along a linear strip.

Standing timber stock— All trees > 40 *cm* DBH were enumerated on 10 x 20 *m* plots along the strip, whereas trees ≥ 10 *cm* DBH were enumerated within 10 x 10 *m* plots along the same strip.

Potential crop trees (PCTs)— PCTs > 5 *cm* DBH were selected within the 10 x 10 *m* plots. PCTs are defined as those commercially valuable trees below the minimum cutting limit (i.e. 60 cm DBH), of good form and vigour, and most likely to form the future crop of harvestable trees. A defective commercial tree does not count as a PCT. Defects were defined as those thought to undermine the future survival, suitability and quality of the tree for timber production (e.g., termite infestation, severe bark damage, leaning bole, poor stem form, multiple leaders, and broken crowns). Only 2 PCTs were allowed to be selected within the 10 x 10 *m* plot, thereby giving a maximum stocking of 200 PCTs ha^{-1}.

Vines—Vine abundance was also evaluated. They were separated into two groups: woody vines and climbing bamboo. Woody vines and climbing bamboo were counted within the 10 x 10 *m* nested sub-plots. For woody vines, only stems ≥ 2.5 cm DBH were enumerated. For climbing bamboo, each clump was counted as one individual. In order to evaluate the proportion of trees affected by vines, all trees > 5 *cm* DBH within the 10 x 10 *m* plots were evaluated for the presence or absence of vines, either on their boles or crowns.

APPENDIX O

HCV elements in the Timimbang-Botitian FMU and the management and monitoring recommendations for each HCV.

HCV	Findings	Management Prescription	Monitoring
1.1	Timimbang and Botitian Forest Reserves are Class I Protection Forest.	Conduct periodic patrolling and surveillance in all designated HCV areas to curb illegal activities such as encroachment and poaching.	Periodic monitoring and control should be carried out to prevent encroachment in the buffer zone. Any signs of encroachment should be reported and dealt with immediate actions. Quarterly progress reports in reporting of the progress of activities as prescribed in the approved Annual Work Plan (AWP), encompassing reporting of monitoring results of known HCV attributes.
1.2	The presence of considerably high number of high conservation significant fauna and flora from both past research findings and the recent HCV assessment may concludes that this FMU unit is an important natural plant habitat or for wildlife nesting and foraging habitats.	Conduct periodic patrolling and surveillance in all designated 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. The trees listed in the prohibited list, significant fruit trees or nesting sites for wildlife, annotated IUCN red list species found in TBFMU should be clearly marked on the ground and on the maps. Migratory pathway of wildlife on logging roads, along streams or wildlife trails in the forest should be marked on the map and kept to ensure wildlife are able to use it for movement within and between forest reserves. TBSFM Wildlife Management System to be enhanced through collaboration with wildlife experts such as HUTAN, WWF and other research institutes. Field staff is 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,	Periodic monitoring and control should be carried out to prevent encroachment in the buffer zone. Any signs of encroachment should be reported and dealt with immediate actions. Quarterly Progress reports in reporting of the progress of activities as prescribed in the approved Annual Work Plan (AWP), encompassing reporting of monitoring results of known HCV attributes. Periodical monitoring by conducting re-enumeration of the trees in the permanent sample plots to be conducted once every three years to get an indication of changes in tree structure and species assemblages. Periodical monitoring of endangered, endemic and migratory wildlife species will be practiced using Wildlife Management System adopted by the management team. Any changes in terms of population count or migratory pathways observed by either researchers or ground staffs, the management team must be alerted. Similarly, this monitoring prescription also applies to endangered and endemic plant.

		endemic and forestry prohibited lists to ensure they do not harvest or damage and also for monitoring purposes. Update current biodiversity conservation status to TBSFM team of the upgrade or downgrading of threat status locally and globally.	
1.3	The presence of considerably high number of endemic fauna and flora from both past research findings and the recent HCV assessment may conclude that this FMU unit is an important natural plant habitat or for wildlife nesting and foraging habitats.	Conduct periodic patrolling and surveillance in all designated 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. Migratory pathway of wildlife on logging roads, along streams or wildlife trails in the forest should be marked on the map and kept to ensure wildlife are able to use it for movement within and between forest reserves. TBSFM Wildlife Management System to be enhanced through collaboration with wildlife experts such as HUTAN, WWF and other research institutes. Field staff is 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. Update current biodiversity conservation status to TBSFM team of the upgrade or downgrading of threat status locally and globally.	Periodic monitoring and control should be carried out to prevent encroachment in the buffer zone. Any signs of encroachment should be reported and dealt with immediate actions. Quarterly Progress reports in reporting of the progress of activities as prescribed in the approved Annual Work Plan (AWP), encompassing reporting of monitoring results of known HCV attributes. Periodical monitoring by conducting re-enumeration of the trees in the permanent sample plots to be conducted once every three years to get an indication of changes in tree structure and species assemblages. Periodical monitoring of endangered, endemic and migratory wildlife species will be practiced using Wildlife Management System adopted by the management team. Any changes in terms of population count or migratory pathways observed by either researchers or ground staff, the management team must be alerted. Similarly, this monitoring prescription also applies to endangered and endemic plant.
1.4		No HCV area is indicated. In the event that any salt	No HCV area is indicated. In the event that any salt licks

		licks and potential nesting sites are found within the TBSFM area in the future, demarcation of HCV boundaries on the ground and installing clear signage along existing road, foot trails and navigable rivers/streams indicating critical values	and potential nesting sites are found within the TBSFM area in the future, periodic monitoring as prescribed above will be conducted.
2	The entire TBFMU should be categorised as HCV 2 as potential for linking large forested areas between Bongaya and Ulu Tungud Forest Reserves is applicable.	Conduct periodic patrolling and surveillance in all designated 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. Migratory pathway of wildlife on logging roads, along streams or wildlife trails in the forest should be marked on the map and kept to ensure wildlife are able to use it for movement within and between forest reserves. TBSFM Wildlife Management System to be enhanced through collaboration with wildlife experts such as HUTAN, WWF and other research institutes.	Periodic monitoring and control should be carried out to prevent encroachment in the buffer zone. Any signs of encroachment should be reported and dealt with immediate actions. Quarterly progress reports in reporting of the progress of activities as prescribed in the approved Annual Work Plan (AWP), encompassing reporting of monitoring results of known HCV attributes. Periodical monitoring by conducting re-enumeration of the trees in the permanent sample plots to be conducted once every three years to get an indication of changes in tree structure and species assemblages. Periodical monitoring of endangered, endemic and migratory wildlife species will be practiced using Wildlife Management System adopted by the management team. Any changes in terms of population count or migratory pathways observed by either researchers or ground staff, the management team must be alerted. Similarly, this monitoring prescription also applies to endangered and endemic plant. Long term monitoring of TBSFM landscape using remote sensing technology and to be conducted once every three years to detect changes within the reserve and also vicinity areas. If threats are detected,

			precautionary approached will be taken and potential mitigation measures will be incorporated in the management plan.
3	The forests located below 200 m a.s.l. contain rare, endangered, threatened and also endemic species and appropriate to be categorised as HCV 3.	Conduct periodic patrolling and surveillance in all designated 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.	Periodic monitoring and control should be carried out to prevent encroachment in the buffer zone. Any signs of encroachment should be reported and dealt with immediate actions. Quarterly progress reports in reporting of the progress of activities as prescribed in the approved Annual Work Plan (AWP), encompassing reporting of monitoring results of known HCV attributes. Periodical monitoring by conducting re-enumeration of the trees in the permanent sample plots to be conducted once every three years to get an indication of changes in tree structure and species assemblages.
4.1		No HCV area is indicated.	No HCV area is indicated.
4.2	All areas with slopes >25° and 30 m riparian buffer strips should be categorised as HCV 4.2 for their importance in erosion control.	Conduct periodic patrolling and surveillance in all designated HCV areas to curb illegal activities, such as encroachment and poaching.	Periodic monitoring and control should be carried out to prevent encroachment in the buffer zone. Any signs of encroachment should be reported and dealt with immediate action. Quarterly progress reports in reporting of the progress of activities as prescribed in the approved Annual Work Plan (AWP), encompassing reporting of monitoring results of known HCV attributes.
4.3	Buffer strips of 100 m inside TBSFM boundaries that border local communities land and northern boundary that bordering oil palm estate are categorised as HCV 4.3.	Conduct periodic patrolling and surveillance in all designated HCV areas to curb illegal activities, such as encroachment and poaching. When the Forest Fire Management Plan is available it has to be implemented and updated periodically. Forest restoration of indigenous tree species as	Periodic monitoring and control should be carried out to prevent encroachment in the buffer zone. Any signs of encroachment should be reported and dealt with immediate actions. Quarterly progress reports in reporting of the progress of activities as prescribed in the approved Annual Work Plan (AWP), encompassing reporting

		part of the remedial action to increase forest structural diversity and mitigate any forest fire incidence spreading into the FMU core area, especially area dominated with lalang grassland and ferns.	of monitoring results of known HCV attributes. Ensure that all fire prevention procedures (monitoring, fire drills, public awareness campaign and etc) to be practised on a regular basis (at least once a year) especially during the drought season.
5	No community basic need is indicated within TBFMU.	No HCV area is indicated.	No HCV area is indicated.
6	No cultural value is indicated within TB FMU.	No HCV area is indicated.	No HCV area is indicated.