**KUMPULAN PENGURUSAN KAYU KAYAN
TERENGGANU
SDN BHD (KPKKT)**

PUBLIC SUMMARY 2019

ON

**THE SUSTAINABLE FOREST MANAGEMENT (SFM)
OF DUNGUN TIMBER COMPLEX (DTC),
TERENGGANU, MALAYSIA**

By

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**Bukit Besi, Malaysia
31 December 2019**

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1.0   INTRODUCTION

1.1   Location and Description of Project Area

The concession forest area identified as Dungun Timber Complex (DTC) is located about 120km to southwest of the state capital city of Kuala Terengganu, between latitude 3˚53" - 5˚51" North and longitudes 103˚30" - 102˚23" East. It now covers a total area of 106,697ha of rich mixed dipterocarp forest being sustainably managed following the dictates of the Malaysian Selective Management System (SMS) since early 1980s. The whole of DTC lies within the administrative district of Dungun, but in terms of forest administration, it lies mainly in the Forest Districts of South Terengganu and West Terengganu (**Fig. 1**).

General Location of Dungun Timber Complex (DTC) Area (106,697ha) within Dungun District

Fig. 1   General Location Map of Dungun Timber Complex (DTC), Terengganu, Malaysia

Fig. 2: The Permanent Reserved Forests (PRFs) Within Dungun Timber Complex (DTC).
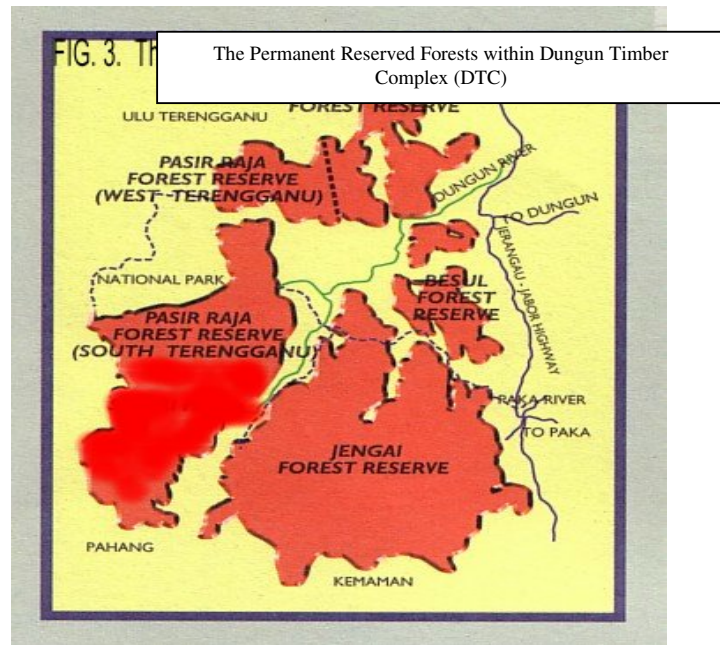
The 6 Permanent Reserved Forests (PRFs) that make up DTC are located north, west and east of the Sungai Dungun Valley, currently stand as follows: (1) Jengai PRF (51,840 ha), (2) Besul PRF (6,270 ha), (3) Jerangau PRF (9,810 ha), (4) Pasir Raja Barat PRF (6,547 ha), (5) Pasir Raja Selatan PRF (31,712 ha), and (6) Besul Tambahan PRF (518ha); giving a total of 106,697ha (see **Fig. 2**). Approx. 70,000ha (65%) of the latter falls under the "productive" category. KPKKT continues to manage DTC following the tenets of Sustainable Forest Management (SFM) principles as laid out in KPKKT's Forest Management Plan (FMP) which covers a 30-year period, from 2008 – 2037. The latter represents the second cycle of the Malaysian Selective Management System (SMS) whereby all of the prescriptions contained in the FMP were drawn in such a way as to accommodate as much as possible the current as well as anticipated future changes in global attitudes and trends in the approaches towards forest resource management, biodiversity conservation, climate amelioration and environmental protection.

As such the FMP, as a living document, is subject to revision on periodic basis, from time to time.

1.2   Climate

The Project Area has a typical tropical monsoon climate with uniformly high temperatures (from 24.2^{o}C to 29.9^{o}C), high humidity (from 70% to 98%) and a relatively high rainfall of up to in excess of 4,000mm per year, particularly in areas along the east coast to up to those hill lands of Pasir Raja PRF, Jengai PRF and Hulu Dungun. As a result of the heavy and often prolonged rainy season which frequently leads to floods in Dungun District, the proportion of really productive working days in the forest may range between 30% to 40% only per year.

Rainfall in the Project Area is brought about by two monsoons: Northeast monsoon during October – February and Southwest monsoon during April – July, but peaks during the northeast monsoon, in November and December. Usually, there are no logging operations conducted from November through to late January due to the unusually heavy downpour

during these months. The driest month usually occur around February to June. The high annual rainfall also gives rise to a correspondingly high Mean Annual Runoff (MAR). According to DID (1995), Sg Dungun which has a total catchment area of 1,410km^2 has an observed MAR of 2,675mm which is about 22% higher than the MAR for the whole of Terengganu (catchment area = 13,257 km^2) at 2,080mm and 44% higher than that of Peninsular Malaysia (catchment area = 134,423 km^2) at 1,185mm.

1.3   Geology, Topography and Site Conditions

The Project Area is part of Peninsular Malaysia's Titiwangsa Main Range and Banjaran Timur (Eastern Range). The altitude above mean sea level (asl) ranges from 50m in the north to more than 1,400m in the southeast (Gunung Celah with 1,459m), with the majority of the area lying between 200 and 800m asl. The soil condition in the eastern side of DTC is of granitic derivatives ranging from Biotic Muscovite Granite of Grandodio Rite to Alkaline Composition, whereas along Sungai Angka to Kuala Sungai Angka, soils derived from carbonaceous slate, orgillite, phyllite and variably metamorphosed siltstone and sand-stone predominate.

Table 1: Geology: Rock Types in the Project Area

Rock Type	Proportion of total area (%)
Carbonaceous Slate	57%
Acid Igneous Rock	35%
Intermediate Igneous Rock	8%

The area's topography is very variable and comprises flat river plains and swamps, rolling hills and mountainous areas 80% of which consists of short and steep slopes. The western boundary is dominated by steep, rugged mountains of the East Coast Range whereas the foothills tend to be less rugged than the mountains, separated by flat to gently undulating riverine flood plains.

The whole region is underlain with a mixture of undifferentiated granitic rocks and shales, predominated by sandstones, mudstones and siltstones. Some minor pockets of gravel, sand, and clayey sandstone and siltstones are found here and there. The whole region is mainly on steepland with red yellow podzolics derived from granites on lower slopes, especially in the northern and southern portions. Soils of sedimentary origin which are frequently associated with the granite-derived soils are mainly found on the foothills.

In terms of site degradation risk, the slope gradient imposes particular restrictions on timber harvesting. Field surveys had shown that some 60% of the Project Area have a gentle to moderately steep (0° - 20°) topography, 30% are steep (21° - 30°), and 10% very or extremely steep (over 30°; see **Table 2.7**). In terms of soil fertility it was found that more than three fourth of the area were of poor fertility and less than a fourth was fertile (see **Table 2.6**).

Table 2. Topography in the Project Area: Slope Classes

Slope Classes	Definition: Slope Gradient	Proportion of total area (GIS Analysis)
Gentle	0° – 10° (0 – 18%)	59%
Moderately steep	11° – 20° (19 – 37%)	
Steep	21° – 30° (38 – 59%)	32%
Very Steep	31° – 40° (60 – 84%)	9%
Extremely steep	>40° (>84%)	
Total		100%

Table 3: Soil Units in DTC

Soil Unit	Some ecological characteristics	% of total area
Acrisol	(1) Strongly weathered, acid soils (lessivation/leaching and ferralisation ➔ Podzols; (2) Poor; (3) Physical properties not favourable; (4) High risk of soil compaction; (5) Highly erodible in hilly terrain.	63%
Cambisol	(1) Relatively young, moderately weathered soils, usually on steep slopes; (2) Fertile; however, pronounced leaching of nutrients due to coarse soil texture (3) Often stony, which prevents rootability; (4) Sometimes shallow; (5) Good water-holding capacity.	20%
Leptosol	(1) Skeletal soils, which develop on some steep slopes, where erosion may have removed older soil cover; (2) Poor; (3) Shallow and extremely stony; (4) Low water-holding capacity; (5) Tree growth seriously restricted.	14%
Fluvisol	(1) Of colluvial and alluvial origin, developing on lower slopes, and in valleys and floodplains; (2) Very fertile soils; (3) Frequent high groundwater levels and periodic flooding; (4) Fine texture and high groundwater level ➔ low loading capacity.	3%
Total		100%

Source: GTZ (1998).

1.4   Hydrology

Sungai Dungun which originates in the eastern side of the Titiwangsa Main Range at the south-western border of Terengganu, appears to be the most important river in the Project Area running through its length for about 55 kilometres to its confluence with Sungai Jerangau, virtually cutting the bell-shaped concession into two halves, east and west. On the eastern side are Besul Tambahan PRF, Besul PRF and Jengai PRF, whereas on the western half are Jerangau PRF, Pasir Raja West PRF and Pasir Raja South PRF. Each of these six PRFs constitutes its own catchment though some of them may lie contiguously with the other or separated by rivers. A majority of the rivers in the individual catchment flow into Sungai Dungun before draining into the South China Sea at Dungun town.

1.4   Timber Harvesting In Relation To the Influence of Natural Environment

KPKKT's experience over the years have shown the strong influence of weather and rainfall pattern on timber harvesting and work efficiency in DTC. Logging and timber removal activities are generally prohibited during poor and unpredictable weather and the safety concern in the variable and adverse topography. Experience shows that, the third quarter of the year witnesses the highest percentage in terms of production (>45%) due to good weather, followed by the months of March and April at 10% and 11% respectively.

1.5   Harvesting Technique

Under the currently practised "Reduced Impact Logging (RIL)" approach, KPKKT employs the conventional logging method to harvest the timber. Under this method, a selected (and marked) tree, upon being directionally felled by a trained tree feller, is bucked into lengths of about 6 meters, and the resulting logs would then be skidded by a light bulldozer equipped with an A-Frame, along the skid trail (Lorong Penarik) to the nearest Temporary Matau/ Hot Deck. By employing the Directional Felling approach, extreme care was made to adhere as much as possible to the prescribed felling direction and protect the integrity of the ecosystem and ensure the future sustainability of the resource. This would mean, among others, to avoid any disturbance of the riverine buffer zone and other protected habitats, whilst the felling should impart the minimum damage possible to the standing residual trees and regeneration. All Skid Trails are kept uncompacted, and never exceed 300 meters in length. Care is also made during skidding to ensure minimum damage and avoidance of compaction to the soil by lifting the front end of the logs during its journey to the Temporary Matau (Fig. 4). From the Temporary Matau, a santaiwong truck would transport the timbers to a larger Matau to be sorted out accordingly before being delivered to the respective clients.

Fig. 3   Bulldozer fitted with an A-frame winch skidding timber along s skid trail

Pembalakan dengan cara menarik dengan menggunakan traktor adalah biasa diamalkan di negara-negara tropika. Di sini kelihatan sebatang kayu balak besar sedang ditarik ke matau terdekat yang mungkin terletak pada jarak sejauh hingga 300 meter. Apabila sampai di matau, kayubalak-kayubalak di asingkan, misalnya menurut spesies, pasaran atau pun jenis penggunaan, etc; dan di gred sebelum di naikmuat ke atas lori balak untuk dihantar ke kilang-kilang pemproses.

Fig. 4.   The front-end of the log is lifted off the ground during skidding operation.

Fig. 5

Fig. 6

Figs. 5 & 6. A typical skid-trail

1.5   EIA-Compatibility and Compliance

The management of DTC continues to comply with the environmental management standards as laid out by the relevant authorities, namely the Department of Forestry as well as Department of Environment, Terengganu State. The Malaysian National Policy on the Environment aims at continued economic, social, and cultural progress of the country and enhancement of the quality of life of its people, through environmentally sound and sustainable development. In this context, appropriate environmentally-benign forest management standards and practices have been and will continue to be duly observed by KPKKT in all of its forest management decisions, activities and field operations, in order to minimise potential negative impacts of such operations.

1.6   Compliance with Existing Laws and Legislations as well as FSC P&C

KPKKT continues to comply with **(1)** the National Forestry Policy 1997; **(2)** National Forestry Act 1984 (NFP & NFA), **(3)** the "Forest Concession Agreement of Dungun Timber Complex (DTC)" (SFD TERENGGANU 1982), and **(4)** other relevant legislation as well as standards prescribed by local and international certification bodies such as the Forest Stewardship Council (FSC). The State Government of Terengganu first signed the concession agreement with KPKKT for the long term management and development of the FMU, covering a period of 25 years, from 1983 to 2007, which had been subsequently renewed and extended to cover the present cycle of management, from 2008 to 2037.

DTC was first recognised and certified by FSC as a "Well-Managed Forest" in April 2008. This certification was subsequently renewed for a further five years from 2012 after the first re-certification exercise. The second re-certification exercise conducted in 2018 saw the FSC certification for DTC as a well-managed forest being extended yet again till the year 2022.

2.0   HUMAN RESOURCE

As of the date of this report (January 2020), KPKKT employs a total of 83 staff comprising 73 males and 10 females (Table 1). Of these, 12 personnel or about 14.5% work at the management level (Senior General Manager, Deputy GM, Senior Forest Manager, Forest Manager, Assistant Managers and Forest Executives) (Fig. 1), and 85.5% at the technical level (Forest Supervisors, Foresters and Machine Operators). A total of 66 staff (79.5%) are involved directly in the forestry operations. KPKKT places an utmost priority on field and R & D operations. For road construction, tree felling and timber extraction, KPKKT engages a total of 6 local contractors who are experienced in their jobs and regularly updated and kept informed on the latest changes and requirements.

Capacity and training for staff in the following areas continue to be arranged and provided from time to time:
1. Mentoring programme on FSC for staff and contractors
2. Training of machine operators in environmentally benign and damage-limiting techniques
3. Training in silviculturally significant tree marking procedures
4. Training on the management of HCVF
5. Training on wildlife inventory and management
6. Training on nursery technology and planting stock production.

Table 2 summarises the trainings and capacity buildings provided to KPKKT staff as well as the contractors.

JUMLAH TENAGA PEKERJA

BIL	JABATAN	JUMLAH KAKITANGAN	LELAKI	PEREMPUAN
1	PENTADBIRAN	9	6	3
2	KEWANGAN	4	1	3
3	OPERASI	12	12	0
4	PERANCANGAN & PEMBANGUNAN	25	25	0
5	LOGISTIK & KUALITI	26	24	2
6	PEMATUHAN & PENSIJILAN	3	3	0
7	TEKNOLOGI MAKLUMAT	1	1	0
8	LADANG HUTAN	3	1	2
	JUMLAH KESELURUHAN	83	73	10

66 ORANG TENAGA KERJA TERLIBAT SECARA LANGSUNG DALAM PENGURUSAN HUTAN

Table 4.   Staffing Position of KPKKT (Jan. 2020)

Fig. 7. Organisational Structure of KPKKT's Management Team (Jan. 2020)

Training and capacity building involving both KPKKT's personnel and those of KPKKT's contractors, are of utmost importance in order to achieve SFM within DTCand maintain our FSC-certified status. As for the contractors and their staff, KPKKT provides the necessary support and incentives for training initiatives by, for instance, roping-in the contractors

concerned into our training programmes aimed at enhancing knowledge and skills in field techniques.

KPKKT is committed to employing local Malaysian citizens into its workforce. The same requirement also applies to all contractors engaged by KPKKT to conduct various work within DTC. This is in line with current policies of the Federal and State Governments. Effective from January 2020, all contractors are required to subscribe to the Employee Insurance System (Sistem Insurans Pekerja) under PERKESO.

Table 5.

Courses, Seminars, In-Service Trainings and Field Visits Organised for KPKKT Staff and Contractors During 2018 and 2019

No	Date & Duration	Course Title	Venue	Participation
1	13 Dis. 2018 (1 day)	Bengkel Berkaitan Economic Cutting & Yield Regulation	KPKKT	Kakitangan KPKKT
2	28 – 29 Nov 2018 (2 days)	MBRS for the Preparation of Financial Statement	Regency Waterfront Hotel, K.T.	1. Nor Mohd Sharif B. Ali @ Jali 2. Roslida Bt Muda
3	25 Nov. 2018 (1 day)	National Tax Seminar	Primula Beach Resort	1. En Suhairi Sulong; 2. Nor Mohd Sharif B. Ali @ Jali 3. Roslida Bt Muda
4	23 Oct 2018 (2 days)	Group Business Recovery Plan 2019	Sutra Beach Resort	1. En Suhairi Sulong; 2. Zulkefly Mohd Sanusi 3. Nor Mohd Sharif B. Jali @ Ali 4. Zulkefli Safie 5. Arnina Rahmad 6. Mohamad Yusof 7. Roslida Muda
5	18 Oct. 2018 (1 day)	Program Keselamatan Bersama Jab. Bomba dan Penyelamat	KPKKT	1. Semua Kakitangan KPKKT 2. Semua Kontraktor
6	11 Oct. 2018 (2 days)	Managing Discrimination at the Workplace	Hotel Istana KL	1. En Suhairi Sulong; 2. Nor Mohd Sharif B. Jali @ Ali 3. Roslida Muda
7	9 Oct 2018 (1 day)	Pengurusan Pekerja Asing	ILP, Kuala Terengganu	1. Nurhariyanti Kayat; 2. Siti Rohani Fauzizs
8	2 Oct 2018 (1 day)	Disciplinary Procedure and Domestic Inquiry	Quinara Al Safir, Tok Jembal	Management Staff
9	22 Sept. 2018 (1 day)	Lawatan Ke Chengal Besar	Pasir Raja PRF	KPKKT Staff
10	22 Sept 2018 (1 day)	Golden Ride	KT	Management Staff
11	30 – 31 Jul 2018 (2 days)	MTR 2018	Darul Iman Training Centre, Kemaman	Management Staff
12	29 – 31 Jul 2018 (3 days)	Seminar For Emergency Response Team	Jab. Bomba & Penyelamat, Wakaf Tapai	1. Mohd Khairully Anwar bin Sakaria @Zakaria 2. Tun Muhammad Amrie Bin Tun Razak
13	7 Sept 2018 (1 day)	EIA (Second Schedule) for Projek Ladang Hutan Komersil	Dept Environment, Putrajaya	1. En. Suhairi Sulong; 2. Arnina Rahmad; 3. Osmadi Othman; 4. Nurhariyanti Kayat.
14	27 Sept 2018 (1 day)	World Tourism Day	KT	Selected Staff

15	19 Sept 2018 (1 day)	Conference on Accounting, Business & Economics 2018	UMT	En Suhairi Sulong
16	19 Aug 2018 (1 day)	Stakeholder Consultation	UiTm Dungun	Management Staff, Supervisors & Contractors
17	20 Aug 2018 (1 day)	FSC Mentoring	UiTM Dungun	Staff & Contractors of KPKKT & Pesama
18	29 Jan 2019 (1 day)	Bengkel Pemantapan Pengeluaran Kayubalak & Kursus Asas Pertolongan Cemas serta Latihan CPR	Hotel UiTM Dungun	1. Semua Staff KPKKT 2. Kontraktor Pembalakan
19	3 Apr 2019 (1 day)	Bengkel Protokol dan Etika Sosial	Wisma Terengganu Inc., Chendering, K. T	Semua Staf Pengurusan KPKKT
20	8 Mei 2019 (1 day)	Kursus Enterprise Risk Management (ERM)	Wisma Terengganu Inc., Chendering, K. T	1. En Suhairi B Sulong 2. Zulkifly B. Sanusi 3. Nor Mohd Sharif B Jali 4. Pn Nurul Saerah Bt Ibrahim 5. Ab. Basir B. Ali
21	9-11 July 2019 (3 days)	International Conference on Tropical Forest Science 2019	Hotel Promenade, Kota Kinabalu	En Suhairi B Sulong
22	24 July 2019 (1 day)	Workshop on FSC Malaysia National Forest Stewardship Standards (NFSS).	FSC Malaysia Office	1. Pn Arnina Bt Rahmad 2. Osmadi B. Othman 3. Khairul Nizam B Jamaluddin
23	28 Aug 2019 (1 day)	Taklimat Drp Lembaga Perkhidmatan Kewangan Labuan	Wisma TI, Chendering, K. Terengganu	1. En Suhairi B Sulong 2. Nor Mohd Sharif B Jali
24	5 Sept 2019 (1 day)	Taklimat mengenai Protes, Aduan, Rungutan dan Chain of Custody (CoC)	KPKKT	Semua Kakitangan KPKKT
25	1 Oct 2019 (1 day)	Kursus Pemantapan Perlaksanaan RIL	Pusat Edu-Tourism Sg Menyala, Port Dickson	1. Musa B Sulong (KPKKT) 2. Tengku Alias B Tg Mat Rani (Kepala Hutan) 3. Mohd Saifudin B Zainuddin
26	8 Oct 2019 (1 day)	Kursus Latihan Keselamatan dalam Pekerjaan dan Teknik Tebangan Berarah	Base Camp Komp. 60, HSK Jengai	1. Pekerja Kontraktor KPKKT 2. Pekerja KPKKT
27	14 – 15 Oct 2019 (2 days)	Kursus Financial Modelling in Excel	TDM Berhad, Bang. UMNO Terengganu	1. Nor Mohd Sharif B. Ali @ Jali 2. Roslida Bt Muda
28	29 Oct 2019 (1 day)	Taklimat Mengenai Perjanjian Kontrak Bukan Perkhidmatan Kepada Kontraktor/ Majikan	KPKKT	1. Kontraktor Pengeluaran 2. Kontraktor Pengangkutan 3. Kontraktor Pembangunan 4. Kontraktor Tapak Semaian 5. Kontraktor Pembersihan 6. Pekerja KPKKT
29	4 Nov 2019 (1 day)	Seminar Pengurusan Risiko Kebakaran Jab. Bomba dan Penyelamat, Tereangganu	Permai Hotel, K. Terengganu	1. Mas Khomidin B Mas Hassan 2. Mohd Nawi Abas
30	18 Nov 2019	FSC Mentoring	Permai Hotel, K. Terengganu	Kakitangan KPKKT
31	19 Nov. 2019	Stakeholders Consultation	KPKKT	Kakitangan KPKKT, Local Stakeholders

3. MANAGEMENT STRATEGY AND TIMBER RESOURCE BASE

3.1 Management Strategy

The 6 Permanent Reserved Forests (PRFs) that make up DTC stand as follows: (1) Jengai PRF (51,840 ha), (2) Besul PRF (6,270 ha), (3) Jerangau PRF (9,810 ha), (4) Pasir Raja Barat PRF (6,547 ha), (5) Pasir Raja Selatan PRF (31,712 ha), and (6) Besul Tambahan PRF (518 ha); giving a total of 106,697ha of which 70,000ha falls under the "productive" category. The latter is being presently managed in the second rotation of the Selective Management System (SMS) of 30 years and estimated to have a timber standing stock of 32 – 45m^3/ha.

These forests are still rich in various tropical timber species including:
(1) Balau, (2) Balau laut merah, (3) Balau membatu, (4) Chengal, (5) Keruing, (6) Kempas, (7) Merbau, (8) Meranti nemesu, (9) Meranti bukit, (10) Meranti seraya, (11) Meranti sengkawang merah, (12) Meranti rambai daun, (13) Meranti kepong, (14) Keruing, (15) Meranti tembaga, (16) Resak, (17) Damar hitam, (18) Damar minyak, (19) Kapur, (20) Keladan, (21) Mersawa, (22) Meranti sarang punai, (23) Meranti melantai, (24) Meranti langgong, (25) Gerutu, (26) Meranti paang, (27) Nyatoh, (28) Sepetir, (29) Bintangor, (30) Durian, (31) Jelutong, (32) Kedondong, (33) Kembang semangkok, (34) Giam, (35) Kulim, (36) Merawan, (37) Melunak, (38) Merpauh, (39) Medang, (40) Simpoh, (41) Mengkulang, (42) Meranti bumbong, (43) Meranti belang, Kelat, as well as a host of "miscellaneous species".

In terms of its long term management strategy, KPKKT continues to embrace and practise the Malaysian Selective Management System (SMS) to manage the mixed dipterocarp forest within DTC. The company's commitment to remain viable while at the same time maintain its FSC-certified status, remains unchanged. These can be summarised as follows:
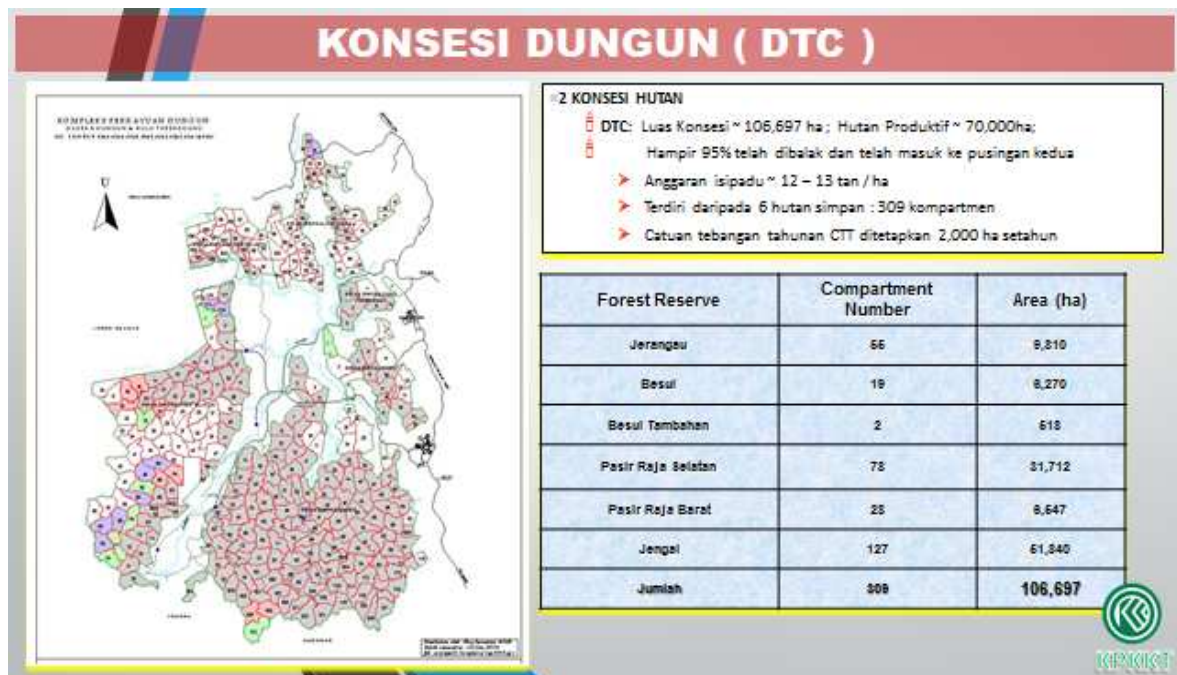

Fig. 8. Dungun Timber Complex (DTC), showing Permanent Reserved Forests (PRFs) and forest compartments.

1. Strict adherence to and proper implementation of the prescriptions laid out in the Forest Management Plan and guided by the Terengganu State Forestry Department.

2. Commitment to reducing the impact of logging on the natural environment by protecting residual Potential Crop Trees (PCTs), regeneration, biodiversity, soil, water resources, habitats and high conservation value forest (HCVF) and the human environment

3. Maintenance of ecology and the ratio of dipterocarp vs non-dipterocarp species in the residual stands as in the original forest composition

4. Commitment towards maximum utilisation of timbers and minimisation of wastes

5. Continued investment in developing Reduced/Low Impact Logging (RIL) methodologies,

6. Provision of necessary training and mentoring programmes to staff and contractors along with supervision on the ground on regular basis.

7. Management of the Concession Area as a self-sustaining, multiple-use FMU

8. A full subscription to all FSC's Principles and Criteria for SFM.

9. Commitment towards employing local citizens, particularly those from the surrounding communities into KPKKT's workforce.

3.2 Forest Function Mapping and Forest Zoning

The natural forests within DTC have been generally and conveniently classified into functional classifications as defined in the National Forestry Act of 1993 (see Table 5). Over the years KPKKT had performed accordingly and never breached this functional zoning.

Table 6. Forest Functions in DTC in relation to the Functions Defined in the NFA1993.

National Forest Policy 1992		National Forestry Act 1993	Forest Zonation in Dungun Timber Complex (DTC)	% DTC Area
Production Forest		Sustainable timber prodn.	Timber Production (TP)	67%
Protection Forest	Soil protection	Soil protection	Soil Protection (SP)	14%
			Soil Conservation (SC)	37%
		Soil reclamation	-	-
	Flood control	Flood control	Flood Control Conservation (WFC)	-
	Safeguarding of water resources	Water catchment	Water Catchment Conservation (WCC)	37%
			Riparian Buffer Protection (WBP/ HCVF)	18%
	Preservation of biodiversity	Wildlife Sanctuary	Rare Ecosystem Protection (HCVF)	-
		Virgin Jungle Reserve	Protected Area Buffer (HCVF)	1%
	Climate amelioration	-	-	-
Amenity Forest	Recreation	Amenity	e.g. Chemerong Waterfall	<1%
	Ecotourism	-	e.g. Chemerong Waterfall	<1%
	Public awareness	-	-	-
Research and Education Forests (added in Rev. 1992)		Research	e.g Compts. 51 & 54 of Jengai FR.	<1%
		Education	e.g. Compartment 52 of Jengai FR.	<1%
		Forest for federal purposes	-	-

3.3   Timber Production from Harvesting Under the Selective Management System (SMS)

Sustainable Forest Management (SFM) programme under the SMS involves a series of operations and activities which could be generalised in the following order:
- (1) Forest Planning which include Pre-Felling Inventory and Determination of Minimum
  Diameter Cutting Limits,
- (2) Field (Pre-Felling) Operation and Preparation of Site, including boundary marking, siting
  and building of access road and other forest infrastructure along with appropriate mitigation measures, tree marking, etc.
- (3) Closely supervised Selective Felling following the reduced impact logging (RIL) and
  directional felling specifications,
- (4) Timber sorting and haulage,
- (5) Forest development and rehabilitation, and
- (6) Priming the residual stand for the next rotation.

Table 7 lists all the forest compartments that had been licensed for selective logging under SMS over the years 2013 – 2019, along with the volume of harvest allowed/ permitted from each compartment in an effort to ensure its sustainability through to the next rotation. Table 4 shows the result of benefit-cost analysis for the years 2014 – 2019 which show that KPKKT had successfully maintained BCA ratios of greater than 1.0 consistently, year after year. However the best performance was achieved in 2014 during which the BCA ratio was 2.28, whilst the lowest was in 2017 when its value was only 1.00.

**Table 7: List of Forest Compartments That Were Licensed for Selective
Timber Harvesting During 2013 – 2019**

Year	No.	Compartment	Luas (Ha)	License No.	Dates License Effective	Allowable Timber Production (M^3)
2013	1	37 Jengai	120	L3005/2013	19/03/2013 - 18/03/2014	8,160.00
	2	9 Besul	339	L3006/2013	15/04/2013 - 14/04/2014	14,780.39
	3	2B Besul	484	L3008/2013	10/07/2013 - 09/07/2014	19,917.11
	4	40 Jengai	363	L3009/2013	06/08/2013 - 05/11/2014	10,710.82
	5	98 Pasir Raja (B)	255	L2018/2013	24/09/2013 - 23/09/2014	13,961.67
	6	42 Jengai	411	L3013/2013	22/09/2013 - 21/09/2014	17,040.87
	Total		**1,972**			**84,570.86**
2014	1	39 Jengai	309	L3008/2014	06/03/2014 - 05/03/2015	14,970.60
	2	41 Jengai	489	L3012/2014	30/03/2014 - 29/03/2015	15,271.58
	3	33 Jengai	381	L3013/2014	10/07/2014 - 09/07/2015	20,371.83
	4	32 Jengai	371	L3014/2014	13/07/2014 - 12/07/2015	14,940.45
	5	104 Jerangau	186	L2010/2014	24/09/2014 - 23/09/2015	8,628.74
	6	51A Pasir Raja (S)	53	L3025/2014	28/12/2014 - 27/12/2015	3,604.00
	Total		**1,789**			**77,787.20**
2015	1	63 Jengai	357	TS 01-05-15	22/02/2015 - 21/02/2016	10,713.00
	2	62 Jengai	378	TS 01-07-15	05/05/2015 - 04/05/2016	11,411.64
	3	7 Besul	92	TS 01-09-15	18/08/2015 - 17/08/2016	5,506.79
	4	43 Jengai	414	TS 01-12-15	27/12/2015 - 26/12/2016	14,844.60
	5	51B Pasir Raja (S)	162	TS 01-10-15	27/12/2015 - 26/12/2016	12,873.15
	Total		**1,403**			**55,349.18**
2016	1	6 Besul	312	TS 01-09-16	15/02/2016 - 14/02/2017	12139.52
	2	61 Jengai	403	TS 01-11-16	16/06/2016 - 15/12/2017	14,066.35
	3	44 Jengai	417	TS 01-21-16	01/11/2016 - 30/04/2018	21,176.28
	4	8A Besul	350	TS 01-22-16	15/11/2016 - 14/11/2017	9,340.26
	5	99 Jerangau	377	TB 01-24-16	15/12/2016 - 14/06/2018	15,344.28
	6	100 Jerangau	89	TB 01-22-16	01/10/2016 - 31/03/2018	4,660.27

		Total	**1,948**				**76,726.96**
2017	1	8B Besul	225	TS 01-14-17	01/07/2017 - 30/06/2018		7,089.63
	2	64 Jengai	366	TS 01-15-17	15/07/2017 - 14/07/2018		12,498.73
		Total	**591**				**19,588.36**
2018	1	10 Besul	413	TS 01-01-18	01/01/2018 – 31/12/2018		14,141.21
	2	65 Jengai	444	TS 01-03-18	01/01/2018 – 31/12/2018		21,066.26
	3	15 Besul	382	TS 01-10-18	15/4/2018 – 14/4/2019		14,344.79
	4	16 Besul	393	TS 01-11-18	15/4/2018 – 14/4/2019		15,326.28
	Total		**1,632**				**64,878.54**
2019	1	60 Jengai	382	TS 01-02-19	01/01/2019 – 31/12/2019		23,449.72
	2	11 Besul	365	TS 01-03-19	01/01/2019 – 31/12/2019		10,516.58
	3	45 Jengai	395	TS 01-07-19	01/01/2019 – 31/12/2019		20,055.46
	4	66 Jengai	460	TS 01-16-19	01/06/2019 – 31/05/2020		15,396.42
		Total	**1,602**				**69,418.18**

Table 8: Revenue & Costs for the Period 2014 – 2019

Year	ΣRevenue, MYR	ΣCost, MYR	B/C Ratio
2014	47,691,221.00	20,929,291.00	2.28
2015	16,859,822.00	16,456,841.00	1.02
2016	16,802,830.00	14,648,186.00	1.15
2017	17,386,825.00	17,380,630.00	1.00
2018	29,952,067.96	23,762,663.07	1.26
2019	22,150,816.60	16,924,213.55	1.31

3.1 Forest Types and Composition Before and After Selective Logging

The forests in DTC comprises the climatic climax natural moist TRF formations consisting of a series of **(1)** lowland mixed dipterocarp forests; **(2)** hill mixed dipterocarp forests; and **(3)** upper hill dipterocarp forests, all of which can be classified into the following forest types, *i.e.* based on emergent tree species dominance:

1. Kapur forests, which grow on low hills, concentrated in the east of DTC,
2. Meranti/ Keruing forests in the western part of Jerangau PRF, southern part of Besul PRF and the western part of Jengai PRF
3. Meranti/ Seraya forests which are found in the PRFs of Jengai, Pasir Raja Selatan and Pasir Raja Barat.

3.2 Forest Sub-types and Population Dynamics

Upon the completion of the first rotation under SMS, the second growth ecosystems exhibit the following general characteristics in species presence; arranged according to the order of abundance: Kelat > Dipterocarps > Simpoh & Medang > Kasai, Perah, Minyak Beruk, Penarahan & Nyatuh. Specifically, the different species and forest vegetation form alliances or forest sub-types in the following combinations (the most abundant species/ species groups being mentioned first):

(1) Kelat – Simpoh
(2) Dipterocarps – Kelat
(3) Mixed Kelat
(4) Kelat – Dipterocarps – Medang
(5) Dipterocarps – Kelat – Simpoh
(6) Kelat – Dipterocarps – Rengas
(7) Kasai – Medang
(8) Dipterocarps – Kelat – Perah
(9) Kelat – Dipterocarps – Minyak Beruk

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(10)   Kelat – Dipterocarps –Penarahan
(11)   Kelat – Dipterocarps – Nyatuh.

As a whole the second growth stands of DTC still maintain a reasonable presence of the Dipterocarp species, *i.e.* after having been successfully subjected to the dictates of the Malaysian Selective Management System (SMS) since about three decades ago. This finding goes to show that the management strategy to maintain a reasonable balance in the ratio of dipterocarp vs non-dipteroacrp both before and after selective logging has worked well. Under the classification adopted by the 2nd National Forest Inventory (NFI), the forests in DTC are identified as "**productive**" and "**non-productive**" based on topography, timber composition and stocking as well as economic and technical feasibility in harvesting (Table 9).

Table 9: Estimated Timber Stock By Forest Category During First Rotation (1983 – 2007)

Forest Category		Ha	Net Round Timber Yield, m3 /Ha	Est. Total Stocking, m3
Productive	Superior	25,731	63.00m^3	1,621,053m^3
	Good	19,625	54.00m^3	1,059,750m^3
	Moderate	41,036	45.00m^3	1,846,620m^3
Total Productive		**86,392**	**53.63m^3**	**4,633,398m^3**
Non-Productive	Poor , Upper hill, Disturbed	22,508	17.50m^3	393,890m^3

Fig. 9 . Dungun Timber Complex: General Forest Type Classification as of 2002

15
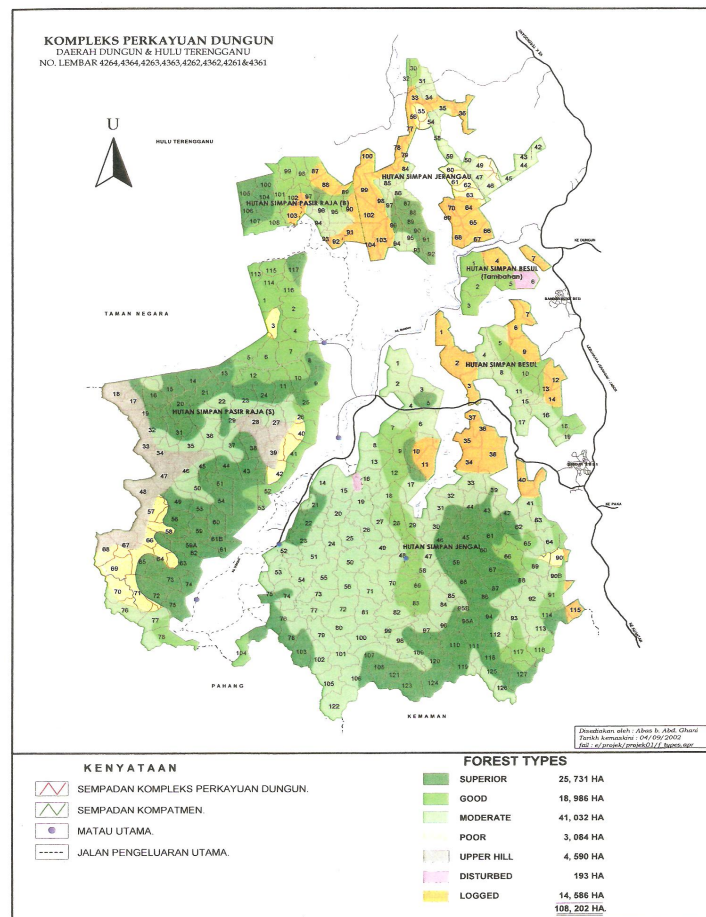
Table 10. Forest Classification Based on NFI

CATE-GORY	GENERAL DISTRIBUTION	MAJOR SPECIES	EXPECTED NET TIMBER YIELD, m³/ha
PRODUCTIVE FOREST			
Superior Forest	In areas with topography 1,000m asl or less.	Seraya, Red MT, DRM, Balau, Kapur, Chengal, Kelat.	Dip.>60cm Ø: **44.4**m³/ha; NDip. >45cm Ø: **38.**1m³/ha.
Good Forest	(i) Besul Tambahan PRF (ii) Pasir Raja Utara PRF (iii) Scattered in clumps in Jengai PRF	Red MT, KR, Seraya, Balau, Kapur, Chengal, KLT	Dip >60cm Ø: **24.1**m³/ha, NDip. >45cm Ø: **41.2** m³/ha
Moderate Forest	Mostly in Jengai PRF	Red MT, KR, KPS, KD, KLT	Dip. >60cm Ø: **17.2**m³/ha NDip. >45 cm Ø: 1**7.1** m³/ha
Poor Hill Forest	(i) In the lowlands of Jerangau PRF (ii) Southwest of Pasir Raja PRF	Mainly trees of Non Dipterocarps	Dip >60cm Ø + NDip. >45cm Ø : **27.9**m³/ha
NON-PRODUCTIVE FOREST			
Upper Hill Forest	(i) Found only in Pasir Raja PRF bordering Taman Negara (ii) in the middle of Pasir Raja PRF	Dark Red Meranti, small trees of low quality	Dip. >60cm Ø + NDip.>45cm Ø: 12.2m³/ha.
Disturbed Forest	(i) Former shifting cultivations, (ii) along river valleys, (iii) areas logged prior to 1966	Red Meranti, Kempas, Kedondong, Medang, Kelat	Dip. >60cm Ø + NDip. >45cm Ø: 34.5 m³/ha.
Logged Forest	(i) Areas that had been logged before Concession Agreement came into effect in 1984		

Table 11. Standing Regeneration Stocking (# /ha) by "Age/ YEAL" in Jengai PRF.
(Note (1) on sizes: Sapling = 150cm Ht <5cm DBH; Small Pole = 5<15cm DBH; Big Pole = 15<30cm DBH; Small tree = 30<45cm DBH; Timber tree = >45cm DBH).
(2) YEAL = **Y**ears **E**lapsed **A**fter **L**ogging, taken here to mean "age" of forest stand since last logging.

YEAL[1]	Dipterocarps					Non Dipterocarps (Regeneration Species)				
	Saplings	Small Poles	Big Pole	Small Trees	Timber Trees	Sapling	Small Poles	Big Poles	Small Trees	Timber Trees
13	1,482	58	10	11	3	254	19	7	5	2
12	2,696.5	34	13.5	9	7.5	892	34.5	11	8	4
11	2,261	25	8	6	2	999	44	13	6	1
10	2,017	20	5	6	0	1,179	30	11	7	3
9	1,506.8	25.25	7.75	6	4	1,523.5			5.5	2.5
8	1,213.3	22.1	6.1	4.8	3.6	1,606.1			7.9	4.3
7	1,144.7	23.33	5.3	4	2.7	2,055			8.3	3.7
6	1,015	22	6.5	5	5	2,421			12.5	6
5	1,021	19.25	4.75	3.8	4	1,823			9.3	6.8
3	1,924	37	8	5	5	2,854	86	23	12	11
2	1,794	28.5	6.5	7.5	5	2,001.5		15	7.5	3
1	1,092	22	7	5	4	1,249	41	11	8	3

Source: summarised from Muziol *et al.* (1999)

3.3   Timber Resource Inventory of Production Forest

3.3.1   Diameter Distribution and Volume

(a)   Virgin Forest
In virgin stands, the number per ha of regeneration and trees follows the reverse-J pattern, reducing, with the increase in size in the following order: around *12,000 - 16,000 seedlings* (HEIGHT 15.0 - < 150.0 cm); *2,000 saplings* (HEIGHT 150.0CM - < DBH 5.0cm); *330 small poles* (DBH 5.0 - <15.0cm); *120 big poles* (DBH 15.0 - <30.0cm); *28 small trees* (DBH 30.0cm - <45.0cm); and *15 timber trees* (DBH >45.0cm). In total there were about 1,000 trees above 5.0cm DBH per ha, around half of which were commercial. The proportion (*percentage of number*) of commercial trees was high in the seedling stage with 60% falling to 45 % in the sapling and small pole stages, but then steadily increasing to over 80% amongst the largest trees. The fall in the proportion of dipterocarps from 30% in the seedling stage to 7% in saplings is steeper, indicating their high seedling mortality. The percentage of dipterocarp volume slowly increased to 20% until rising sharply to 60% in the size classes above 60cm DBH.

(b)   *Regeneration in relation to Logging Strata (YEAL):*
In a virgin stand there was an average of nearly 20,000 – 30,000 seedlings of all tree species per ha. During the first two to three years after logging, as a result of the sudden opening of the upper canopy trees, the number of seedlings would dramatically increase to around 40,000 per ha. This number would later experience a consistent reduction whereby, after five years they would be reduced by 25% of the original virgin stocking; then increased to some 15% in the next 10 years, reaching 110% in the period beginning from 15 years after logging, more in the untouched stand. A very similar development takes place with the saplings which accounted for an average of more than 4,000 saplings per ha. In the 5 years after logging this is reduced by 10%; in the next 10 years increased again by 10%; and reached 130% later on.

(c)   *Gross Volume in relation to Logging Strata:*
After logging the volume of small poles (DBH 5.0 <15.0 cm) was reduced from around 20m^3 by 15%, and increased to more than 120% after 5 years. The reason for the higher densities in older logged forest compared to virgin forest in the three smaller size classes was the increase of light in the lower forest strata after logging. In big poles (DBH sizes: 15.0cm to <30.0cm), logging damage apparently had more long-term effect: the relatively high initial volume (compared to the next two higher size classes) of 80m^3/ha in virgin stand was reduced by 20%. The effect in trees with a DBH 30.0 < 45.0cm and 45 < 60 cm is similar, but less strong (50m^3 stays reduced by around 10%). The volume of loggable trees above 60cm is reduced dramatically from 140m^3 in virgin stand to only 40% immediately after logging (Table 3.5).

Table 12. Total Volumes, m^3/ha in Stands of Different YEAL (Years Elapsed After Logging)

YEAL	MANAGEMENT SYSTEM	STANDING VOLUME, m^3/HA	
		TOTAL VOL., m3/ha	DIPTEROCARP VOL., m3/ha
0 (Virgin Forest)		340	260
<10	SMS	220	150
10 < 15	SMS	240	170
15 < 20	SMS	245	170

(c) **Proportion of Species Groups in relation to Logging Strata:**

Table 13. Seedlings and Saplings Analysed over Time after Logging

Logging Status	SEEDLINGS (HEIGHT 15cm – 150cm)				SAPLINGS (>150cm Ht- <5cm DBH)			
	N/ha	Comparison	No of dipterocarps/ ha	Proportion (%) of Dipterocarps	N/ha	Comparison	No. of dipterocarps/ ha	Proportion (%) of Dipterocarps
Virgin stand (YEAL = 0)	26,408	100%	7,535	28.5%	4,152	100%	304	7.3%
YEAL = <10yrs	19,866	75%	2,568	2.9%	3,751	90%	508	13.5%
YEAL 10 - <15 yrs	23,572	89%	4,631	19.6%	4,048	97%	616	15.2%
YEAL = 15 - < 20 yrs	28,965	110%	10,172	35.1%	5,463	132%	828	15.2%

Table 14: Trees & Regeneration (i.e. Poles and Small Trees)

LOGGING STATUS (YEARS ELAPSED AFTER LOGGING (YEAL)		SMALL POLES (DBH 5.0<15.0CM)			BIG POLES (DBH 15.0<30.0CM)			SMALL TREES, (DBH 30.0<45CM)		
		All species	Dipterocarp	% Dipterocarp	All species	Dipterocarp	% Dipterocarp	All species	Dipterocarp	% Dipterocarp
YEAL = 0	N/ha	739	69	9%	218	24	11%	42	7	17%
	Vol, m^3/ha	20.7	1.5	7%	81.3	8.7	11%	47,7	8.6	18%
YEAL = < 10 YRS	N/ha	663	41	6%	172	14	8%	37	5	14%
	Vol, m^3/ha	17.7	1.1	6%	59.3	5.7	9%	42.4	6.6	16%
YEAL = 10 - <15 YRS	N/ha	795	77	10%	189	19	10%	43	6	14%
	Vol, m^3/ha	27.5	2.6	9%	67.5	7.0	10%	46.0	7.9	17%
YEAL = 15 - <20 YRS.	N/ha	893	134	15%	182	22	12%	42	9	21%
	Vol, m^3/ha	26.6	4.1	15%	67.8	8.4	12%	41.9	11.0	26%
YEAL = 20	N/ha	n.a.	n.a.	n.a.	34.1	2.3	6.7%	36.4	6.8	18.7%
	Vol. m^3/ha	n.a.	n.a.	n.a.	5.5	0.4	7.3%	22.8	5.6	24.6%
YEAL = 32	N/ha	n.a	n.a.	n.a.	110	12.5	11.4%	75	12.5	16.7%
	Vol. m^3/ha	n.a	n.a.	n.a.	22	1.3	5.9%	39.3	8.1	20.6
YEAL = 43	N/ha	n.a	n.a	n.a	157.5	22.5	14.3%	82.5	15	18.2%
	Vol. m^3/ha	n.a	n.a.	n.a	28.9	3.7	12.8%	33.8	7.5	22.2%

n.a. = not available.

**Table 15.** Potentially Loggable Trees (i.e. with DBH 45cm ++), and Total of All Trees with DBH 15cm ++

Y.E.A.L.		DBH 45.0 <60.0 CM			DBH 60.0CM++			ALL TREES WITH DBH >15.0CM		
		All Speces	Dipterocarps	Proportion (%) of dipterocarps	All Species	Dipterocarps	Proportrion (%) of Dipterocarps	All Species	Dipterocarps	Proportion (%) of Dipte-rocarps
YEAL = 0	N/ha	18	4	22%	18	9	50%	1,035	112	11%
	Vol, m³/ha	**48.1**	**12.1**	**25%**	**139.5**	**84.9**	**61%**	**337.2**	**115.9**	**34%**
YEAL = <10 YRS	N/ha	17	3	18%	9	3	33%	898	66	7%
	Vol, m³/ha	**43.6**	**9.7**	**22%**	**57.8**	**25.3**	**44%**	**220.8**	**48.4**	**22%**
YEAL = 10 - <15	N/ha	19	4	21%	10	3	30%	1,056	109	10%
	Vol, m³/ha	**43.8**	**10.3**	**24%**	**56.4**	**21.6**	**38%**	**241.2**	**49.4**	**20%**
YEAL = 15 - <20	N/ha	20	5	25%	11	4	36%	1,150	175	15%
	Vol, m³/ha	**45.9**	**12**	**26%**	**65.2**	**27.2**	**42%**	**247.4**	**62.7**	**25%**
YEAL = 20	N/ha	38.6	9.1	23.6	64	27	42.2%			
	m³/ha	**53.3**	**23.9**	**44.8**	**360.9**	**237.7**	**65.9%**			
YEAL = 32	N/ha	32.5	0	0	50	15	30.0%			
	m3/ha	**27.2**	**0**	**0**	**155.1**	**85.4**	**55.1%**			
YEAL = 43	N/ha	50	20	40.0%	35	2.5	7.1%			
	m³/ha	**60.5**	**25.5**	**42.2%**	**96.6**	**11**	**11.4%**			

3.3.2a. Seedlings

Figure 10. Bar Charts showing distribution/ ha of seedlings and saplings.

Y.E.A.L.	SEEDLINGS				SAPLINGS			
	0	15 - <20	10 - <15	< 10	0	15 - <20	10 - <15	<10
Non Dipterocarps	18,873	18,793	18,941	17,298	3,848	4,635	3,430	3,243
Dipterocarps	7,535	10,172	4,631	2,568	304	828	616	508

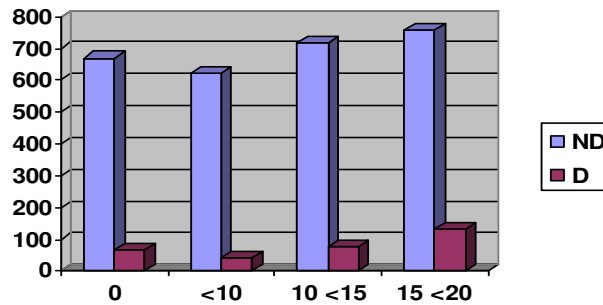* YEAL for virgin forest is taken as = 0
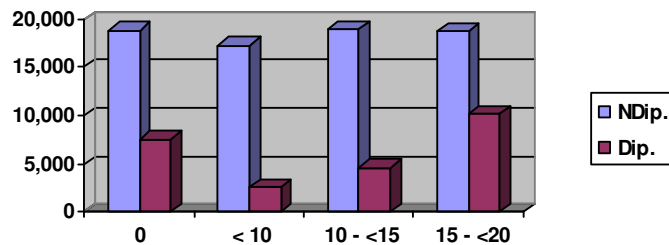
3.3.2b. Saplings
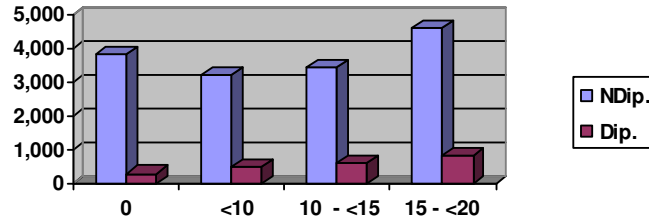
3.3.3a. Poles

Figure 11. Bart Chart showing distribution of poles and small trees

	Small poles: 5.0 - <15.0cm DBH				Big Poles: 15.0 - <30.0cm DBH				Small Trees: 30.0 -< 45.0cm DBH						
YEAL	15<20	10<15	<10	0	15<20	10<15	<10	0	43	32	20	15<20	10<15	<10	0
ND	759	718	622	670	160	170	158	194				33	37	32	35
D	134	77	41	69	22	19	14	24				9	6	5	7

D = Dipterocarps; ND = Non-dipterocarps

3.3.4a.   Trees 45.0 <60.0cm DBH

Figure 12. Bar Chart Showing the Distribution of Trees with DBH 45.0cm ++

	TREES 45.0 - <60.0CM DBH				TREES > 60.0CM DBH			
YEAL	15<20	10<15	<10	0	15 < 20	10 >15	<10	0
ND	15	15	14	14	7	7	6	9
D	4	5	4	3	4	3	3	9

D = Dipterocarps; ND = Non-Dipterocarps
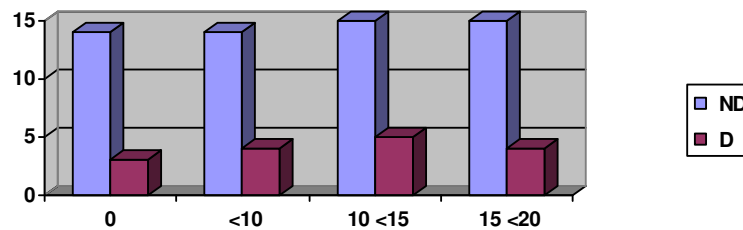
3.3.4b. Trees >60cm DBH
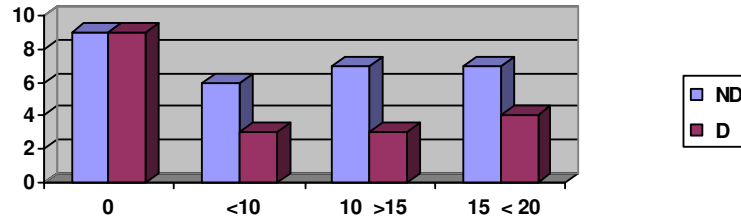
Figure 13. Volume of all trees with DBH 5cm ++

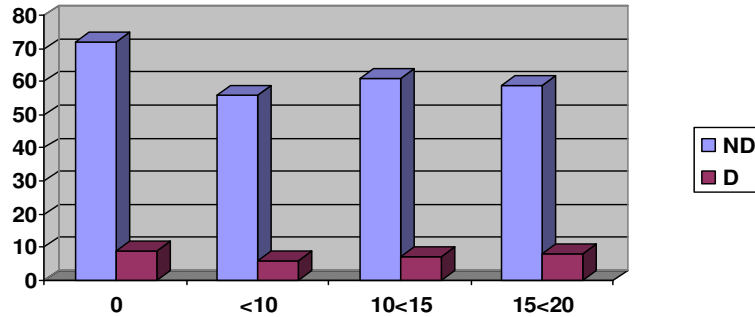| YEAL	Primary Forest	<10	10 - <15	15 - <20
5<15	21	18	28	27
15<30	81	59	68	68
30<45	48	42	46	42
45<60	48	44	44	46
>60cm	140	58	56	65
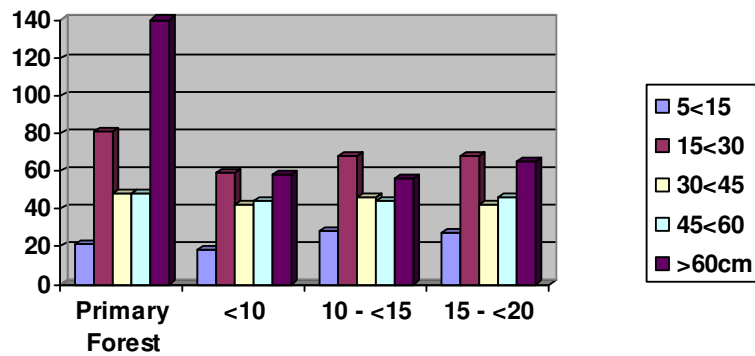
Figure 14.   Volume of trees with DBH 5.0cm - < 15cm

YEAL	0	<10	10<15	15<20
ND	20	17	15	22
D	2	1	3	4

21
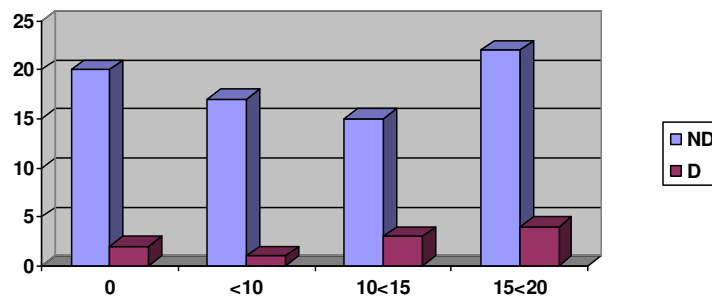
Figure 15. Volume of trees with DBH 15.0 - < 30.0cm

YEAL	0	<10	10<15	15<20
ND	72	56	61	59
D	9	6	7	8

Figure 16. Volume of trees with DBH 30.0 - < and 45.0 cm

YEAL	0	<10	10<15	15<20
NDip	39	36	38	31
Dip.	9	7	8	11
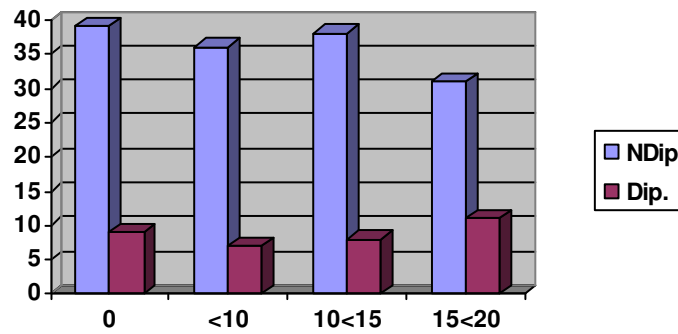
Figure 17. Volume of trees with DBH between 45 and 60 cm, m3/ha

YEAL	0	<10	10<15	15<20
Non Dip	36	33	34	34
Dipt.	12	10	10	12
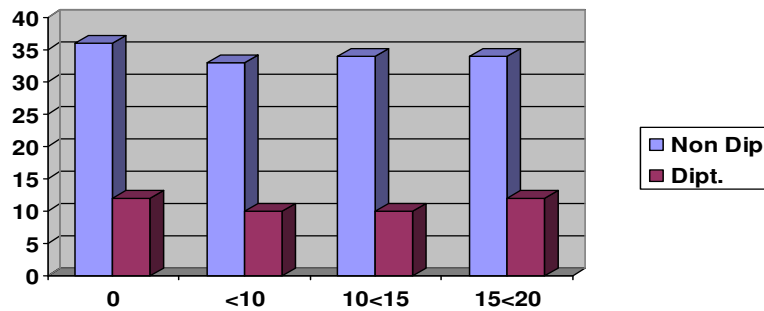
Figure 18.   Volume of trees with DBH above 60cm, in m3/ha

YEAL	0	<10	10<15	15<20
Non Dip.	55	33	35	38
Dipt.	85	25	22	27
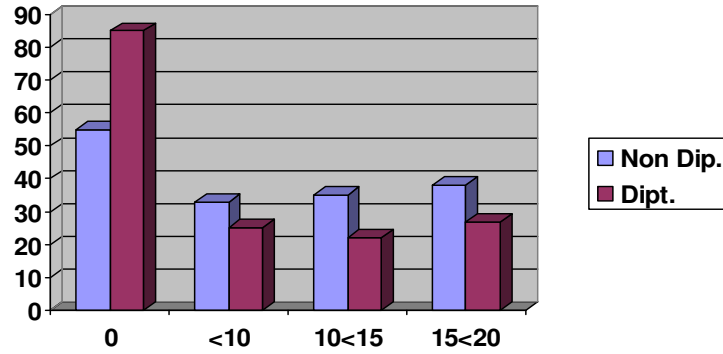
3.4   Species Composition

The timber outturn data in Table   show that dipterocarp volume comprised about 57.46% of the total timber produced. Among the non-dipterocarps include Merbau, Kempas, Mengkulang, Nyatoh, Jelutong, Sepetir, Durian, etc. Table   shows that the net volume of timber that can be extracted from the second growth forest vary very widely, from 33.9m^3/ha in C6B Jengai PRF to a high 76.45m^3/ha in C95 Pasir Raja PRF.

Table 16. Summarises the volume statement of several selected forest compartments

| No.	Compartment & PRF	Minimum DBH Cutting Limits	EXPECTED NETT VOLUME, m3	
			m³/ha	Total, m³/ha
1	C94 Jerangau PRF (L2036/2011 (H.S))	Dipterocarp: 65cm Non Dip: 55cm Chengal: 70cm	39.61 27.83 00.09	67.53
2	C6B Jengai PRF (L3010/2012 (H.S))	Dipterocarp: 65cm Non Dip: 55cm Chengal: 70cm	13.93 19.97 00.00	33.90
3	C95 Pasir Raja Barat PRF (L2029/2010 (H.S))	Dipterocarp: 65cm Non Dip. 55cm Chengal: 70cm	38.31 32.73 5.41	76.45
4	90 Pasir Raja Barat PRF (L2006/2011 (H.S))	Dipterocarp: 65cm Non Dip.: 55cm Chengal: 70cm	22.34 22.27 00.74	45.35

3.5   Quality of Poles

The quality and future potential of poles was determined by the health and quality of the bole and the vigour of the crown, and divided into three classes, as shown in the following Table 3.11. According to the results of the FMI, 90% of the dipterocarp poles and 80% of the commercial non-dipterocarp poles are of good quality (see chart below), and could therefore be regarded as potential crop trees (PCTs).

Table 17.   Pole Quality Classes

Pole Quality	Tree Part	Criteria
Good	Bole	Gun barrel. Bole straight and cylindrical; minor defects are acceptable (e.g. slight bend of bole or superficial bark damage). Ideal for use as peeler logs for veneer and plywood.
	Crown	Crown more or less well developed
Medium		Bole and crown neither "good" nor "bad" (intermediate). Timber suitable for use as saw logs.
Bad	Bole	Bole strongly bent, crooked or leaning and/ or with large bark damages down to the cambium, deep wounds beyond the cambium, or rot and/ or with large rotting or dead branches.
	Crown	Crown heavily damaged.

Figure 19. Quality of poles (small: 5-15cm dbh) and big (15 – 30cm dbh)

| Quality Category	Small poles; Dipt., %	Small poles: Non-Dip, %	Big poles: Dipt. %	Big poles: Non—Dips. %
Bad	0.4	0.8	0.5	2
Medium	9.8	20.9	9.9	17.7
Good	89.7	78.3	89.6	80.3
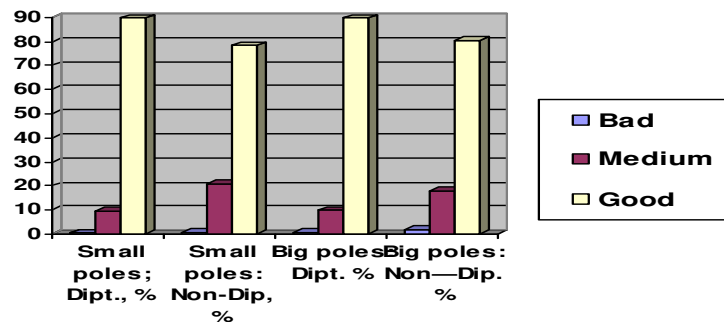
3.6 Quality of Timbers

The whole stem was divided into 5m logs, starting from the clear bole above the stump up to the base of the crown. The number of logs was counted and the quality of each log determined by its straightness and by visible defects, if any (see **Table 3.12** below). Around 80% of all commercial logs of trees with dbh above 30cm were found to be straight and bear no visible defects. The most common defect is swept logs.

Table 18: Log Quality Classes

Log Quality Class	Indicators
Veneer/ prime log	• Straight • No visible defects

Saw log	• Straight to swept
	• With 1-3 of the following minor defects:
	  1. up to 4 live branches with diameter <5cm
	  2. minor swellings
	  3. superficial bark damage, or deeper wounds that are likely to heal
	  4. climbers that slightly affect tree form and growth.

Utilisable log	Crooked and/or slightly defective:
	• with more than 3 minor defects
	• or with 1 of the following major defects:
	  1. 4 or more live branches with a diameter <5cm
	  2. live or dead branches with diameter >5cm
	  3. big swellings
	  4. large bark damages down to the cambium
	  5. signs of rot, e.g. consoles of polyporous fungi
	  6. climbers that strongly affect tree form and growth

Not utilisable log	Crooked and Strongly defective: with more than one major defect

Figure 20. Timber quality of trees with dbh above 30cm

	Dipterocarps, %	Non-Dipterocarps, %
Crooked/ defective	0	0
Crooked/ minor defects	0.9	0
Crooked/ no defects	1.5	0.3
Swept/ defective	0.1	0.1
Swept/ minor defects	2.1	2.5
Swept/ no defects	10.9	7.3
Straight/ defective	0.1	0.4
Straight/ minor defects	5.2	6.1
Straight/ no defects	79.1	83.4
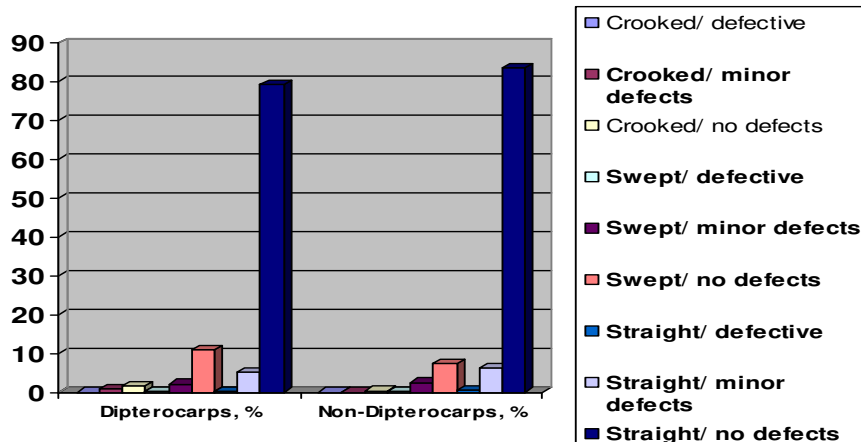
3.7   Non-Timber Forest Produce (NTFP)

The NTFPs referred to include rattan, bamboo, palms and ornamental plant species which can be of economic value. Palms have an average density of 30 stems or clumps per ha, including bertam (*Eugeissona triste*). Rattan species occur with a frequency of 25 stems or clumps per ha. Bamboos are less common at 7/ha.

Table 19. Occurrence of non-timber forest produce in the Concession Area (densities per ha).

RATTAN				25.1/HA			
A: Rotan manau (*Calamus mannan*)	B: R. manau tikus (*Calamus tumidus*)	C: R. sega (*Calamus caesius*)	D: R. semambu (*Calamus scipionum*)	E: R. dok (*Calamus ornatus*)	F: R. dahan (*Korthalsia spp.*)	G: others, dbh >4cm	H: other, dbh <4cm
3.3	2.0	2.8	0.1	0.4	0.1	2.7	13.7
BAMBOO			7.2/HA				
A: Buluh semantan/ rayah/ gala/ paao/ seremai/ telur (*Gigantochloa scortechinii*); B. beti/ raga (*G. wrayi*)	B: B. beting/ bisa/ berang (*G. levis);* B. betung/ pering (*Dendrocalamus asper*)	C: B. semeliang/ semenyih (*Schizostachyum grande*); B. dinding/ kasap/ telur/ pelang/ nipis/ (*S. zollingeri*); B. tali/ akar (*Dendrocalamus pendulus*)		D: B. tumpat (*Gigantochloa ligulata*)		E: other species with maximum dbh >5cm	F: other species with maximum dbh <5cm
1.6	1.3	2.0		0.0		1.3	1.1
PALMS				30.2/HA			
A: Bertam (*Eugeissona tristis*)		B: Bayas (*Oncoperma horridum*), Nibung (O. f*lagellarium*)		C: Nipah (*Nypa fruticans*)		D: Other species	
11.0		4.2		0.3		14.7	

3.4 Botanical Surveys

KPKKT continues to be committed to explore, study and learn as much as possible about the multitude of forest resources, its biodiversity, ecology and ecosystems within DTC, and build and expand the knowledge base and knowhow, the view of utilising such knowledge to improve and move forward in its SFM and conservation of the forest resources. Knowledge and understanding of the flora and fauna is gained through collaboration with outside organization and agencies including FRIM, MNS, WWF Malaysia, NFSC, UMT as well as private consultants.

During 2018 and 2019 a series of botanical survey were conducted in compartment no. 17 of Besul PRF wherein a project on "Intensive Forest Management" was being undertaken necessitating the "rescue operation" of botanical species of interest. During the survey a total of 200 species from 122 genera and 64 families of trees, shrubs, herbs, vines and palms were identified and collected. Among them 2 species were new records for Peninsular Malaysia as well as Terengganu, namely ***Dipterocarpus confertus*** and ***Shorea cf. havilandii***. Based on the survey, it was confirmed that the richest family is Dipterocarpaceae, coming mainly from 5 genera namely Dipterocarpus, Dryobalanops, Hopea, Shorea and Vatica.

3.4.1   Living Collection for Ex situ Conservation

A total of 195 living specimens of wildings from 24 families of plants had been rescued during the expedition. The collections are made of trees as well as non-trees. These included a total of 75 wildings of Dipterocarps and 26 Zingiberaceae, 22 Gesneriaceae, along with small numbers of other species (see Table 20).

Table 20. List of families and number of wildings collected from Compt. 17, Besul PRF

No.	Family	No. of Wildings Collected
1	Annonaceae	3
2	Araceae	2
3	Arecaceae	4
4	Aristolochiaceae	2
5	Asparagaceae	3
6	Bombacaceae	10
7	Calophyllaceae	2
8	Celastraceae	1
9	Clusiaceae	1
10	Cyperaceae	5
11	Dipterocarpaceae	75
12	Ebenaceae	1
13	Euphorbiaceae	2
14	Gesneriaceae	22
15	Hypoxidaceae	1
16	Maranthaceae	2
17	Myristicaceae	2
18	Myrtaceae	9
19	Nepentaceae	7
20	Orchidaceae	5
21	Pentaphragmataceae	22
22	Polygalaceae	1
23	Selaginelaceae	7
25	Zingiberaceae	26
	Total	**195 individuals**

The two new records *Dipterocarpus confertus*, *D. concavus*, along with *Shorea cf havilandii*, *Kostermansia malayana* and *Hopea mengarawan*, are categorised as Threatened by IUCN and the Malaysian Red List (VU), whereas *Dipterocarpus lowii* has been classified as Near Threatened (NT) and *Hopea kerangaensis* Endangered

Table 21. Endemic Plant Species in Jengai & Besul PRF (Updated List, Dec. 2019)
Key: PM = Peninsular Malaysia; Trg = Terengganu; * = New finding in Terengganu;
A = Cpt 76,78,79 (11 years elapsed after logging); B = Cpt 63 (24 YEAL); C = Cpt 6 (27 YEALs)

No.	Species	Vernacular name	Family	Endemic to:	Locality
1	*Eugeissona verticillaris*	Rotan Sabong	Palmae	PM	B, C
2	*Pinanga scortechinii*	Pinang Hutan	Palmae	PM	B,C
3	*Scaphochlamys breviscarpa*	-	Zingiberaceae	PM, Trg	C
4	*Scaphochlamys laxa*	-	Zingiberaceae	PM	A,C
5	*Anisophyllea reticulata*	Delex	Anisophylleaceae	PM*	A, B
6	*Cyathocalyx pruniferus*	Antoi	Annonaceae	PM	A,C
7	*Enicosanthum fuscum*	Mempisang	Annonaceae	PM	A
8	*Vatica scortechinii*	Resak Langgong	Dipterocarpaceae	PM	A,B,C
9	*Diospyros argentea*	Kayu Arang	Ebenaceae	PM	C
10	*Diospyros nutans*	Kayu Arang	Ebenaceae	PM	B
11	*Diospyros penangiana*	Kayu Arang	Ebenaceae	PM*	B, C
12	*Ptychopyxis caput-medusae*	Rambai Hutan	Euphobiaceae	PM	B
13	*Ptychopyxis costata var. oblanceolata*	Mendaroh	Euphobiaceae*	PM*	A,B,C
14	*Lithocarpus curtisii*	Mempening	Fagaceae	PM	A
15	*Hydnocarpus filipes*	Setumpol	Flacourtiaceae	PM	A,B,C
16	*Hydnocarpus kunstleri var. tomentosa*	Setumpol	Flacourtiaceae	PM	C
17	*Henckelia miniata*	-	Gentianaceae	PM, Trg	A,B,C
18	*Henckelia puncticulata*	-	Gentianaceae	PM	A,B,C
19	*Kayea elegans*	Penaga	Guttiferae	PM*	B,C
20	*Callicarpa maingayi*	-	Labiatae	PM	A,C
21	*Bauhinia bidentata subsp. bidentata*	-	Leguminosae	PM	A,B,C
22	*Oxyspora bullata*	Senduduk	Melastomataceae	PM*	A,B,C
23	*Ficus deltoidea var. trengganuensis*	Mas Cotek	Moraceae	PM	C
24	*Ficus mollisima*	Ara	Mo0raceae	PM*	A,B
25	*Ardisia kunstleri*	-	Myrsinaceae	PM*	A,B
26	*Embelia canescens var. canescens*	-	Myrsinaceae	PM*	C
27	*Syzygium politum*	Kelat	Myrtaceae	PM*	C
28	*Aporosa globifera*	Sebasah	Phyllanthaceae	PM*	A,C
29	*Diplospora lasiantha*	-	Rosaceae	PM	B
30	*Hypobathrum venulosum*	-	Rubiaseae	PM	A,B
31	*Psychotria griffithii*	-	Rubiaceae	PM	A,B
32	*Saprosma glomerulata*	Sekentut	Rubiaceae	PM	C
33	*Tarenna maingayi*	-	Rubiaceae	PM*	A,B
34	*Timonius wrayi*	-	Rubiaceae	PM	A,B
35	*Pentace grandefolia*	Melunak	Tiliaceae	PM, Trg	C
36	*Pentace strychnoidea*	Melunak	Tiliaceae	PM	B
37	*Areca ridleyana*		Arecaceae	PM	Basul 17
38	*Pinanga simplicifrons*		Arecaceae	PM	Besul 17
39	*Pinanga malaiana (Mart.) Scheff.*		Arecaceae	PM	Besul 17
40	*Shorea cf. havilandii Brandis*	Selangan batu pinang	Dipterocarpaceae	PM	Besul 17
41	*Dipterocarpus confertus Slooten*	Keruing kobis	Dipterocarpaceae	PM	Besul 17

3.5 Wildlife Management

Similarly, in the aspect of wildlife management, KPKKT enjoys strong support namely from PERHILITAN, as well as the Terengganu State FD and WWF-Malaysia etc. Fig. 21 shows a summary of KPKKT's activity as of 2019 by way of camera trapping whereby several achievements were noteworthy.   These were in addition to the existing dossier of information at our disposal. Wildlife management, protection and conservation within DTC continues to be undertaken by KPKKT as an on-going project.

Fig. 21. Wildlife Management within DTC During 2019: Results from Camera-trapping activity.

Table 22.

Mammal Species Identified in Jengai Permanent Reserved Forest (PRF) During 2011
Survey

Common name	Scientific Name	Protection Status	Status	
			IUCN	CITES
Large Indian civet	*Viverra zibetha*	TP	NT	III
Malay civet	*Viverra tangalunga*	TP	LC	NL
Malayan porcupine	*Hystrix brachyura*	P	LC	III
Pig-tailed macaque	*Macaca nemestrina*	P	VU	II
Long-tailed macaque	*Macaca fascicularis*	P	LC	II
Banded langur	*Presbytis femoralis*	P	NT	II
White handed gibbon	*Hylobates lar*	TP	EN	II
Common barking deer	*Muntiacus muntjak*	P	LC	NL
Lesser Mouse deer	*Tragulus javanicus*	P	DD	NL
Wild pig	*Sus scrofa*	P	LC	NL
Malayan tapir	*Tapirus indicus*	TP	EN	I
Asian elephant	*Elephas maximus*	P	EN	I
Smooth otter	Lutra perspicillata	TP	VU	NL
Malayan sun bear	*Helarctos malayanus*	P	VU	I
Asiatic wild dog	*Cuon alpinus*	TP	EN	I
Leopard cat	*Prionailurus bengalensis*	TP	LC	I
Leopard	*Panthera pardus*	TP	NT	I
Asiatic Golden cat	*Catopuma temminckii*	TP	NT	II
Malayan tiger	*Panthera tigris jacksoni*	TP	EN	I

Key:

EN – Endangered	VU- Vulnerable	TP- Totally Protected
VU – Vulnerable	LC – Least Concern	P- Protected
NT - Near threatened	DD - Data deficient	NL- Not listed

Table 23. Avifauna species, their protection & conservation status, location and relative density.

[Key: Besul (T) = Besul (Tambahan) forest reserve, P = protected, IUCN = IUCN Red List of Threatened Species 2010, VU = vulnerable species, NT = Near Threatened species. Appx. 1 = Appendix 1 (CITES). Refer to Appendix 1 for scientific name and species number. Relative density: 40-50 = fairly high, 20 - 30 = medium, 10-20 = fairly low, 5-10 = low, 1-5 = extremely low. Note: density estimate given as a general guide]

NO.	Species common Name/Family	P	IUCN	CITES	Forest reserve	Relative density
Phasianidae						
1	FERRUGINOUS PARTRIDGE	TP	NT		Jengai	1
2	Malaysian Peacock Pheasant	TP	VU		Jengai, Besul	3
3	Great Argus	TP	NT		Jengai	2
Accipitridae						
4	Lesser Fish Eagle	TP	NT		Jengai, Besul	7
5	Grey-headed Fish Eagle	TP	NT		Jengai	1
Psittacidae						
6	Blue-rumped Parrot	TP	NT		Jengai, Besul	27
Cuculidae						
7	Short-toed Coucal	TP	VU		Besul	1
8	Chestnut-bellied Malkoha	TP	NT		Jengai	3
9	Black-bellied Malkoha	TP	NT		Besul	1
Trogonidae						
10	Scarlet-rumped Trogon	TP	NT		Jengai	2
Alcedinidae						
11	Rufous-collared Kingfisher	TP	NT		Jengai	1
Bucerotidae						
12	Black Hornbill	TP	NT		Jengai, Besul, near Cp. J37/B3? (Sg. Jengai)	18
13	Great Hornbill	TP	NT	Appx. 1	Jengai	2
14	Rhinoceros Hornbill	TP	NT		Jengai	17
15	Helmeted Hornbill	TP	NT	Appx. 1	Jengai	2
16	White-crowned Hornbill	TP	NT		Jengai, Besul	5
17	Wrinkled Hornbill	TP	NT		Jengai	4

Megalaimidae						
18	Red-crowned Barbet	TP	NT		Jengai	5
19	Red-throated Barbet	TP	NT		Jengai	3
20	Yellow-crowned Barbet	TP	NT		Jengai, Besul	2
Picidae						
21	White-bellied Woodpecker			Appx.1	Jengai, Besul	5
22	Olive-backed Woodpecker	TP	NT		Near border of Cp. J37/B3?	1
23	Great Slaty Woodpecker	TP	VU		Jengai, Besul	7
Eurylaimidae						
24	Green Broadbill	TP	NT		Jengai, Besul	7
25	Black-and-yellow Broadbill	TP	NT		Jengai, Besul, Besul (T)	16
Pittidae						
26	Garnet Pitta	TP	NT		Jengai	2
Aegithinidae						
27	Green Iora	TP	NT		Jengai, Besul	32
Campephagidae						
28	Fiery Minivet	TP	NT		Jengai, Besul, Besul (T)	8
Corvidae						
29	Crested Jay	TP	NT		Jengai	1
30	Black Magpie	TP	NT		Jengai, Besul	14
Pycnonotidae						
31	Black-and-White Bulbul	TP	NT		Jengai	1
32	Grey-bellied Bulbul	TP	NT		Jengai, Besul, Besul (T)	7
33	Puff-backed Bulbul	TP	NT		Jengai, Besul	17
34	Buff-vented Bulbul	TP	NT		Jengai, Besul, Besul (T)	25
35	Streaked Bulbul	TP	NT		Jengai, Besul	10
Timaliidae						
36	Brown Fulvetta	TP	NT		Jengai, Besul	5
37	Black-throated Babbler	TP	NT		Jengai	2
38	Chestnut-rumped Babbler	TP	NT		Jengai, Besul	6
39	Fluffy-backed Tit-Babbler	TP	NT		Jengai, Besul, Besul (T)	27
40	Sooty-capped Babbler	TP	NT		Besul	2
41	White-chested Babbler	TP	NT	Jengai, near border of Cp. J37/B3 (Sg. Jengai)		3
42	Striped Wren-babbler/ Kenopia	TP	NT		Jengai	2
Chloropsidae						
43	Lesser Green Leafbird	TP	NT		Jengai, Besul	8

4.   SILVICULTURE

KPKKT continues to adopt a pragmatic policy with regard to the silviculture of the managed TRF stands, in line with the dictates of SMS and contemporary thinking on TRF resource management. Residual stands are regenerated through natural means as well as controlled artificial regeneration in the form of Open Area Planting (*Tanaman Kawasan Lapang* - TKL) while selective harvesting takes care of the larger sized regeneration and pole-sized trees.

4.1   Selective Harvesting as a Form of Silvicultural Treatment

KPKKT subscribes to the view that selective harvesting of trees combined with RIL and directional felling, judiciously planned and carried out in an environmentally-benign manner could pass as being equivalent to a silvicultural treatment. This is by virtue of the fact that such operation incorporates the following:

   (i)   a network of well-constructed and uncompacted network of skid trails which forms a convenient and well-distributed network of fertile germination beds for wildings ideal for enrichment planting and open-area planting (TKL);

   (ii)   the use of appropriate RIL methods and machines which would lead to controlled and minimal amount of damage and compaction to the soil and disturbance to the forest ecology,

   (iii)   the practice of directional felling; and

(iv) use of a well-trained and motivated workforce who ensures that harvesting activities are done professionally and to the desired specifications and standards.

4.2   Forest Regeneration and Mother Trees

The SMS considers a forest as being regenerated, if there was a sufficient number of individuals above the prescribed SMS stocking standards in all size classes up to 45cm DBH. Our observation and surveys have shown that this requirement was well met and there were sufficient young regeneration (up to the size 45.00cm DBH), as well as mother trees in residual stands of all ages.

4.3   Open/ Disturbed Area Planting (*Tanaman Kawasan Lapang (TKL)*)

Tanaman Kawasan Lapang (TKL) activities conducted within DTC during 2019 can be summarised in the following points:

- Total area subjected to TKL activities was spread over a total Felling Coupe of 2,173ha ha.
- Total number of seedlings planted as of Dec. 2019 stood at 27,500 seedlings at a rate of 13 seedlings/ha.
- Average cost of planting remained at RM2.03 / seedling excluding the cost of raising the seedling in our forestry nursery in Compt 52 Jengai PRF.
- Species planted comprises the following:
  (1) Meranti rambai daun, (2) Meranti tembaga, (3) Balau, (4) Keruing, (5) Gerutu, (6) Meranti langgung, (7) Merawan, (8) Meranti melantai, (9) Meranti nemesu.

The different species were   planted at different spacings depending on the degree of openness of the site and hardness of the soil; as well as the slope condition.   The seedlings were either produced in KPKKT's nursery located in Compartment 52 of Jengai PRF, or procured through contract suppliers which complement those seedlings supplied by the TSFD. KPKKT keeps records on the areas planted as well as the tending treatments conducted up to 4 years after planting. Attempts will be made to update the records and monitor the growth performance of the plantings.

Table 24. Summary of Tanaman Kawasan Lapang Activities during 2019

BIL	TARIKH TANAM	KPT	LUAS	SPESIS DAN KUANTITI		JUMLAH POKOK
1	13-01-19	48 H.S Cerul (Ts -01-08-18)	248 ha	Mt.R. Daun	1500	3000
				Mt. Tembaga	500	
				Mt. Melantai	1000	
2	22-01-19	65 H.S JENGAI (TS 01-03-18)	444ha	Mt. Rambai Daun	2500	6500
				Mt. Tembaga	1000	
				Mt. Melantai	1000	
				Balau	1000	
				Gerutu	1000	
3	10-05-19	15 H.S BESOL (TS 01-10-18	382ha	MT. R. Daun	2500	5000
				MT. Tembaga	1500	
				Mt. Melantai	500	
				Balau	500	
4	12-06-19	16 H.S BESOL (TS 01-11-18	392ha	MT.Nemesu	2000	6000
				MT. Tembaga	1000	
				Mt. Melantai	1000	
				MT. Langgong	1000	
				Keruing	1000	
5	10-09-19	18 H.S	313ha	MT. R. Daun	1000	4000

		BESOL (TS 01-01-19)		*Balau*	*1000*	
				Keruing	*1000*	
				MT. Langgong	*1000*	
6	*10-09-19*	*102 H.S JRG (TB 01-01-19)*	*394ha*	*Mt. Tembaga*	*1000*	*3000*
				Mt. Melantai	*1000*	
				MT.Nemesu	*1000*	

5.0   GROWTH AND YILEDS

5.1   Permanent Sample Plots (PSPs)

A total of 4 new PSPs had been established as follows, to replace the old set of PSP which have become disused and unmanageable.

1. Compartment 6, Besul Forest Reserve
2. Compartment 9, Besul Forest Reserve
3. Compartment 5, Jengai Forest Reserve, and
4. Compartment 7, Jerangau Forest Reserve

All PSPs are 1 ha in size each. General findings show that there were on average, a total of 526 trees $\geq$ 10 cm dbh consisting 152 tree species identified from 49 families. Of the total individuals, 17 tree species are from Dipterocarp group while 135 tree species are from non-dipterocarp group such as Euphorbiaceae, Myrtaceae, Lauraceae and others.

5.1   Tree composition

Ten leading tree species from for each plots were listed out as in Table 25 whereby *Saraca thaipengensis* (Plot 1), *Syzygium sp.* (Plot 2) and *Aglaia spp.* (Plot 3 and 4) were found to be present in highest density in all PSPs.

Table 25: The Four PSPs with their respective ten leading tree species

Plot	Species	Tree density (tree/ha)
1	1.*Saraca thaipengensis*	52
	2.*Vitex pinnata*	36
	3.*Syzygium sp.*	36
	4.*Pellacalyx saccardianus*	32
	5.*Psychotria sp.*	16
	6.*Gironniera nervosa*	16
	7.*Timonius wallichianus*	12
	8.*Aporosa sp.*	12
	9.*Aglaia spp.*	12
	10.*Shorea pauciflora*	12
2	1.*Syzygium sp.*	60
	2.*Palaquium sp*	40
	3.*Calophyllum sp.*	32
	4.*Xylopia ferruginea*	24
	5.*Polyalthia sp.*	20
	6.*Aporosa sp.*	20
	7.*Shorea hopeifolia*	20
	8.*Drybalanops oblongifolia*	16
	9.*Pentace sp.*	16
	10.*Knema sp.*	16
3	1.*Aglaia spp.*	40
	2.*Palaquium sp*	36
	3.*Pellacalyx saccardianus*	28
	4.*Pentace sp.*	24
	5.*Poyalthia sp.*	24

Plot	Species	Tree density (tree/ha)
	6.*Litsea sp.*	24
	7.*Shorea macroptera*	16
	8.*Syzygium sp.*	16
	9.*Shorea ovalis*	12
	10.*Neolamarkia cadamba*	12
4	1.*Aglaia spp.*	40
	2.*Syzygium sp.*	36
	3.*Macaranga gigantea*	32
	4.*Glochidion sp.*	24
	5.*Macaranga hypoluca*	24
	6.*Poyalthia sp.*	20
	7.*Aporosa sp.*	20
	8.*Endospermum didianum*	16
	9.*Nephelium sp.*	16
	10.*Scorodocarpus borneensis*	16

5.2 Non-tree forest products

Among herbaceous plants there were *Labisia pumila* (Kacip Fatimah), *Polyalthia bullata* (Tongkat Ali Hitam), *Tacca integrifolia* (Janggut Adam) and *Thottea grandiflora* (Hempedu beruang). These are summarised as in Table26.

Table 26. List of non-tree forest products in all PSPs

No.	Local name	Species	Family	Status
1	Akar tapak kuda	*Bauhinia sp.*	Fabaceae	Climber
2	Paku gajah	*Cyathea latebrosa*	Cyatheaceae	Fern
3	Bakong	*Hanguana malayana*	Hanguanaceae	Herb
4	Bemban	*Donax grandis*	Marantaceae	Herb
5	Gajah beranak	*Goniothalamus sp.*	Annanoceae	Herb
6	Halia hutan	*Zingiber sp.*	Zingiberaceae	Herb
7	Halia hutan	*Hornstedtia sp.*	Zingiberaceae	Herb
8	Halia hutan	*Globba sp.*	Zingiberaceae	Herb
9	Hempedu beruang	*Thottea grandiflora*	Aristolochiaceae	Herb
10	Henkelia	*Henckelia sp.*	Gesneriaceae	Herb
11	Janggut Adam	*Tacca integrifolia*	Dioscoreaceae	Herb
12	Jenjuang	*Dracaenea sp.*	Dracaenaceae	Herb
13	Kacip Fatimah	*Labisia pumila*	Myrsinaceae	Herb
14	Keladi ular	*Alocasia denudata*	Araceae	Herb
15	Lemba	*Molineria latifolia*	Hypoxidaceae	Herb
16	Lerek	*Calathea lutea*	Marantaceae	Herb
17	Mengkuang	*Pandanus sp.*	Pandanaceae	Herb
18	Paku gajah lembik	*Angiopteris evecta*	Marattiaceae	Herb
19	Paku merak	*Selaginella willdenowii*	Selaginellaceae	Herb
20	Pandan tikus	*Mapania cuspidata*	Cyperaceae	Herb
21	Pisang hutan	*Musa sp.*	Musaceae	Herb
22	Selingsing	*Pandanus sp.*	Pandanaceae	Herb
23	senduduk bulu	*Clidemia hirta*	Melastomataceae	Herb
24	Serai kayu	*Syzygium sp.*	Myrsinaceae	Herb
25	Setawar putih	*Cheilocostus speciosus*	Costaceae	Herb
26	Tongkat Ali hitam	*Polyalthia bullata*	Annanoceae	Herb
27	Bayas	*Oncosperma horridum*	Arecaceae	Palm
28	Langkap	*Arenga westerhoutii*	Arecaceae	Palm
29	Palas	*Licuala spinosa*	Palmae	Palm
30	Pinang	*Iquanura sp.*	Palmae	Palm
31	Pinang legong	*Pinanga malaiana*	Palmae	Palm
32	Rotan cucur	*Calamus castaneus*	Arecaceae	Palm
33	Rotan dahan semut	*Korthalsia echinometra*	Arecaceae	Palm
34	Rotan jaharca	*Daemonorops geniculata*	Arecaceae	Palm

No.	Local name	Species	Family	Status
35	Rotan jelayan	*Calamus peregrinus*	Arecaceae	Palm
36	Rotan jernang	*Daemonorops sp.*	Arecaceae	Palm
37	Rotan Jernang dua daun	*Daemonorops didymorphylla*	Arecaceae	Palm
38	Rotan kerai hitam	*Calamus diepenhorstii*	Arecaceae	Palm
39	Rotan lilin	*Calamus javensis*	Arecaceae	Palm
40	Rotan manau	*Calamus manan*	Arecaceae	Palm
41	Rotan matang	*Plectocomia elongata*	Arecaceae	Palm
42	Rotan perut ayam	*Calamus rugosus*	Arecaceae	Palm
43	Rotan sabung	*Daemonorops verticillaris*	Arecaceae	Palm
44	Rotan sendang	*Daemonorops grandis*	Arecaceae	Palm
45	Rotan tai landak	*Daemonorops hystrix*	Arecaceae	Palm
46	Rotan tunggal	*Calamus sp.*	Arecaceae	Palm
47	Tukas	*Caryota mitis*	Arecaceae	Palm

Fig. 22: *Tacca integrifolia* (Janggut Adam)

Fig. 23: *Labisia pumila* (Kacip Fatimah)

Fig. 24: *Korthalsia echinometra* (Rotan dahan)

Fig. 25: *Hornstedtia sp.*(Halia hutan)

5.3   Tree density

The number of standing trees per ha amongst all study plots did not differ much (Figure 32). Small and juvenile trees were contributed a large number in Plot 2.However Plots 1 and 3 were found to contain large Dipterocarp trees and not in Plots 2 and 4.

Table 27: Tree density (trees/ha) of Dipterocarp and Non-dipterocarp groups based on
diameter classes

Plot No.	Dipterocarp (trees/ha)				Non-dipterocarp (trees/ha)				Total (trees/ha)
	10-30 cm	30-50 cm	50-70 cm	70+ cm	10-30 cm	30-50 cm	50-70 cm	70+ cm	
1	8	8	0	4	380	60	8	4	472
2	56	16	0	0	428	68	24	4	596
3	20	20	12	8	360	56	16	4	496
4	24	4	0	0	464	44	4	0	540
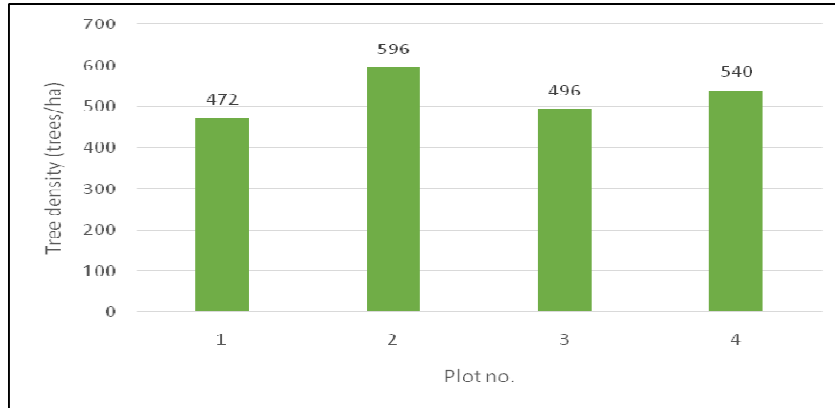
Figure 26: Total tree density (trees/ha) for each plot

Table 28: Tree density and percentage based on national minimum diameter cutting limit for
Dipterocarp ($\geq$ 65 cm) and Non-dipterocarp ($\geq$ 55 cm) groups

Plot No.	Dipterocarp (trees/ha)	Non-dipterocarp (trees/ha)	Total (trees/ha)	Percentage Dipterocarp (%)	Percentage Non-dipterocarp (%)
1	4	12	16	25.00	75.00
2	0	20	20	0.00	100.00
3	8	20	28	28.57	71.43
4	0	4	4	0.00	100.00
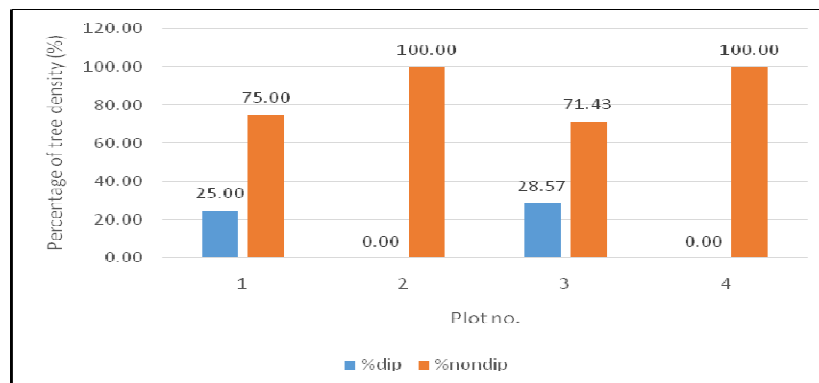
Figure 27: Percentage of tree based on minimum diameter cutting limit

36

5.4   Basal Area

Based on Table 6, Plot 3 recorded 35.47 m^2/ha which is the higher than Plot 2 (29.11 m^2/ha), Plot 1 (23.17 m^2/ha) and Plot 4 (17.44 m^2/ha). No big tree ($\geq$ 70 cm) was seen inside Plot 4. Figure 34 shows the general trend of basal area in the four PSPs.

Table 29: Basal area (m^2/ha) of Dipterocarp and Non-Dipterocarp groups based on diameter classes

Plot No.	Dipterocarp (m^2/ha)				Non-dipterocarp (m^2/ha)				Total (m^2/ha)
	10-30 cm	30-50 cm	50-70 cm	70+ cm	10-30 cm	30-50 cm	50-70 cm	70+ cm	
1	0.16	0.90	0.00	1.78	9.47	6.02	2.26	2.59	23.17
2	1.31	2.31	0.00	0.00	9.61	7.70	6.29	1.88	29.11
3	0.75	2.32	2.99	6.47	8.81	7.12	4.79	2.24	35.47
4	0.61	0.61	0.00	0.00	10.46	4.74	1.03	0.00	17.44
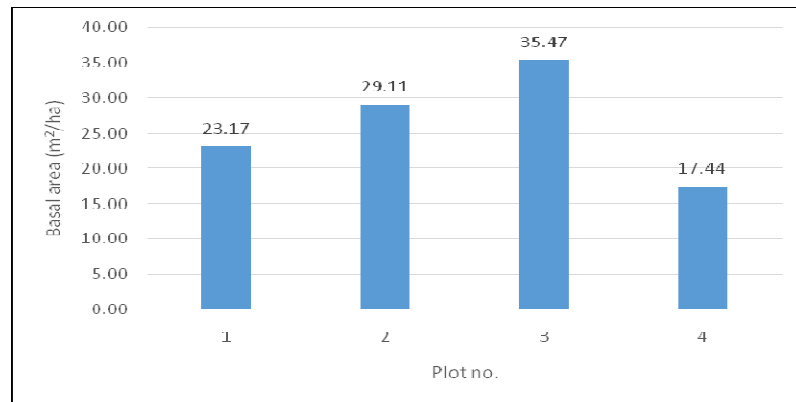
Figure 28: Total basal area (m^2/ha) for each plot

Table 30: Basal area based on national minimum diameter cutting limit for Dipterocarp ($\geq$ 65 cm) and Non-dipterocarp ($\geq$ 55 cm) groups

Plot No.	Dipterocarp (m^2/ha)	Non-dipterocarp (m^2/ha)	Total (m^2/ha)
1	1.78	4.85	6.62
2	0.00	6.47	6.47
3	6.47	7.03	13.50
4	0.00	1.03	1.03
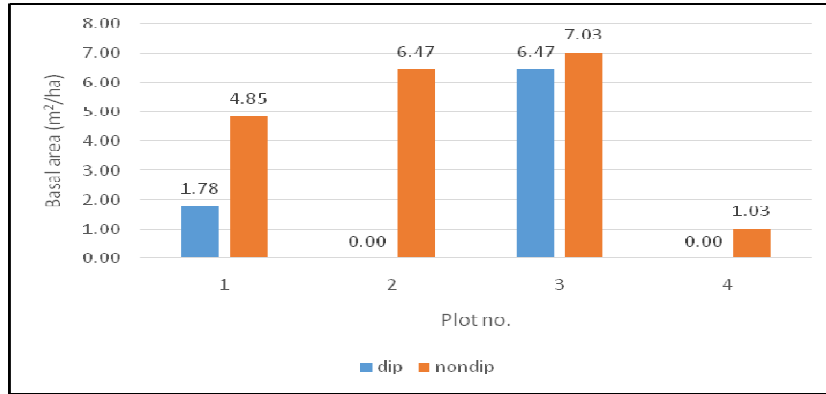
Figure 29: Basal area based on minimum diameter cutting limit

5.5   Tree Volume

Higher tree volume also found in Plot 3 (Figure 36). According to Figure 36, the trend of tree volume found similar as in basal area (Figure 34). In term of diameter classes analysis, the higher volume (95.38 m^3/ha) found in big dipterocarp trees (70+ cm) compared to non-dipterocarp group (37.91 m^3/ha) in Plot 3 as stated in Table 8. Meanwhile, big dipterocarp trees (more than 50 cm dbh) absent in Plot 4 where no volume calculated for diameter class 50-70 cm and 70+ cm.

Table 31: Tree volume (m^3/ha) of Dipterocarp and Non-Dipterocarp groups based on diameter classes

Plot No.	Dipterocarp (m^3/ha)				Non-dipterocarp (m^3/ha)				Total (m^3/ha)
	10-30 cm	30-50 cm	50-70 cm	70+ cm	10-30 cm	30-50 cm	50-70 cm	70+ cm	
1	1.53	8.28	0.00	32.34	66.64	56.45	31.37	18.52	215.13
2	12.37	27.49	0.00	0.00	83.49	82.65	81.11	35.48	322.60
3	7.59	29.70	46.03	95.38	69.38	75.59	70.48	37.91	432.07
4	5.35	8.66	0.00	0.00	62.53	34.40	12.74	0.00	123.69
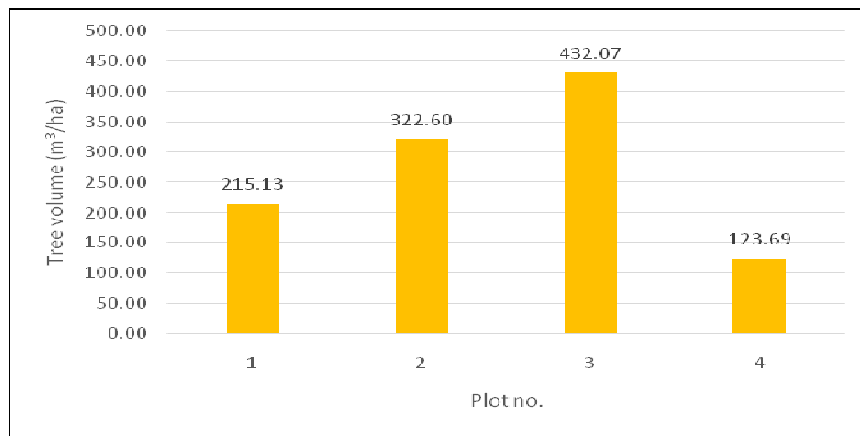
Figure 30: Total tree volume (m^3/ha) for each plot

By having a proper analysis on tree volume based on national minimum diameter cutting limit for Dipterocarp ($\geq$ 65 cm) and Non-dipterocarp ($\geq$ 55 cm) groups will facilitate concessionaire to plan the suitable procedure to log this area. Table 9 shows that the area of Plot 3 is having higher number of tree volume compared to other places. The non-dipterocarp group contributed the large number of tree volume in all PSPs. Higher number of tree volume based on minimum cutting limit recorded for non-dipterocarp trees in Plot 2 and 3 (Figure 37). However, plot 4 contains small portion of tree volume in this situation.

Table 32: Tree volume based on national minimum diameter cutting limit for Dipterocarp ($\geq$ 65 cm) and Non-dipterocarp ($\geq$ 55 cm) groups

Plot No.	Dipterocarp (m³/ha)	Non-dipterocarp (m³/ha)	Total (m³/ha)
1	32.34	49.89	82.23
2	0.00	95.59	95.59
3	95.38	108.39	203.77
4	0.00	12.74	12.74
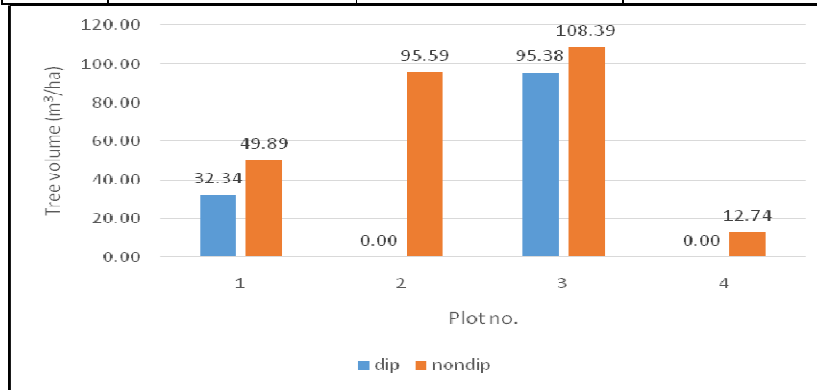
Figure 31: Tree volume based on minimum diameter cutting limit

5.6 Tree Mapping

Tree maps for all trees inside PSPs were displayed as in figures below:

Taburan pokok PSP Petak 1 (50m x 50m), Plot 1. Kompt. 9. H. S. Besul
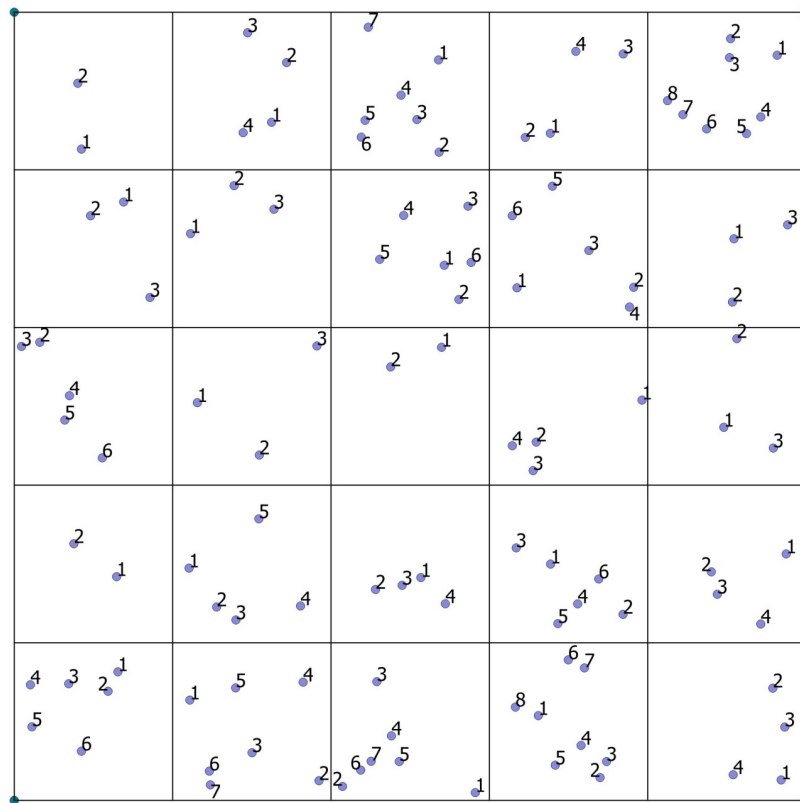
Fig. 32

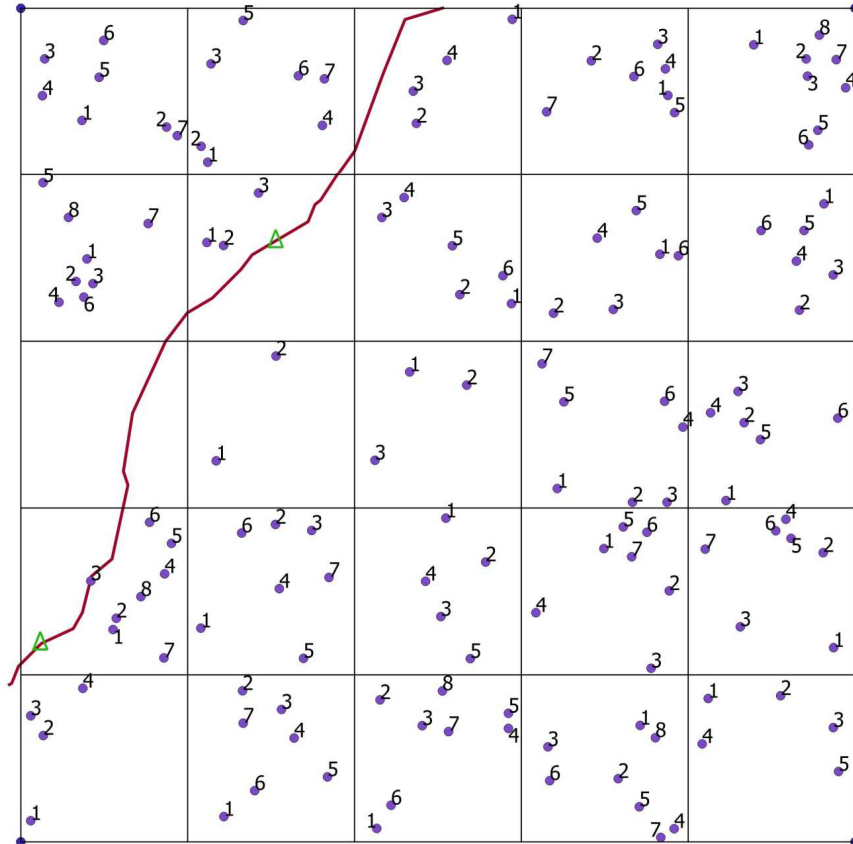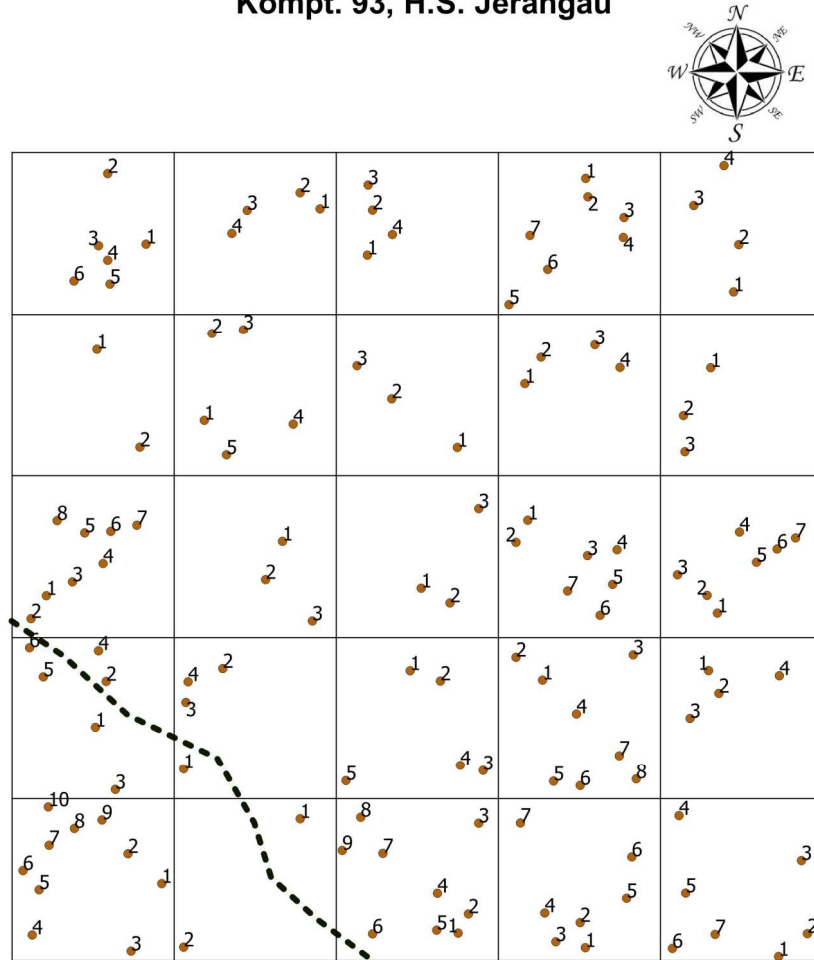## Taburan Pokok PSP Petak 2 (50 x 50m)
Kompt 5, H.S. Jengai

Fig. 33

Taburan Pokok PSP Petak 3 (50 x 50m)
Kompt. 6A, H.S. Besul

Fig. 34

Taburan Pokok PSP Petak 4(50mx 50m)
Kompt. 93, H.S. Jerangau

Fig. 35

6.0   RECREATION AND ECOTOURISM

The use of the forest concession for recreation and eco-tourism is set to increase in the future. The Chemerong Waterfall in the 418-ha Compt. 26 of Pasir Raja Selatan PRF, and located some 155 km from the airport in Kuala Terengganu and 77km from Dungun, the nearest major town; has attracted an estimated 1,000 tourists per year. This suggests a high potential for tourism development. In 1995 and early 1996 KPKKT spent RM110,000.00 to build access road and parking space. For further improvement, the Tourism Committee of Terengganu has endorsed a RM1 million contribution from government funds to develop the waterfall area into an attractive eco-tourism spot.

7.0   DEMARCATION AND CONTROL OF BOUNDARIES

KPKKT continues to assist, to the extent possible, and facilitate the work done by the Terengganu SFD to mark and clean forest boundaries within the Project Area. The work on forest boundaries follow the guidelines as specified in the Malaysian Forestry Manual and MC & I on cutting of boundary lines, marking of boundary trees, sequence of boundary inspection, replacement of missing beacons, *etc.*   In this connection construction of access roads and other relevant forest infrastructure continues to be undertaken by contractors with close supervision and control by KPKKT.

8.0   FOREST NURSERY

KPKKT's nursery is located within compartment 52 Jengai PRF covering an area of about 0.56 ha. located along the main road to Jengai PRF. This nursery has the capacity to accommodate a total of 40,000 tree seedlings at any one time. Species that are raised in this nursery include dipterocarp species such as *Neobalanocarpus heimii* (Chengal), *Shorea atrinervosa* (Balau), *Shorea multiflora* (Damar Hitam), *Parashorea* (Gerutu), *Hopea nutans* (Giam), *Dryobalanops aromatic* (Kapur), *Dipterocarpus spp* (Keruing), *Hopea pubescens* (Merawan bunga), *Hopea griffithii* (Merawan Siput Jantan), *Shorea platycaldos* (Meranti Bukit), *Shorea pauciflora*(Meranti Nemesu), *Shorea Acuminata* (Meranti Rambai Daun), *Shorea parvifolia*(Meranti Sarang Punai), *Shorea curtisii* (Meranti Seraya), *Shorea leprosula* (Meranti Tembaga) and Non Dipterocarp species such as *Callophylum biflorum* (Bintangor), *Agathis borneensis* (Damar Minyak), *Aquilaria malacensis* (Karas), and *Scophium macropodum* (Kembang Semangkok). The seedlings were used in our "open area planting programme" in Dungun Timber Complex (DTC) and Cherul Forest Concession (CFC) upon the seedlings concerned reaching a height of about 2 feet (60 cm)..

9.0   RESOURCE C0NSERVATION AND MANAGEMENT OF BIODIVERSITY

9.1   Biodiversity Management Strategies and Activities in DTC

Dungun Timber Complex (DTC) plays a very crucial role in safeguarding the high biodiversity values as it shares the boundary with Taman Negara National Park in the western flank of Pasir Raja PRF (**HCV 1**). A total of four endangered dipterocarp species were identified during the survey on flora (**HCV 1.2**). A total of thirty five new species were recorded for Terengganu, 11 of which are endemic to Malaysia (**HCV 1.3**).
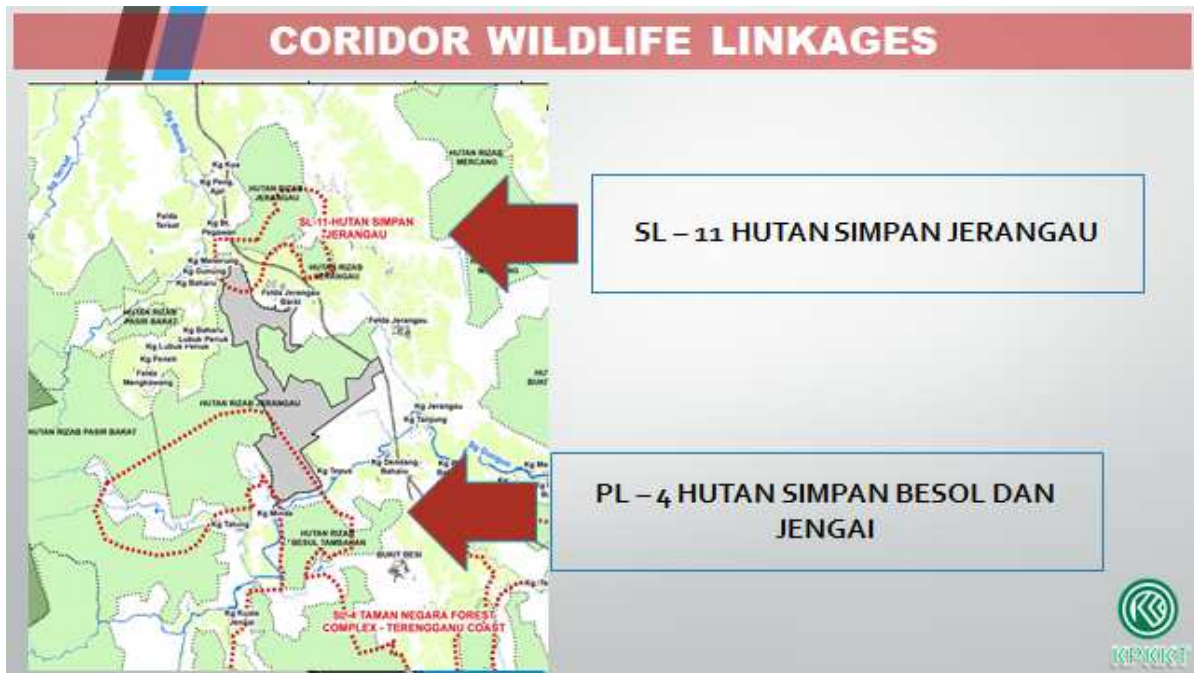
Fig. 36. Wildlife Corridor Linkages with the National Park

The area is rich in bird diversity with 176 near threatened, threatened and endangered (IUCN Redlist) bird species recorded (**HCV 1.2**). Nineteen threatened and endangered (**HCV 1.2)** mammal species recorded with the iconic Malayan Tiger, Asian Elephant, Malayan Tapir, Dhole and White-handed gibbon listed as Endangered (IUCN Redlist). A further enhancement in wildlife protection, stricter enforcement and anti-poaching measures are the best management options to reduce threats to the HCV species. Critical temporal use of areas for birds were identified (**HCV 1.4**) and sustainable forest management practices will be important to ensure that these areas are not degraded during logging operations.

DTC plays an important role as part of a larger forest landscape (**HCV 2**) being part of the *Banjaran Taman Negara - Banjaran Timur* forest complex; its close proximity to Taman Negara National Park and because it shares boundary with Gunung Aais and Sg. Nipah FRs in the south. One potentially threatened and endangered ecosystem (**HCV 3**) was identified in the PRFs assessed namely Pandan Swamp. DTC is listed as an important water stress area in Peninsular with five catchments legally gazette as *Hutan Tadahan Air* (**HCV 4).**

The social survey when looking at all the communities surrounding DTC on a whole suggested that, more than 80% do not depend on the DTC forest for subsistence or to supplement their income. For families that do depend on the forest they rely on the forest for 3 main products i.e. NTFP, medicinal plants and fish with fish being the most critical resource of the three (**HCV 5**).

9.2   General Recommendations for Biodiversity Management

9.2.1   Avifauna conservation

Regular patrols along the roads near the borders of the forest reserves could deter hunting activities at the DTC and mitigate the loss of threatened birds. Patrols could ideally be

carried out with cooperation of the Forestry Department and Department of Wildlife and National Parks (PERHILITAN). A community outreach programme including socio-economic improvement to educate surrounding communities on the importance biodiversity, could play a meaningful role in mitigating hunting activites and inculcate a sense of belonging for the forest and its wildlife.

9.2.2   Large mammal conservation

The survey indicates that Jengai FR still harbours iconic wildlife species such as the Malayan tiger, Asian elephant and Malayan Tapir. However, these HCVs are in serious threat and their survival in under pressure.

In order to ensure the survival of these species, appropriate strategies will be developed aimed at reducing encroachment into KPKKT's concession area. Effective enforcement to stop poaching and encroachment should be immediately implemented through increased patrolling and security as well as community engagement and awareness campaigns with assistance from Perhilitan, TSFD, FDPM and WWF-Malaysia. The presence of browse vegetation along the roadsides; serves as important food source for deers and other herbivores. In term of primates and other frugivores, KPKKT will help by replanting fruit trees (e.g. *Ficus sp*.) as part of the company's silviculture treatment.

9.2.3   HCVF/ GRA within the Project Area

The following sites have been identified and marked as potential HCVFs within the Forest Concession.

1. The area around the *Neobalanocarpus heimii* (Chengal) tree which has been listed in the Malaysia Book of Records as the <u>largest Chengal tree in the world</u>.
2. The strip of forest that forms a corridor and buffer between the concession forest and Taman Negara. It is proposed that the width of this buffer/ corridor strip be set at 100 metres.
3. The area around Gunung Mandi Angin which has been the subject of many scientific and botanical expeditions and supports unique flora and fauna.
4. The Keruing Sarawak and Resak stands in Jerangau PRF

As of present, the following two areas have been chosen as HCVFs within DTC to be maintained and managed by KPKKT:

1. The Keruing Sarawak plot within Compt 31 Jerangau PRF, and
2. The community watershed forest within Compt 52 Jengai PRF.

Detailed descriptions on these two HCVFs are embodied in a separate **HCVF Management Plan** document prepared by KPKKT, which also covers Future Activities & Plan of Actions to be undertaken within the HCVFs concerned.

10.0   FOREST PROTECTION, MONITORING AND CONTROL

10.1   Forest Protection

Main aspects of protection include: (1) Protection from encroachment; (2) Protection from pest and disease outbreak; (3) Protection from fire; and (4) Protection from pollution.

10.1.1　　Protection from Encroachment

KPKKT has taken appropriate steps to protect strategic parts of DTC by installing gates or berms that would reduce the potential for encroachment and wildlife harassment. These measures will be strengthened through regular patrol with the help of the enforcement division of the SFD and the relevant authorities concerned such as the police, army personnel, PERHILITAN, etc.

10.1.2　　Protection from Pests and Diseases

In KPKKT the line of action that was followed in this respect during the planning period focuses on the following:
(1)　　Improvement in Nursery Practice
(2)　　Improvement in Forest Hygiene

10.1.3　Protection from Fire

The control and protection of the concession forest from fire require several important steps that need to be clearly understood and followed by the management. These are:
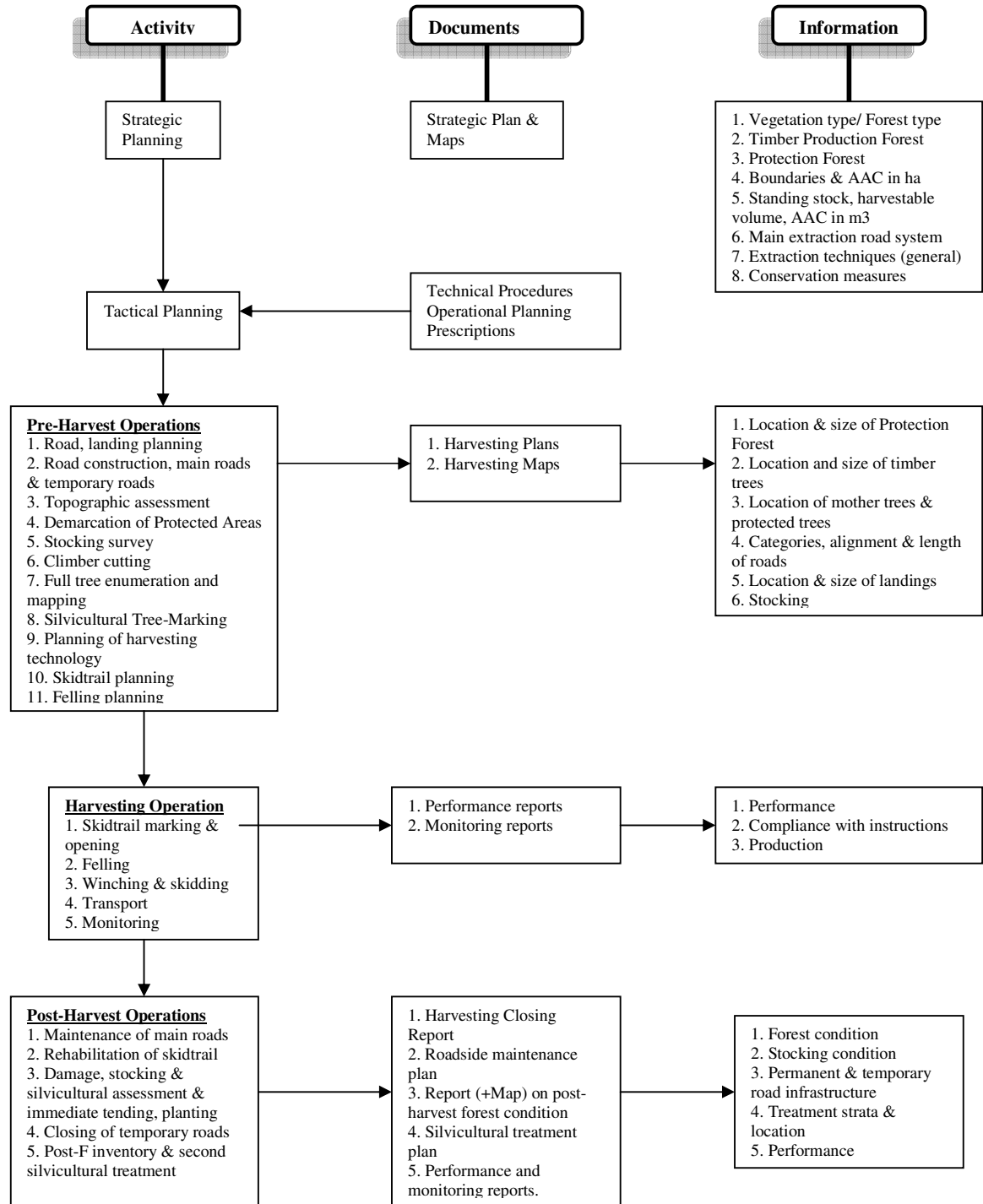1) demarcation of clear and well-defined boundaries;
2) establishment of permanent firebreaks;
3) provision of standing instructions to staff and workers;
4) establishment of communications channel;
5) provision of training in fire fighting skill for staff and workers.

10.2　　Monitoring and Control

Periodic reviews of the Forest Management Plan will be undertaken to reassess the initially calculated AAC and, if necessary, adjusted. The periodic reviews will also take into consideration any over- or under-logging during the preceding 5 years, forest conversions, and transitions from untreated/ unsustainable to sustainably managed forest, costing, protection status of the forest etc.

An indispensable part of any professional monitoring, evaluation and control is the existence of proper documentation and records keeping. A good records management provides a recipe for what to do, how to do it, and where to begin. It has the following major components: (i) records creation management, (ii) records retention development, (iii) vital records security, (iv) filing systems management, (v) records centres management, (vi) development of organising schemes, indexing, and knowledge of how and when to dispose of quality records.

Figure 37.   Planning, implementation and monitoring of reduced-impact logging (RIL).

Activity	Documents	Information

Strategic Planning

Strategic Plan & Maps

1. Vegetation type/ Forest type
2. Timber Production Forest
3. Protection Forest
4. Boundaries & AAC in ha
5. Standing stock, harvestable volume, AAC in m3
6. Main extraction road system
7. Extraction techniques (general)
8. Conservation measures

Tactical Planning

Technical Procedures
Operational Planning
Prescriptions

Pre-Harvest Operations
1. Road, landing planning
2. Road construction, main roads & temporary roads
3. Topographic assessment
4. Demarcation of Protected Areas
5. Stocking survey
6. Climber cutting
7. Full tree enumeration and mapping
8. Silvicultural Tree-Marking
9. Planning of harvesting technology
10. Skidtrail planning
11. Felling planning

1. Harvesting Plans
2. Harvesting Maps

1. Location & size of Protection Forest
2. Location and size of timber trees
3. Location of mother trees & protected trees
4. Categories, alignment & length of roads
5. Location & size of landings
6. Stocking

Harvesting Operation
1. Skidtrail marking & opening
2. Felling
3. Winching & skidding
4. Transport
5. Monitoring

1. Performance reports
2. Monitoring reports

1. Performance
2. Compliance with instructions
3. Production

Post-Harvest Operations
1. Maintenance of main roads
2. Rehabilitation of skidtrail
3. Damage, stocking & silvicultural assessment & immediate tending, planting
4. Closing of temporary roads
5. Post-F inventory & second silvicultural treatment

1. Harvesting Closing Report
2. Roadside maintenance plan
3. Report (+Map) on post-harvest forest condition
4. Silvicultural treatment plan
5. Performance and monitoring reports.

1. Forest condition
2. Stocking condition
3. Permanent & temporary road infrastructure
4. Treatment strata & location
5. Performance

11.0   SOCIO-ECONOMICS

Besides the obvious services and environmental benefits of the natural forest, some of its produce are traditionally known to have high consumption and income values to certain segments of the communities living in its vicinity. While areas of DTC containing these resources may not be designated as HCVF, KPKKT is nonetheless, obliged to institute appropriate management prescriptions with the view to enhance the values of these resources and coordinate their utilisation. KPKKT continues to ensure that all its activities, particularly harvesting operations, do not severely damage, and thereby reducing the values of these resources. At the same time, KPKKT will attempt, to the extent possible, to implement the necessary measures to enhance the quantity and quality of these resources. KPKKT will also continue with the initiative to create and instil awareness about the relevant laws and regulations which govern the collection, keeping and utilisation of these resources. This will be done in cooperation with the relevant authorities which, in turn have their respective areas of responsibility and jurisdictions.

Regular consultations between KPKKT, the relevant households and the authorities concerned (incl. TSFD) continued to be held to discuss on issues related to the collection and use of forest produce and services. In this relation, KPKKT continue to conduct Social Impact Assessment (SIA) on its SFM operations within DTC and their effects on the local communities.

The idea of the SIA is to enable KPKKT to continue to monitor and gauge and be mindful of all the positive as well as negative impacts to the local stakeholders, of the series of forestry activities and operations that make up what is called the Selective Management System (SMS) within DTC. KPKKT also maintains close relationship and rapport with other relevant interest groups, government agencies, academia, as well as non-governmental organisations (NGOs) to solicit their professional inputs on relevant issues raised by the affected local communities and act on them as appropriate. In this way, KPKKT hopes to be able to conduct its SFM activities in an informed and more-or-less transparent manner while at the same time carrying out the appropriate mitigative and corrective measures commensurate with the scale and intensity of the company's SFM operations. Such SIA initiative also serves to fulfil one of the Forest Stewardship Council (FSC)'s Principles and Criteria for forest stewardship to which KPKKT subscribes. Since 2008 KPKKT had been committed to follow and abide by FSC P&C which form the basis of FSC certification standards.

Among others, findings from the latest SIA survey (2018) showed that most of the local villagers still live in poverty with about 50 per cent of them surviving on a level of income that is below national rural Poverty Line. Unemployment rate remained high despite a reasonably respectable literacy rate and a sound level of education of the people. Job opportunity is sorely lacking. This has subsequently forced a section of the local community to rely on DTC forests for supplies of forest produce such as freshwater fishes and other non-timber forest produce (NTFP) as well as timber for construction material. Approx. 73 per cent of the people harvested the various forest produce for their own consumption while some 27 per cent engaged in the business and trade of them.   The villagers also had had mixed perceptions on the impacts of SFM activities on the forest and environment and generally showed deep concern on the natural resource, while others expressed their satisfaction and support to KPKKT for its sound and responsible management of DTC forests. Among the main challenges faced by KPKKT in the future include the need to maintain a cordial and healthy rapport with local stakeholders through a strategy that gears towards a heightened public awareness and enhancement of their economic well-being. A series of other recommendations are also outlined in this SIA report which would enhance the positive values while mitigating the negative impacts of SFM operations within DTC's

forests. In this way, KPKKT would be able to contribute in a more positive and meaningful manner towards the welfare of the local population in a spirit of co-existence and mutual respect, while meeting the original social objectives of its establishment and operation.

12.0 SUMMARY OF ENVIRONEMNTAL MANAGEMENT AND MITIGATION MEASURES UNDERTAKEN WITHIN DTC

Table 33. provides a summary of the mitigation measures undertaken within DTC..

Table 33. Summary of Management and Mitigation Measures in the Project Area

No.		Significant Aspect & Impacts	Mitigation Measures & Compliance
1		Project Concept	➢ Selective Logging conducted in Logging Blocks (LBs) of 100- 150 ha. ➢ Tree felling and removal based on "RIL" and Directional Felling with the long term objective of achieving SFM.
2	2.1 a) b) c)	Project Design *Soils* Erosion of soil surface Landslip Slope stability	➢ Appropriate engineering practices by installing culverts, side ditches, cross drains, diversion ditches, sediment basins, rip rap, silt traps or other facilities. Minimisation of total length of roads and area of disturbance along with and proper maintenance. Forest roads and forest tracks follow the specifications laid out by the Forestry Department. ➢ All forest roads are closed when not in active use. ➢ Benching of slopes, diversion, dykes, retention of buffer strips, seeding of grass or cover vegetation. Minimisation of cutting and filling. ➢ Use and movement of heavy machinery are strictly controlled.
	2.2 a) b) c)	*Hydrology and Water Quality Control and Supervision* Water yield, dry season flow and flood response Sediment load and turbidity Physical, chemical and biological qualities	➢ Conservation of catchment areas; density of roads and tracks are kept to a minimum ➢ Proper engineering practices by dumping loose material at designated area; adequate compaction of permanent roads and provision of culverts, cross-drains; silt traps; buffer zones; revegetate slopes with fast growing indigenous species and bamboo. ➢ Efforts made to ensure that the total suspended solid (TSS) in surface water run-off from the project site is kept below 150 mg/l. ➢ Proper storage of gasoline or engine oil; proper waste disposal site. ➢ Prohibition to the use of poison. ➢ Control of the use of fire for open burning ➢ Appropriate and environmentally safe toilet facilities built for the forest workers at or near their kongsis. ➢ All sewage and kitchen sullage from the workers' kongsis are appropriately handled before being released to any water courses.
	2.3	*Drainage*	➢ Utilisation of natural drainage patterns to reduce sedimentation; maintain riparian vegetation. Facilitation of water flow by clearing streams and culverts from rubbish, waste timbers and silt. ➢ All river crossings only constructed upon the approval from TSFD. ➢ All natural water courses, rivers and their tributaries are not used as silt trap or sediment trap. ➢ No activity whatsoever is conducted within river reserve and buffer strips
	2.4 a) b)	*Groundwater* Recharge, quality and aquifer characteristics Existing uses	➢ Conservation and maintenance of catchment areas; minimum disturbance to aquifer. ➢ Avoidance of spillage/ seepage of fuels, engine oil or other similar pollutants on soil. Proper disposal of unused fuels, engine oil, rubbish and sewage. Proper storage of fuel and engine oil. ➢ Disposal of Scheduled Wastes is undertaken in accordance with the Environmental Quality Regulations (Scheduled Wastes) 1989.

	2.5 a) b) c)	*Atmospheric Quality Control* Climate Air pollution Noise	➤ Logging operation conducted according to proper Forest Harvesting Plan and special care taken during rainy seasons. Usage of less polluting machines (bulldozers, excavators, trucks, 4-wheeled drives, chainsaws). These machines are regularly checked and maintained. ➤ Open burning is strictly controlled and supervised at all times ➤ Mechanisms instituted to slow down the speed of running vehicles going downhill by building bunds etc. Surface grade of main roads improved. ➤ Similar to air pollution – noise tends to be localized and temporary in nature. Sources of noise come from chainsaws, heavy machines (bulldozers, excavators, trucks, generators, pumps, etc) particularly those old machines which are not only extremely noisy and producing a lot of smoke but also a safe hazard and dangerous to use. Continued exposures to noises such as old generators, bulldozers and excavators may seriously impair hearing ability of workers and disturb hibernating animals. ➤ Workers should wear safety gears such as ear plugs and machines and engines should not be allowed to run when not in use. New and well-serviced machines should be preferred whenever possible. ➤ No open burning was done on any combustible material or rubbish except those allowed under the Environmental Quality Order (Prescribed Activities) (Open Burning) 2000.
	2.6	*Land Use*	➤ All boundaries for forest compartment and the whole logging block were clearly marked to the specification of TSFD. ➤ Erosion control measures were implemented.
	2.7 a) b) c) d) e) f)	*Habitats, Species and Population* Terrestrial/ Aquatic Habitat Endangered, endemic or protected plant species Birds Mammals, reptiles and amphibians Fish and other aquatic life Fruit trees	➤ A comprehensive survey was conducted with help from WWF-Malaysia and PERHILITAN to document the fauna in the forest area including those animal species which are thought be threatened, rare and endemic to the site. ➤ Proper sustainable forest management practice; protection of catchment areas; proper erosion control measures. ➤ Avoidance of logging in areas identified as containing high conservation value (HCV) species. ➤ Avoidance of felling of nesting trees or felling of timber trees on nesting trees. Avoidance of felling fruiting trees whose fruits are useful to birds and other wildlife. ➤ Construction and logging activities are done in stages (start from fringes of forest) to allow animals to move and migrate to other safer, forested areas. ➤ Erosion control measures implemented; catchment areas preserved. Never use poison and explosive to catch fish. ➤ Prohibition to workers from cutting down fruit trees and trees known to support animals and birdlife.
	2.8 a) b) c) d) e) f) g)	*Human and Socio-Economic* Domestic water supply Physical safety Employment Cultural/ Historical site Local communities Hunting and poaching Public access	➤ Proper erosion control measures; preservation of water catchment areas. Prohibition of use of poison. ➤ Enforcement of safety rules for all workers; safety of logging and transportation; maintenance of machines. ➤ Employment local residents as far as possible ➤ Avoidance from disturbing these areas; report findings to Museum Department or relevant agencies. ➤ Avoidance from operating near local kampung settlements. ➤ Prohibition to workers from hunting and poaching of wild animals as well as destroying nesting sites. ➤ Measures taken to prohibit/ limit access of public into forest area as this may only complicates safety arrangement: their own safety from falling trees and branches, running machines and passing vehicles; protection of the forest against fire, theft of forest produce, etc.
3	a)	Forest Protection	Protection against Pests and Diseases. ➤ Minimisation of use of chemicals but encouragement to use of biological means to control pests and diseases.

13.0   CONCLUDING REMARKS

13.1   Compliance

KPKKT's compliance with FSC's set of P & C during the period subsequent to certification in 2008 up till now, can be summarised as follows:

Principle 1:   Compliance with Laws and FSC Principles (6 criteria)
- KPKKT has a track record of compliance and its business relationship with state and federal regulatory agencies appear to be in harmony.
- No incidence of illegal harvesting or poaching of wildlife so far.

Principle 2:   Tenure and Land Use Rights and Responsibilities (3 criteria)
- KPKKT is a member of the Joint Consultative Committee (*Jawatankuasa Pembangunan and Tindakan Daerah*) at the district level to resolve any forestland ownership disputes, if any. There had never been any forestland dispute in KPKKT forest concession.
- Law establishes legal ownership and right to use the defined forest area.

Principle 3:   Indigenous Peoples' Right (4 criteria)
- There is no indigenous community living inside the Project Area and no indigenous people working for KPKKT or any of KPKKT's contractors.
- However KPKKT is sensitive to the needs of these people and render appropriate assistance in the event they trespass through DTC area. Staff and Contractors of KPKKT have been accordingly regularly briefed to this effect.

Principle 4:   Community Relations and Workers' Rights (5 criteria)
- KPKKT's presence in the district is well received, and the company has been considered in a favourable sense by the local community. Local residents are given priority for services and labour contract.
- KPKKT has contributed positively to the economy of the state and the district of Dungun.
- A joint committee between employer and employee exists and operating.
- KPKKT has been a good paymaster and employer as well as a responsible neighbour.

Principle 5:   Benefits from the Forest (6 criteria)
- As a member of Golden Pharos Berhad (GPB), KPKKT is financially strong and contributes to add value to its timber through various downstream processing under GPB: sawmilling and solid door manufacturing, etc.
- Favourable rate of growth of second growth forest ensures sustainability of operation into second rotation under SMS.

Principle 6:   Environmental Impact (10 criteria)
- A landscape-level EIA on the Forest Concession has been conducted and the relevant EIS had been prepared.
- No usage of fire or open burning in all of KPKKT's forestry operations.
- Management of reserved and protected areas is addressed in the FMP
- Guidelines on measures to mitigate negative impacts of forest operations are being followed in earnest.
- Disposal of chemicals, containers, waste oils, etc is being done properly.

Principle 7:   Management Plan (4 criteria)
- KPKKT management consists of well qualified and experienced team of professionals.
- Resource management is conducted in accordance with SFM which balances up the different needs of economic, social and environment sustainability and protection.

Principle 8:   Monitoring and Assessment (5 criteria)
- Collaborative research projects have taken place with FRIM, JPSM, UPM, etc.
- Research and monitoring plots have been established and remeasured at specified intervals.
- R & D capability is being expanded.
- Appropriate training and exposure provided to relevant staff.

Principle 9:   Maintenance of High Conservation Value Forests (HCVFs) (4 criteria)
- HCVF area have been identified and surveyed the ground with assistance from WWF-Malaysia
- Appropriate plans of action for the management of HCVFs are in place.

8.2   Moving Forward

In what follows, some basic issues are presented for KPKKT to critically address as part of the enabling conditions and critical success factors for the future:

- ☼ KPKKT to continue to build up standing timber inventory to levels associated with optimal stocking, rather than being depleted over time.
- ☼ KPKKT to ensure financial stability of the organisation and anticipate the likelihood that financial exigencies may influence the stability of the timber harvesting regime and exceed the allocated AAC.
- ☼ KPKKT to embark into serious program to educate its staff at all levels as well as the contractors.
- ☼ KPKKT to continue to forge ahead and expand its capability in the fields of R & D and to continuous monitor of the forest conditions through in-house as well as collaborative research initiatives and to build up its own data bank for future planning and execution.
- ☼ KPKKT to make effort to move ahead and take pride in being a truly professional forest management company that subscribes to MC & I and FSC P & C both in spirit and action by adopting a more responsible image as a forest management firm which places due and balanced emphasis on all tangible and intangible aspects of SFM.

--------- end of Public Summary --------
December 2019

Annex: SIA REPORT

**SOCIAL IMPACT ASSESSMENT (SIA)
OF THE SUSTAINABLE FOREST MANAGEMENT OF
DUNGUN TIMBER COMPLEX MANAGED UNDER THE 2ND
ROTATION OF THE MALAYSIAN SELECTIVE
MANAGEMENT SYSTEM (SMS)**

By

BORHAN Mohd & OSMADI Othman

Bukit Besi, Terengganu
1 September 2018

Table of Contents:

Executive Summary

This Social Impact Assessment (SIA) on the sustainable forest management (SFM) on Dungun Timber Complex (DTC) in the State of Terengganu, Malaysia, represents a follow up to an earlier SIA reports prepared in 2009 and 2013 on the same site and subject. It has always been the intention of Kumpulan Pengurusan Kayu Kayan Terengganu Sdn Bhd (KPKKT) as the manager and operator of SFM within DTC since nearly four decades ago, to continue to conduct such survey and assessment periodically from time to time and to see to it that the interest of the forest-dependent communities that live within the vicinity of DTC are well-catered for, by following as closely as possible the recommendations laid out in the SIA reports. The idea of the SIA is to enable KPKKT to continue to monitor and gauge and be mindful of all the positive as well as negative impacts to the local stakeholders, of the series of forestry activities and operations that make up what is called the Selective Management System (SMS) within DTC. KPKKT also maintains close relationship and rapport with other relevant interest groups, government agencies, academia, as well as non-governmental organisations (NGOs) to solicit their professional inputs on relevant issues raised by the affected local communities and act on them as appropriate. In this way, KPKKT hopes to be able to conduct its SFM activities in an informed and more-or-less transparent manner while at the same time carrying out the appropriate mitigative and corrective measures commensurate with the scale and intensity of the company's SFM operations. Such SIA initiative also serves to fulfil one of the Forest Stewardship Council (FSC)'s Principles and Criteria for forest stewardship to which KPKKT subscribes. Since 2008 KPKKT had been committed to follow and abide by FSC P&C which form the basis of FSC certification standards.

Among others, findings from the present SIA survey showed that most of the local villagers still live in poverty with about 50 per cent of them surviving on a level of income that is below national rural Poverty Line. Unemployment rate remained high despite a reasonably respectable literacy rate and a sound level of education of the people. Job opportunity is sorely lacking. This has subsequently forced a section of the local community to rely on DTC forests for supplies of forest

produce such as freshwater fishes and other non-timber forest produce (NTFP) as well as timber for construction material. Approx. 73 per cent of the people harvested the various forest produce for their own consumption while some 27 per cent engaged in the business and trade of them.   The villagers also had had mixed perceptions on the impacts of SFM activities on the forest and environment and generally showed deep concern on the natural resource, while others expressed their satisfaction and support to KPKKT for its sound and responsible management of DTC forests. Among the main challenges faced by KPKKT in the future include the need to maintain a continued compliance with FSC Principles and Criteria of Forest Stewardship, along with all the tenets of SFM which call for the maintenance of a cordial and healthy rapport with local stakeholders through a strategy that gears towards a heightened public awareness and enhancement of their economic well-being. A series of other recommendations are also outlined in this SIA report which would enhance the positive values while mitigating the negative impacts of SFM operations within DTC's forests. In this way, KPKKT would be able to contribute in a more positive and meaningful manner towards the welfare of the local population in a spirit of co-existence and mutual respect, while meeting the original social objectives of its establishment and operation.

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Acknowledgement

We wish to express our profound thanks and appreciation to the management of KPKKT for the trust and opportunity given to us to conduct this social impact assessment of the sustainable forest management (SFM) operations within its DUNGUN TIMBER COMPLEX (DTC). The term SFM operations was deliberately used throughout this report instead of just "logging" or "selective logging" in order to reflect the array of programmes and activities that are systematically planned and judiciously executed on the ground. It was also to present the image of KPKKT as a responsible forest manager rather than a plain, profit-motivated logging concern. Together, those activities and operations carried out by KPKKT constitute SFM as a discipline which in turn calls for such dedication and professionality in the part of all those involved, not only from KPKKT and its staff and contractors but also the Terengganu State Forestry Department (TSFD), along with the mutual understanding and respect shown by such stakeholders as local residents and relevant agencies. As has been shown there had been no apparent conflict between the SFM operations conducted by KPKKT within DTC and the local residents over the years, and both sides continue to maintain a cordial relationship and mutual respect, which had enabled KPKKT to move forward and successfully conduct its business virtually unhindered without causing undue stress to the people, environment or harassment to the wildlife. The spirit of goodwill and mutual co-existence between KPKKT and local villagers have always been on the high note.

We thank KPKKT's Senior General Manager Mr Suhairi Bin Sulong, as well as others who had been of such great help during the preparation of this report. Tuan Haji Wan Suhaimi Wan Aziz of Golden Pharos Berhad deserves a special mention for this dedication, professionalism, understanding, help and enduring friendship.

Thank you.

Abbreviations and Acronyms

DBH, dbh	diameter at breast height
C.L.	Cutting limit
DTC	DUNGUN TIMBER COMPLEX
CFC	Cherul Forest Concession
CPRF	Cherul Permanent Reserved Forest
CSR	Corporate Social Responsibility
EIA	Environmental Impact Assessment
FELDA	Federal Land Development Authority
FELCRA	Federal Land Consolidation and Rehabilitation Authority
FMP	Forest Management Plan
FMU	Forest Management Unit
FSC	Forest Stewardship Council
GLC	Government-Linked Company
GPB	Golden Pharos Berhad
HCVF	High Conservation Value Forest
HCVFMP	HCVF Management Plan
JaKOA	Jabatan Kemajuan Orang Asli (Aborigine People Development Department)
JPNT/ TSFD	*Jabatan Perhutanan Negeri Terengganu*/ Terengganu State Forestry Department (TSFD)
KETENGAH	*Lembaga Kemajuan Terengganu Tengah* (Central Terengganu Development Authority)
Kg	*Kampung* (Village)
KPKKT	*Kumpulan Pengurusan Kayu Kayan Terengganu Sdn Bhd*
OSH	Occupational Safety and Health
m.a.i.	mean annual increment
PCT	Potential Crop Tree
PERHILITAN	*Jabatan Perlindungan Hidupan Liar dan Taman Negara* (Wildlife Protection and National Parks Department)
PLI	Poverty Lime Income
PPE	Personnel and Protective Equipment
PRF	Permanent Reserved Forest
Pre-F	Pre-Felling (Inventory)
R&D	Research and Development
RIL	Reduced Impact Logging
RISDA	Rubber Industry Smallholders Development Authority
SFM	Sustainable Forest Management
Sg.	Sungai (River)
SIA	Social Impact Assessment
SMS	Selective Management System
TKL	*Tanaman Kawasan Lapang* (Open Area Planting)
TM	Tree Marking
TRF	Tropical Rain Forest
TSI	Timber Stand Improvement
UPM	Universiti Putra Malaysia
WWF-Malaysia	Worldwide Wildlife Fund – Malaysia Office

Social Impact Assessment (SIA)

on the Sustainable Forest Management (SFM) of Dungun Timber

Complex (DTC) Managed Under The 2nd Rotation Of The Selective

Management System (SMS)

1.0   Introduction: Approach and Methods

Economic development projects bring about both positive as well as detrimental and undesirable effects on human population, natural resources and the surrounding environment. While significant benefits may flow in from the various development actions, there is a need to identify and evaluate the attendant negative externalities. This can be done by identifying and measuring those impacts through appropriately designed and executed impact assessment, as well as managing those impacts in such a way that the positive externalities are maximized and the negative externalities are minimized (Center for Good Governance, 2006). Some of the negative and undesirable impacts many of which tend to be unintended, include the disruption of social organization and communal harmony and values; modification of ecosystem; impairment and loss of human livelihood, culture and life; introduction of new diseases; and the destruction of renewable resources, all of which could potentially overwhelm and eventually wipe out whatever benefits or positive consequences the project might have generated in the first place.

A social impact assessment (SIA) is usually conducted for this purpose at regular intervals or whenever the need arises, for the purpose of identifying, assessing, gauging and monitoring the impact of a project on the surrounding community, and to recommend appropriate mitigation and improvement measures.

At Kumpulan Pengurusan Kayu Kayan Terengganu Sdn Bhd (KPKKT), a series of social impact assessment of the company's sustainable forest management (SFM) programmes and activities within its 108,900ha, long-term forest management unit (FMU) of DUNGUN TIMBER COMPLEX (DTC) in Terengganu had been initiated since 2009 and followed by another in 2014, conducted by appointed consultants. The present initiative therefore seeks to present a review and update of the earlier reports by incorporating findings from surveys conducted on the stakeholders namely the local communities living in villages in the vicinity of DTC.

In conducting this SIA the following approaches were used for data collection and information gathering:

i.   Reviews of past reports, papers and records relevant to the subject

ii. Analyses of available secondary data on local socio-economic condition

iii. Consultations with local community leaders, workers and other stakeholders

iv. Surveys of sample populations of local households and workers.

v.   Deliberations with the management of KPKKT.

## 2.0 Kumpulan Pengurusan Kayu Kayan Terengganu Sdn Bhd (KPKKT)

2.1 Company Profile

KPKKT which is one the 6 subsidiary companies under the Terengganu state-owned enterprise Golden Pharos Berhad (GPB) manages the timber concession area of Dungun Timber Complex (DTC) following the tenets of Sustainable Forest Management (SFM) principles as laid out in KPKKT's long term Forest Management Plan (FMP) which covers a 30-year period, from 2008 – 2037. The latter represents the second cycle of KPKKT's management of DTC under the

Malaysian Selective Management System (SMS). All of the prescriptions contained in the FMP were formulated in such a way as to accommodate as much as possible the current as well as anticipated future changes in local and global attitudes and trends in the approaches towards forest resource management, biodiversity conservation, climate amelioration and environmental protection.

The management of DTC by KPKKT complies with the environmental management standards as laid out by the relevant authorities, namely the Terengganu State Department of Forestry (TSFD) as well as Department of Environment, Terengganu. In this context, appropriate environmentally-benign forest management standards and practices have been and will continue to be duly observed by KPKKT in all of its forest management activities and field operations, in order to minimise potential negative environmental and social impacts of such operations. DTC was recognised and certified by the internationally-renowned Forest Stewardship Council (FSC) as a "Well-Managed Forest" since April 2008 after successfully complying all 9 FSC's Principles and Criteria of Forest Stewardship (FSC P&C). This certification was subsequently renewed for a further five years as from 2012.

The 6 Permanent Reserved Forests (PRFs) within Dungun District that make up DTC are: (1) Jengai PRF (51,640 ha), (2) Besul PRF (6,190 ha), (3) Jerangau PRF (9,710 ha), (4) Pasir Raja Barat PRF (6,463 ha), (5) Pasir Raja Selatan PRF (31,512 ha), and (6) Besul Tambahan PRF (3,360 ha); giving a total area of 108,900ha natural tropical rain forest comprised mostly the mixed dipterocarp forest (MDF) type. A total of 70,000ha of these forests falls under the "productive" category with an average estimated timber standing stock of 32 - 45–3/ha., and
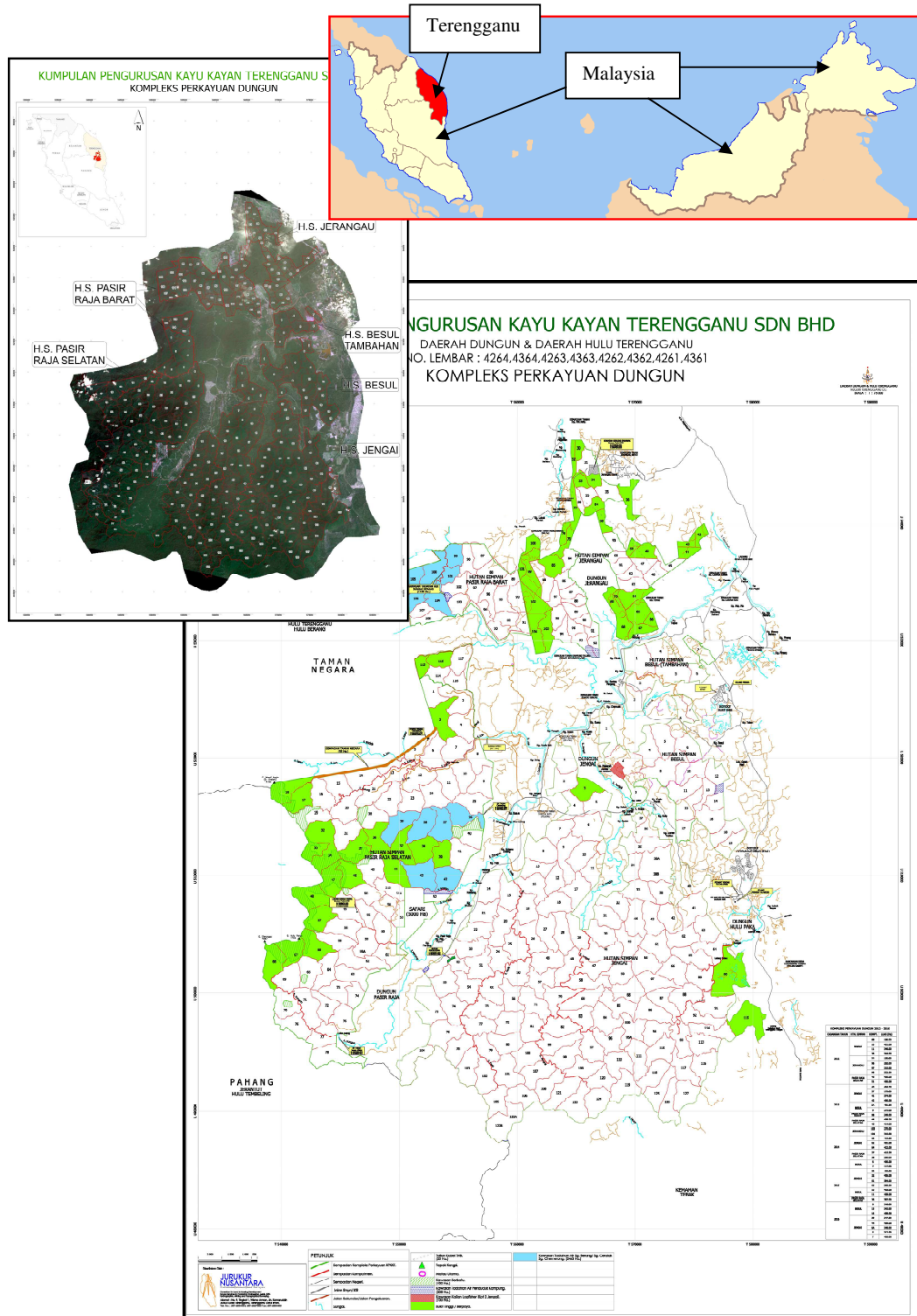
Fig. 1. Dungun Timber Complex in Dungun District, Terengganu, Malaysia.

presently being managed under the second rotation of the Selective Management
System (SMS) of 30 years. These forests are still rich in various tropical timber
species including:

(1) Balau, (2) Balau laut merah, (3) Balau membatu, (4) Chengal, (5) Keruing,
(6) Kempas, (7) Merbau, (8) Meranti nemesu, (9) Meranti bukit, (10) Meranti
seraya, (11) Meranti sengkawang merah, (12) Meranti rambai daun, (13) Meranti
kepong, (14) Keruing, (15) Meranti tembaga, (16) Resak, (17) Damar hitam,
(18) Damar minyak, (19) Kapur, (20) Keladan, (21) Mersawa, (22) Meranti
sarang punai, (23) Meranti melantai, (24) Meranti langgong, (25) Gerutu,
(26) Meranti paang, (27) Nyatoh, (28) Sepetir, (29) Bintangor, (30) Durian,
(31) Jelutong, (32) Kedondong, (33) Kembang semangkok, (34) Giam, (35)
Kulim, (36) Merawan, (37) Melunak, (38) Merpauh, (39) Medang, (40)
Simpoh, (41) Mengkulang, (42) Meranti bumbong, (43) Meranti belang, Kelat, as
well as a host of "miscellaneous species". Based on a 5-year (2011 – 2015)
production data, the productive forests were found to produce an average of 15.15
nett hoppus ton of round timber per ha from the species mentioned above. This is
equivalent to approx. 28 m^3/ha.

2.2   Management Objectives and Strategy

In terms of its long term management strategy, KPKKT continues to embrace
and practise the Malaysian Selective Management System (SMS) to manage the
mixed dipterocarp forest within DTC. The company's commitment to remain viable
while at the same time maintain its FSC-certified status, remains unchanged. These
can be summarised as follows:

10. Strict adherence to and proper implementation of the prescriptions laid out in the Forest Management Plan and guided by the Terengganu State Forestry Department (TSFD).

11. Commitment to reducing the impact of logging on the natural environment by protecting residual Potential Crop Trees (PCTs), regeneration, biodiversity, soil, water resources, habitats and high conservation value forest (HCVF) and the human environment.

12. Maintenance of ecology and the ratio of dipterocarp vs non-dipterocarp species in the residual stands as in the original forest composition.

13. Commitment towards maximum utilisation of timbers and minimisation of wastes.

14. Continued investment in developing Reduced/Low Impact Logging (RIL) methodologies in all types of timber production areas,

15. Provision of necessary training and mentoring programmes to staff and contractors along with supervision on the ground on regular basis.

16. Management of the Concession Area as a self-sustaining, multiple-use FMU.

17. A full subscription to all FSC's Principles and Criteria for SFM.

18. To help uplift the economy and social wellbeing of the forest-dependent communities in the region through the creation of employment and business opportunities as well as good neighbourliness.

19. To foster good governance, sound professional ethics and business goodwill with stakeholders, thereby leading to appropriate recognition by the relevant international such as the Forest Stewardship Council (FSC), and local certifying bodies of SFM as subscribed and practiced by KPKKT.

2.3   Manpower Position

As of the date of this report (August 2018), KPKKT employs a total of 86 staff comprising 76 males and 10 females. Of these, about 16.3% work at the management level (General Manager, Deputy GM, Senior Forest Manager, Forest Manager, Assistant Managers and Forest Executives), and 83.7% at the technical level (Forest Supervisors, Foresters and Machine Operators). The high proportion of technical staff reflects the importance attached by KPKKT on field and R & D operations. For road construction, tree felling and timber extraction, KPKKT engages a total of 6 contractors.

Fig. 2. Organisational Chart of KPKKT (June 2018)

2.4   Human Resource Development

Training and capacity building involving both KPKKT's personnel and those of KPKKT's contractors, are of utmost importance in order to achieve SFM within DTC and maintain its FSC-certified status as a "well-managed forest". As for the contractors and their staff, KPKKT provides the necessary support and incentives for training initiatives by, for instance, roping-in the contractors concerned into KPKKT's training programmes aimed at enhancing knowledge and skills in field techniques. **Table 1** below summarises the trainings, workshops and courses which were participated in by KPKKT during 2017 and 2018 in order to avail the workers to the latest thinking and development in areas related to their tasks and responsibilities.

Apart from that, training for staff in the following areas are also being considered and will be arranged from time to time:

7. Training of machine operators in environmentally benign and damage-limiting techniques

8. Training in silviculturally significant tree marking procedures

9. Training in silviculturally relevant stand treatment techniques

10. Training on nursery technology and planting stock production.

Table 1.

Selected Short Courses, Seminars and In-Service Field Visits Organised for KPKKT Staff in 2017 and 2018

No	Date & Duration	Course Title	Venue	Participation
1	9 Oct 2018 (1 day)	Pengurusan Pekerja Asing	ILP, Kuala Terengganu	Selected Staff
2	2 Oct 2018 (1 day)	Disciplinary Procedure and Domestic Inquiry	Quinara Al Safir, Tok Jembal	Management Staff
3	22 Sept. 2018 (1 day)	Lawatan Ke Chengal Besar	Pasir Raja PRF	KPKKT Staff
4	22 Sept 2018 (1 day)	Golden Ride	KT	Management Staff
5	30 – 31 Jul 2018 (2 days)	MTR 2018	Darul Iman Training Centre, Kemaman	Management Staff
6	29 – 31 Jul 2018 (3 days)	Seminar For Emergency Response Team	Jab. Bomba & Penyelamat, Wakaf Tapai	Selected Staff
7	7 Sept 2018 (1 day)	EIA (Second Schedule)	Dept Environment, Putrajaya	Selected Management Staff
10	27 Sept 2018 (1 day)	World Tourism Day	KT	Selected Staff
11	19 Aug 2018 (1 day)	Stakeholder Consultation	UiTm Dungun	Management Staff, Supervisors & Contractors
12	20 Aug 2018 (1 day)	FSC Mentoring	UiTM Dungun	Staff & Contractors of KPKKT & Pesama
13	25 – 27 July 2017 (3 days)	Kursus Pemantapan Pensijilan MC&I	Pusat Latihan Perhutanan, Terengganu	Selected Staff
14	10 – 12 Jan 2017 (3 days)	Training on Dendrology, Pre-F, Tree Marking	Rest House Pasir Raja	Pembangunan Staff
15	24 July 2017 (1 day)	Kursus Panduan Jalan Hutan 2010 (Pindaan 2013)	KPKKT	Operasi Staff, Contractors
16	10 July 2017 (1 day)	Seminar Pengendalian Bahan Kimia	Hotel Permai Inn, KT	Selected Staff
17	25 – 26 July 2017 (2 days)	National Tax Conference	KLCC	Selected Mgt Staff
18	25 – 29 Sep 2017 (5 days)	CompTIA Network	Kuala Lumpur	Selected Staff
19	24 – 25 Oct 2017 (2 days)	Programme & Abstract Book	Magellan Sutera Harbour Resort, Kota KInabalu, Sabah	Selected Mgt Staff
20	14 Dec. 2017 (1 day)	Latihan Pengurusan Kanan, Terengganu Inc.	Hotel Permain Inn, KT	Selected Staff
21	20 Dec 2017 (1 day)	Kursus Akta Keselamatan & Kesihatan Pekerjaan 1994 & Peraturan-Peraturan	KPKKT	KPKKT Staff & Contractors

3.0   The SFM of DTC Forests and Phases of Activities/ Operations

The array of forestry programmes, planning and management, activities and operations conducted within DTC are governed and dictated by a long term Forest Management Plan (FMP) which is a planning document specifically prepared and designed to meet the three main pillars of SFM, namely

(1) economic viability, technical feasibility and financial growth,

(2) corporate's social acceptability and camaraderie, and

(3) forest protection, environmental safety and biodiversity conservation.

The FMP for DTC has been designed and prepared to serve as a general guide and instruction for KPKKT to protect, manage, develop and conserve in perpetuity, the invaluable natural mixed tropical rain forest (TRF) resource within DTC as a single and distinct Forest Management Unit (FMU), based on the precepts of **sustainable forest management (SFM) principles.** To this end, DTC forests are identified into several categories according to their functions based on their locations and characteristics as defined in NFA 1993 (**Table 2**).

3.1   Selective Logging Planning

Annual Working Area (AWA)

In managing the production forest category for sustainable timber production, KPKKT considers several relevant factors, including the following, some of which are largely tentative and subject to revision as new facts come to light:

1) The dbh m.a.i's of trees larger than 30.0cm dbh under the Selective Management System are assumed to be in the range of 0.80cm – 1.00cm/tree/yr for both Dipterocarps and Non-Dipterocarp species,

2) It follows from the above, the rate of volume m.a.i. for all trees above 15.0 cm dbh is conservatively assumed to be $2.62m^3$/ha/yr.

3) Net Timber production area: 70,000ha

4) The sustainable cut for timber production is approx. 80,000 $m^{3/}$year

5) Silvicultural tending and open area planting & rehabilitation programmes are conducted to enhance the stocking and growth of the dipterocarp component.

Table 2.
Forest Functions in DTC in relation to the Functions Defined in the NFA1993.

National Forest Policy 1992		National Forestry Act 1993	Forest Zonation in Dungun Timber Complex (DTC)	% DTC Area
Production Forest		Sustainable timber production	Timber Production (TP)	67%
Protection Forest	Soil protection	Soil protection	Soil Protection (SP)	14%
			Soil Conservation (SC)	37%
		Soil reclamation	-	-
	Flood control	Flood control	Flood Control Conservation (WFC)	-
	Safeguarding of water resources	Water catchment	Water Catchment Conservation (WCC)	37%
			Riparian Buffer Protection (WBP/ HCVF)	18%
	Preservation of biodiversity	Wildlife Sanctuary	Rare Ecosystem Protection (HCVF)	-
		Virgin Jungle Reserve	Protected Area Buffer (HCVF)	1%
	Climate amelioration	-	-	-
Amenity Forest	Recreation	Amenity	e.g. Chemerong Waterfall	<1%
	Ecotourism	-	e.g. Chemerong Waterfall	<1%
	Public awareness	-	-	-
Research and Education Forests (added in Rev. 1992)		Research	e.g Compts. 51 & 54 of Jengai FR.	<1%
		Education	e.g. Compartment 52 of Jengai FR.	<1%
		Forest for federal purposes	-	-

6) Volume m.a.i.'s are assumed to be 2.618m^3/ha/yr for all species; 2.09m^3/ha/yr for the dipterocarps; and 1.453m^3/ha/yr for the non-dipterocarp tree species.

7) A cutting cycle of 30 years as recommended by the Terengganu State Forestry Department (TSFD).

Timber Production 2012 - 2017

The progress with timber production from DTC over five years (2012 – 2016) can be summarised as in the following points:

- The average yearly round timber production over the past 5 years (2012 – 2016) was 44,567.225m^3/year from 1824.2 ha/yr.

- The round timber outturn from the second growth stands were extremely varied, ranging from as high as 48.84m^3/ha for Compt. 51A of Pasir Raja Selatan PRF to as low as 7.28m^3/ha for Compt. no. 88 of Pasir Raja Barat PRF, giving an average yield of 24.43m^3/ha calculated based on timber production data from a total of 31 compartments across the concession area.

3.2 Pre-Felling Operations

Boundary Demarcation

Boundary demarcation is the first step to be accomplished before selective logging could commence in any forest compartment. It involves surveying and marking on the ground the external boundary of the working area and buffer zones beyond which logging is prohibited, thereby facilitating monitoring and control in the field. Boundary demarcation is carried out by KPKKT staff under the supervision of the District Forest Office.

Pre-Felling Inventory

Pre-F Inventory is carried out by KPKKT staff for the purpose of determining the pre-felling stocking of the proposed working area, following the standard procedures as prescribed by TSFD. The data collected will be used to determine the set of minimum DBH cutting limits for dipterocarps and non-dipterocarp tree species as well as Chengal which is always accorded a higher minimum DBH cutting limits due to its high market value.

Tree Marking (TM)

TM operation is done once the minimum DBH cutting limits have been determined and prescribed based on calculation on Pre-F Inventory data. Trees above the minimum DBH cutting limits are marked by using plastic tags bearing the necessary information on species and serial numbers, which are nailed to the stem as well on the base to indicate the direction of fall when the tree was cut during felling operation. This is in conformity with the reduced impact logging (RIL) protocols to which KPKKT subscribes and practices.

The number of plastic tags nailed on the tree indicates the number of 5-metre logs that could be bucked and extracted from the tree during logging. The use of plastics tags and serial numbers is to facilitate the stump-to-millgate tracking of the timber which forms part of the accounting and chain-of-custody certification processes.

Certain trees of special significance such as mother trees, fruit trees, nesting trees, protection trees and trees standing within the riparian buffer zones are however spared from logging for obvious reasons, regardless of their species and size.

3.3 Road and Bridge Construction and Maintenance

Road construction is carried out by appointed contractors upon approval of the road alignment by TSFD, well before the start of logging operation. The work is done under close supervision of TSFD as well as KPKKT staff. The designs of the road system follow the specifications in the Forestry Department guidelines, namely the Forest Road Specification, 2010. The specifications guide the construction of forest roads, skid trails, cross drains, side drains, culverts, sumps etc.

3.4 Selective Felling Operations

Tree Felling and Bucking

Trees are felled by using chainsaw following as much as possible the felling direction as recommended by the position of the tag on the stump, while observing all the precautionary and safety measures to the workers as well as the surrounding vegetation and ecosystem. No tree shall be felled into the buffer zones or into rivers, and no felling activity shall be carried out during rainy days or windy times. The instruction on felling direction also is to avoid hitting and injuring potential crop trees (PCTs) as well as mother trees, fruit trees and protection trees. The felled tree is then de-limbed by removing the crown parts, main branches and irregular buttresses, and the tree-length timber is then prepared for haulage operation and subsequent removal from the felling site. In order to minimise damage through destruction of vegetation and compaction of soil surface, the recommended combination of chainsaw: crawler tractor: skidder operating in an area shall ideally be 1:1:2.

Timber Haulage and Transportation

The timber is subsequently pulled by a cable withdrawn from a bulldozer sitting on the skid trail. From there it is skidded along the skid trail to the nearest matau to be bucked, sorted and recorded. A santaiwong would later transport loads of these timbers to the main matau where they are further sorted out for a long haulage on public roads to the recipient sawmills of either PESAKA (Bukit Besi town) or PESAMA (Chukai town). Timber harvesting, haulage and transportation are done by contractors under close supervision by staff of KPKKT.

3.5   Post-Felling Operation

Area Inspection and Closing Report (CR)

Upon completion of logging in a forest compartment, a closing report is prepared by the Range Officer on behalf of the DFO following a close inspection of the working area. This involves a scrutiny on the number of trees felled, the number of trees marked to be felled but not felled, the volumes of timber wastages, damage inflicted on the residual trees and regeneration as well as the buffer zones, rivers and general ecosystem. Findings recorded on the CR are used as a basis for computing the penalty to be levied to KPKKT as the concession holder and manager of DTC.

Area Rehabilitation and Timber Stand Improvement (TSI)

Logging operation causes damage to the remaining residual stand in terms of damage and injury to the PCTs and regeneration and compaction to the soil. These are assessed during CR preparation which is submitted to the DFO for subsequent decisions. Under normal circumstance, a post-felling inventory operation is conducted at 2 – 5 years after completion of logging. The purpose of a post-F inventory is to assess the regeneration status of the residual stand and to help decide

on the type of timber stand improvement (TSI) operations that would be appropriate to rehabilitate and bring back the forest into a "Regenerated Status" within the time period stipulated. At present the most common TSI operation is the "open-area planting" (*Tanaman Kawasan Lapang* – TKL) by using fast-growing indigenous species.

3.6   Logging Contractors

Road construction, harvesting operations and TSI activities are usually contracted out to capable and experienced contractors who are bound by an agreement signed by both parties to carry out the specific activities. The agreement spells out, among others, job specifications, terms of payments, as well as responsibilities and obligations of the parties involved.

3.7   Logging Camps

Logging camps are specially established temporary complex constructed by logging contractors to house their forest workers, machines and supplies. Covering an area of up to 2ha, a logging camp would usually contain units for temporary living quarters complete with facilities such as kitchen, bathrooms, toilets, surau, running water and electricity, television as well as basic recreational facilities. Electricity supplies are provided by a generator which is also connected to the nearby machine workshop and stores. Fuel supplies are provided by a large 15,000-litre tank of diesel. The choice of sites for a logging camp is influenced by such factors as accessibility to working areas, closeness to water sources as well as easy terrain condition. An average-sized logging camp can accommodate about 20 – 30 workers depending on the size of operation and the amount of works still left to be

completed. During a normal working day, workers tend to loosely follow normal working hours, but sometime may also put in extra hours in order to cover for lost time due to rainy periods or other reasons.

The living quarters can be made of sawn timber or metals with zinc or palm *attap* roofing and floor raised to serve as beds for the workers who usually sleep on simple, thin mattresses and covered with mosquito nettings. Bed time is at 10.00pm when the generator is shutdown till 06.00a.m the following morning. Workers are generally allowed to go back to their families during weekends and public holidays.

3.8   Occupational Safety and Health (OSH)

It is a common knowledge that working in the forests can be very physically and emotionally demanding, hazardous and unhealthy due to a combination of factors including the remote environment, the types of machineries involved (e.g. chainsaws, bulldozers, *santaiwong*s, timber trucks, etc), terrain and topographical features of working sites, nature of work and conditions of the logging camp and potential natural catastrophes such as incessant rains and floods. Consequently, appropriate measures must be taken to ensure the health and safety of the workers. To this end KPKKT provides Personal Protective Equipment (PPE) to its forest workers, notably hardhats and safety boots as well as basic medical supplies. KPKKT also requires its contractors to pay due attention to health and safety issues. Records maintained by KPKKT did not show any incidents of accidents or sickness involving forest workers. Occupational diseases are not known amongst KPKKT staff as well as contract workers.

Fig. 3

Fig. 4

Fig. 3 & Fig. 4. Stakeholder Consultations & Training sessions are regularly conducted for KPKKT's staff & workers in order to equip them and upgrade their skills and level of competence. Photos show a joint training session conducted with staff of PESAMA.

3.9   Training & Stakeholder Consultation

As mentioned earlier, training and capacity building are regularly conducted as part of human resource development within KPKKT. The latest training programme conducted by KPKKT for its staff was the FSC Mentoring session conducted jointly wirth Pesama Timber Corporation Sdn Bhd on 20th September 2018. KPKKT also establishes coordination and consultation with the public, industry and other government agencies (such as the Wildlife Dept. (Perhilitan), Dept. of Environment, State Forestry Dept., FRIM, universities, etc.) as well as NGOs (such as WWF-Malaysia and GFTN) on a continuous basis while at the same time reviewing and developing appropriate guidance documents and standard operating procedures (S.O.P.). Apart from the main function of KPKKT to manage and harvest timber produce in a sustainable manner, the company also encourages and promotes local employment, recreation and tourism, visual landscape management, basic raw materials extraction, and bio-prospecting within DTC.

3.10   Implementation and Monitoring

Considerable emphasis is put on mechanisms for checking implementation and improving performance as well as monitoring on major aspects of operations such as timber production, forest road and bridge construction, buffer zones, boundaries, tree felling, reduced-impact logging (RIL), logging camps, workers' safety and health, etc.

Management Prescriptions for Stand Management and Conservation

Management decisions within DTC take into consideration of the following:

1) The concept of forest zonation by function in which different major groups of activities and uses of the forest should be conducted within the areas zoned up for that particular activities/ uses. The idea is to minimise conflict of land uses as well as to maintain resource integrity.

2) The concept of High Conservation Value Forest (HCVF) covering aspects on delineation, census, documentation, planning, future development, formal assessment and monitoring of measurable effectiveness indicators, etc.

3) Standard and guidelines on the control of erosion, minimisation of forest damage during harvesting, road construction, and all other mechanical disturbances, and to protect water resources, as well as the relevant mitigation measures to minimise the negative impacts of those operations.

Ecosystem health and vitality

Ecosystem health is defined as a condition wherein an ecosystem has the capacity across the landscape for renewal, for recovery from a wide range of disturbances, and for retention of its ecological resiliency while meeting current and future needs of people for desired levels of values, uses, products, and services. Ecosystem health in DTC is being monitored throughout the planning period.

The likelihood of the damage incurred to soils from the use of heavy machinery in wet soil conditions is reduced by the introduction of controls on operational measures to limit soil damage from erosion. Water quality maintenance measures are through the buffering of all streams.

High Conservation Value Forests (HCVFs)

The two HCVF areas within DTC are still maintained and in good functioning condition. They are:

1. The Keruing sarawak plot in Compartment 31 Jerangau PRF covering a total of approx.. 63 ha.

2. The community watershed forest within Compartment 52 Jengai PRF which supplies continuous, clean water to the residents of Kg Pasir Raja.

4.0 Physical, Biological and Social Environments

4.1   Physical Environment

The Concession forest area lies in the Dungun Timber Complex (DTC), located about 120km to southwest of the state capital city of Kuala Terengganu, between latitude 3˚ 53'' - 5˚ 51'' North and longitudes 103˚ 30'' - 102˚ 23'' East, covering a total area of approx. 108,900ha (approx. 268,980acres). KPKKT administers and manage DTC from its main office located in the small township of Bukit Besi which is in turn situated some 75km to the south of Kuala Terengganu city, and about 32km to the west of Dungun town, in the Forest District of South Terengganu. Bukit Besi Town can be reached from Malaysia's capital city of Kuala Lumpur (in the southwest) by road via the East Coast Expressway which passes through Gambang, Jabor and Durian Mas. From the north, Bukit Besi can be reached from Kuala Terengganu as well as Dungun by the Terengganu state's coastal trunk road. There are at least 2 airports that serve Kuala Terengganu and thence the project area. These are the Kuala Lumpur International Airport (KLIA) and Sultan Mahmud (Kuala Terengganu) Airport.

DUNGUN TIMBER COMPLEX comprises a total of 308 forest compartments of approx. 400ha each in area. Selective logging under the first cycle of the Selective Management System (SMS) in the area was started in 1983 and ended around 2008.

Fig. 5. Map of DTC (2016).

4.2 Natural and Biological Environment

<u>**Natural Environment**</u>

The natural TRF within DTC embraces various forest functions and zones as follows (*note*: a

particular tract of forest can assume more than one function):

1)   Soil and water conservation area (*i.e.,* areas with slope gradient between 21° - 30°),

2)   Soil and water protection area (*i.e*., areas with slope gradient above 30°);

3)   Riparian buffer protection;

4)   Amenity forest;

5)   Rare ecosystem protection;

6)   Areas for sustainable timber production (TP);

7)   Research forests.

<u>**Forest Types and Composition Before and After Selective Logging**</u>

The whole of DTC comprises the climatic climax natural moist TRF formations consisting of

a series of **(1)** lowland mixed dipterocarp forests; **(2)** hill mixed dipterocarp forests; and **(3)**

upper hill dipterocarp forests. Following along the line of Wyatt-Smith (1963) who had

earlier classified forest types in Peninsular Malaysia according to emergent tree species

dominance, the natural TRF resources in DTC can be classified into

4.   Kapur forests, which grow on low hills, concentrated along the eastern fringes

of DTC,

5.   Meranti/ Keruing forests, which dominate the western part of Jerangau PRF,

southern part of Besul PRF and the western part of Jengai PRF

6.   Meranti/ Seraya forests which cover large parts of Jengai PRF, the whole of

Pasir Raja Selatan PRF and Pasir Raja Barat PRF.

The differences in the vegetation types and species consociation in the above reserved forest seem to be mainly caused by the associated differences in soil properties, particularly so when climate was taken as uniform over the whole of DTC. Under natural conditions, the occurrence of a particular species in any particular spot is determined by the availability of seed bank and regeneration of that species at the time when a gap is formed.   The occurrence of regeneration is largely governed by the distance with which seeds are dispersed from the parent trees followed by suitable conditions for germination and establishment.

Geology, Soil and Topography

The whole region is underlain with a mixture of undifferentiated granitic rocks and shales, predominate with sandstones, mudstones and siltstones. Some minor pockets of gravel, sand, and clayey sandstone and siltstones are found here and there.   The whole region is mainly on steepland with red yellow podzolics derived from granites on lower slopes. This is especially evident in the northern and southern portions of this region.   Soils of sedimentary origin which are frequently associated with the granite-derived soils are mainly found on the foothills. In terms of site degradation risk, the slope gradient imposes particular restrictions on timber harvesting with some 60% of the Project Area having a gentle to moderately steep (0° - 20°) topography, 30% are steep (21° - 30°), and 10% are very or extremely steep (over 30°). More than three fourth of the area were found to be poor, and less than a fourth was fertile.

Fig. 6. Geology of Terengganu and those of the
Ulu Paka area.

(a)

(b)
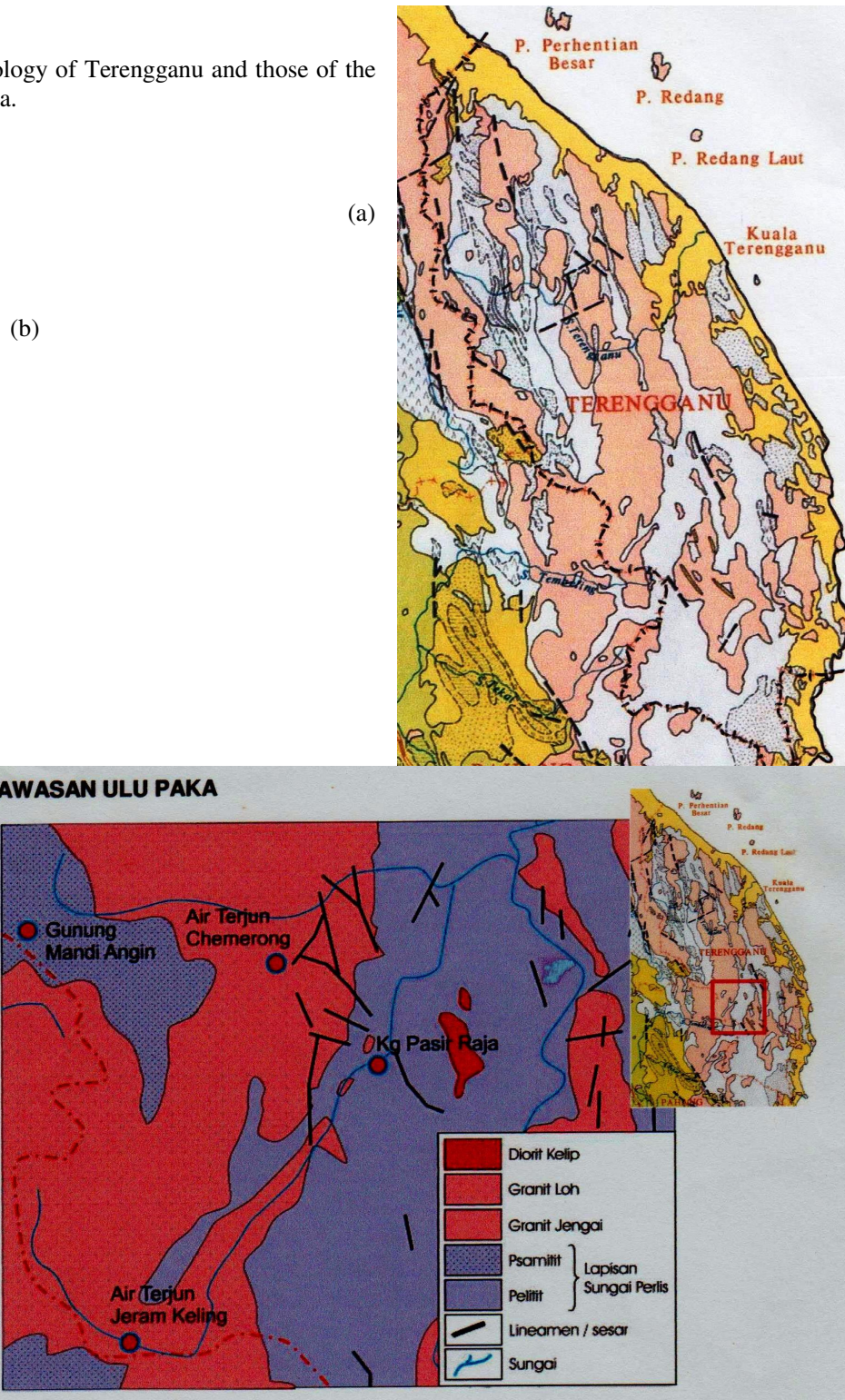
Geologically, the whole of the state of Terengganu lies on the Eastern Stripe (Jalur Timur) of which the most dominant rock types are the sedimentary (including metasediment) from the Carboniferous (most prevalent) and Permian ages as well as Granite (Figs. 6a,b).

Hydrology

Sungai Dungun originates in the eastern side of the Titiwangsa Main Range at the south-western border of Terengganu is the most important river in the Project Area running through its length for about 55 kilometres to its confluence with Sungai Jerangau, virtually cutting the bell-shaped concession into two halves, east and west.   On the eastern side are Besul Tambahan PRF, Besul PRF and Jengai PRF, whereas on the western half are Jerangau PRF, Pasir Raja West PRF and Pasir Raja South PRF. Each of these six PRFs constitutes its own catchment though some of them may lie contiguously with the other or separated by rivers. A majority of the rivers in the individual catchment flow into Sungai Dungun before draining into the South China Sea at Dungun town.

Jerangau PRF as a whole is drained by **(i)** Sg Jemelok which flows from north to south and **(ii)** Sg Melong with its tributary Sg Merong which flow in the northwest - southeast direction. In the south of Pasir Raja PRF major rivers include Sg Kelmin with its tributary Sg Tersat whereas in the north is Sg Berang which flows in the southwest – northeast direction. In Jengai PRF important rivers are Sg Jengai and its tributary Sg Angka both of which flow in the south-north direction through the middle of the watershed. The other rivers within Jengai PRF include Sg Paka in the east and Sg Perlis in the west. Both Sg Perlis and Sg Jengai are tributaries of Sg Dungun and they all flow to the north having originated in the south. Sg Perlis flows from the southeast to the northwest and drains into Sg Dungun near Kg Balu. It has a catchment area of about $150km^2$. The catchment area at

Jerangau Bridge is 1,410km^2, while the total catchment area of the Project site is about 1,800 km^2. Sg Dungun's lowest streamflow rates are from January to July, at 36.5 to 66 cumecs (0.0247 to 0.0466 cumecs per 100ha). The highest rates normally occur during the monsoon period from the end of October to the end of December, at 105 to 859 cumecs. The peak discharge however, could be higher. It is not uncommon for the monsoonal rainfall to reach up to 70mm/ hour in this region. This is equivalent to about 1.94 cumecs per 100ha. The pattern of streamflow naturally coincides with the pattern of runoff, and so does the rate of suspended solids.

A study to monitor the water quality of Sg Perlis which could be considered as a representative of the rivers in the Project Area in 1997 showed that none of the parameters were found to violate the Sewage – Industrial Effluent Discharge Standards of the DoE (VYRAN Group Berhad 1998). However, based on the DoE 1986 Interim Standards, the overall water quality falls within Classes II for both domestic and aquatic life usages, which is "not good". The presence of high levels of ammoniacal nitrogen, bacteria, iron and a low level of dissolved oxygen is attributed to rotting vegetation in upstream logging areas.

Table 3. Classification of Sg Perlis according to DoE 1986 Interim Standards

Criteria	Domestic Usage	Aquatic Life Usage
Ammoniacal N	Class IV	Class IV
Mercury	Class III	Class III
Iron	Class III	-
Bacteria	Class II	-
Low dissolved oxygen	-	Class II

Climate

DTC forest area lies within the tropical monsoon climate belt which is characterised by high temperatures (24° – 30°C), high humidity (70% - 98%) and an average rainfall of more than 4,000mm per year. The wet monsoon season usually occurs from November to January during which period logging operations effectively halt. Daily sunshine period is about 6 – 7 hours but can reach up to 8 – 9 hours especially during the dry months of February – April where logging activities can be active. As a result of the heavy and often prolonged rainy season which frequently leads to floods in Dungun District, the proportion of really productive working days in the forest may range between 30% to 40% only per year. Rainfall in the Project Area is brought about by two monsoons: Northeast monsoon during October – February and Southwest monsoon during April – July, but peaks during the northeast monsoon, in November and December. It is not uncommon for monsoonal rainfall to reach up to 70mm/hour.

Usually, there are no logging operations conducted from November through to late January due to the unusually heavy downpour during these months. Goh K.S. (1995) puts the average annual rainfall in the Hulu Terengganu region at 3,500mm with Annual Potential Evapotraspiration of 1,500mm and Potential Runoff of 2,000mm approximately. This can be compared with Kuala Terengganu area which receives an average of 2,911 mm/ year or 242.6 mm/month of rainfall.

On average there are 182 days per year with more than 0.1mm of rainfall or 15.2 days with a quantity of rain per month. The driest month usually occur around February to June when an average of 109mm of rainfall occurs. The high annual rainfall also gives raise to a correspondingly high Mean Annual Runoff (MAR). According to DID (1995), Sg Dungun which has a total catchment area of $1,410km^2$ has an observed MAR of 2,675mm. This is about 22% higher than the MAR for the whole of Terengganu (catchment area = 13,257 km^2)

at 2,080mm and 44% higher than that of Peninsular Malaysia (catchment area = 134,423 km^2) at 1,185mm.

Biological Environment

The general composition of the natural TRF in DTC is made up of the two main groups of tree species: the Dipterocarps and the non-Dipterocarps. Among the Dipterocarps, the following tree species were found: Meranti *(Shorea species, e.g.* incl. Meranti seraya (*Shorea curtisii),* Meranti sarang punai (S. *parvifolia),* Meranti rambai daun, Meranti langgung, Meranti tembaga (S. *leprosula),* and Damar hitam), Keruing *(Dipterocapus species),* Balau (Heavy hardwood *Shorea* species, *e.g.* Balau laut merah), Merawan (*Hopea spp.),* Mersawa (*Anisoptera spp.),* and Chengal (*Neobalanocarpus heimii).* Among the non- Dipterocarps, the following families and species dominate the tree flora: Kelat (*Syzygium species),* Medang *(Lauraceae),* Kempas *(Kompassia malaccensis),* Merbau (*Intsia palembanica),* Sepetir (*Sindora* spp.), Rengas (*Gluta* & *Melanochylla* species), Bitis, Machang (*Mangifera sp.),* Mengkulang (*Heritiera sp.),* Jelutong (*Dyera costulata),* Durian (*Durio s*pp.), Bintangor (*Callophylum inophyllum),* Kembang semangkuk (*Scaphium spp*.), Melunak (*Pentacme spp.),* and Mahang *(Macaranga spp.).*

4.3   Forest Sub-types and Population Dynamics

A detailed examination of a total of 18 growth and yield (G&Y) permanent sample plots (PSPs) within DTC and the second growth ecosystems around them revealed the unmistakable general characteristics of DTC as a mixed dipterocarp forest rich in the following tree species (arranged according to the order of abundance): Kelat > Dipterocarps > Simpoh & Medang > Kasai, Perah, Minyak Beruk, Penarahan & Nyatuh. In terms of species consociations, the different species and forest vegetation form alliances or forest sub-

types in the following combinations (the most abundant species/ species groups being

mentioned first):

(12)   Kelat – Simpoh

(13)   Dipterocarps – Kelat

(14)   Mixed Kelat

(15)   Kelat – Dipterocarps – Medang

(16)   Dipterocarps – Kelat – Simpoh

(17)   Kelat – Dipterocarps – Rengas

(18)   Kasai – Medang

(19)   Dipterocarps – Kelat – Perah

(20)   Kelat – Dipterocarps – Minyak Beruk

(21)   Kelat – Dipterocarps –Penarahan

(22)   Kelat – Dipterocarps – Nyatuh.

Table 4: Estimated Timber Stock By Forest Category During First Rotation
(1983 – 2007)

Forest Category		Ha	Net Round Timber Yield, m3 /Ha	Est. Total Stocking, m3
Productive	Superior	25,731	63.00m^3	1,621,053m^3
	Good	19,625	54.00m^3	1,059,750m^3
	Moderate	41,036	45.00m^3	1,846,620m^3
Total Productive		**86,392**	**53.63m^3**	**4,633,398m^3**
Non-Productive	Poor , Upper hill, Disturbed	22,508	17.50m^3	393,890m^3

Table 5:   Area Statement (ha) of Production PRFs Within DTC Before Logging During First Rotation (1983-2007)

PRF	Superior	Good	Moderate	Poor	Upper-hill	Disturbed	Total
Besul	-	1,548	1,927	-	-	-	3,475
Besul (T)	-	2,554	-	-	-	93	2,647
Jengai	9,004	7,362	29,587	179	-	158	46,290
P.Raja	16,123	8,038	4,568	2,100	4,590	-	35,419
Jerangau	604	123	4,954	805	-	-	6,485
Total	**25,731**	**19,625**	**41,036**	**3,084**	**4,590**	**251**	**94,317**

4.4 Socio-economic Environment

The district of DUNGUN wherein lies the forest concession of DTC covers an area of 273,503.1ha involving 13 Mukims and a total of 100 villages, constituting about 21.11% of the total area of the state of Terengganu of 1,295,512.10ha. The Mukims are:

(1) Abang (3,315.2ha),   **(2)** Bandar Dungun (22.7ha),   **(3)** Besul (14,251.8ha),   **(4)** Hulu Paka (32,816.4ha),   **(5)** Jengai (78,311.6ha),   **(6)** Jerangau (41,632.5ha),   **(7)** Kuala Dungun (6,345.5ha),   **(8)** Kuala Paka (14,385.8ha),   **(9)** Kumpal (10,764.6ha),   **(10)** Pasir Raja (49,163.3ha),   **(11)** Pekan Kuala Paka (27.9ha),   **(12)** Rasau (19,568.2ha), and **(13)** Sura (2,897.6ha)

Fig. 7.   The 13 Mukims within Dungun District

In terms of land use, slightly more than half i.e. 51.8% (or 141.640.0ha) the land in the district, is still under forest cover of which the 108,900-ha DTC constitutes the largest portion or 76.89%. About 17.51% (or 47,993.5ha) of the land in the district is taken up by agriculture which comprises mostly rubber, oil palm, fruit trees and paddy.

Major land development and agricultural schemes such as those under KETENGAH, FELDA and Ladang Rakyat have, for decades, contributed a great deal towards the economic well-being of the population in the rural areas. Statistics show that about 40% of the people of Terengganu live in the rural areas (UPEN Terengganu 2011). DUNGUN district however is endowed with fertile agricultural lands and abundant marine as well as inland (freshwater) fisheries resources, besides having a great potential for recreation and tourism industries, particularly along the coastal region and the vast natural TRF areas. As for the present, the potential for eco-tourism development is yet to be fully exploited.

The total population of DUNGUN in 2010 was estimated to be about 154,932 which to 190,300 persons in 2015 (population density = 70/km^2). At KPKKT, employment opportunities in the forest are still filled up by local population. Surveys have shown that in general, the local population in DUNGUN does not depend on the forest for their livelihood due largely to the availability of opportunities in the other sectors as mentioned above. For the few individuals who still regularly entered the forest and collected the forest produce for their own consumption, these were limited to such produce as freshwater fishes, fruits, vegetables (e.g. ferns), timbers and rattans. Timbers were used for house repair or construction of chicken coop, while rattans were utilized for making fish traps. River fishes are a popular source of protein for the local communities.

Table 6. DUNGUN District – Land Use in 2011.

No.	Land Use	DUNGUN District	Terengganu State
1	Agriculture	47,993.5ha (17.5%)	287,496.30ha (22.20%)
2	Buildings	64276,460.4ha (2.4%)	40,228.10ha (3.10%)
3	Industry	729.1ha (0.3%)	6,636.80ha (0.50%)
4	Forest Reserve	142,640.0ha (51.8%)	557,661.00ha (43.00%)
5	Others	76,680.0ha (28.0%)	403.289.00ha (31.10%)
6	**Total**	**273,503.1ha (100.00%)**	**1,295,512.10 (100.00%)**

Extracted from UPEN Terengganu (2011). Data Asas Terengganu 2011.

5.0   Legislative and Administrative Frameworks

5.1   Legal Framework

Under the National Forestry Act (NFA) 1984, the State Government is the highest authority for forestry in a particular state. This authority is usually vested to the State Forestry Department (SFD) which is in turn responsible for the management, protection and conservation of the resource in accordance with the provisions as stipulated in the Act and other related legislation.   One of the instruments used by Terengganu SFD is the State Forest Management Plan (FMP) the preparation of which is in accordance with NFA 1984 (i.e. *Akta 313, Akta Perhutanan Negara 1984)* and Forest Concession Agreement between the State Government of Terengganu and Terengganu SEDC (the Concessionaire).

Section 20 of NFA, 1984 states:-

Unless otherwise stated by the State Authority, before any licence is issued the Director shall require the applicant to do any or all of the following:

(a)   *to demarcate on the ground the area or part thereof covered by the licence, the situation and extent of which shall be determined by the Director in accordance*

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with the provisions of the licence, within which operations will be carried out by

the applicant on becoming a licensee;

(b)   *to prepare –*

         (i)   *a **forest management plan** or forest harvesting plan; and*

         (ii)   *a reforestation plan in the manner to be specified by the Director.*

According to the original Forest Concession Agreement signed on 14th September 1975 (and renewed in 2009) between the Terengganu State Government and the Terengganu State Economic Development Corporation (TSEDC), the latter is empowered to manage the concession area in accordance with a Forest Management Plan as approved by the State Government and/or its agents. Clauses 24, 25 and 26 of the Agreement further emphasise that:

Clause 24:

The overall management of the area as covered by this Agreement shall be carried out in accordance with the Forest Management Plan (FMP) to be prepared by the Corporation and submitted not later than 4 (four) years after the signing of this Agreement and as approved by the State Government. The said Forest Management Plan shall be based on a complete forest inventory data properly collected and compiled to a standard set by the State Government and the forest management principles shall be based on the Bicyclic System on a felling cycle of 25 (twenty-five) years or any other management systems directed by the State Director of Forestry, Terenganu.

Clause 25:

(a)   A 5 (five) year Working Plan shall be submitted for each successive 5 (five) year period which plan shall give details of forest development and shall be in accordance with the principles as set out in the Forest Management Plan required by Clause 24.

(b)   The first five (5) year Working Pan shall e submitted together with the FMP and shall be based on the latest forest inventory data available at the time of submission. Al subsequent Working Plans shall be submitted at least 6 (six) months prior to the expiry of currently approved Workng Plan.

(c)   The cutting of trees in the Concession Area shall be in accordance with the correct Working Plan and under the constant supervision of the State Director of Forests, Terengganu or his agent.

Clause 26:

(a)   The object of each succeeding Working Plan shall be to implement sustained yield in equal annual or periodic cuts, and the Plan may embody any method of attaining that objective, as approved by the State Government.

(b)   Should the current Working Plan need revision due to emergency conditions, such as security reasons, insect (and) disease infestations, so that changes are required, these may be carried out with the approval of or on the direction of the State Government.

Other Relevant Legislation

Other relevant legislation include, but not necessarily limited to the following:

1) *Aboriginal Act – Akta Orang Asli, 1954*

2) *Akta Lembaga Penyelidikan dan Pembangunan Perhutanan Malaysia, 1985*

3) *Akta Lembaga Perindustrian Kayu Malaysia, 1973*

4) *Company's Act – Akta Syarikat, 1965*

5) *Criminal Procedure Code - Kanun Acara Jenayah, (FMS Cap. 6), 1903 (Amended 1995)*

6) *Electricity Act – Akta Elektrik, 1949*

7) *Employees' Social Security Act, 1969*

8) *Employment Act, 1955*

9) *Environmental Quality Act – Akta Kualiti Alam Sekitar, 1974 (Amended 1985)*

10) *Evidence Act - Akta Keterangan, 1950 (Amended 1993)*

11) *Factory and Machinery Act – Akta Kilang dan Jentera, 1967*

12) *Federal Constitution – Perlembagaan Persekutuan*

13) *Industrial Relations Act, 1967*

14) *Land Conservation Act – Akta Perlindungan Tanah, 1960*

15) *Mining Enactment – Enakmen Perlombongan, 1929*

16) *National Forestry Policy, 1992*

17) *National Land Code - Kanun Tanah Negara, 1965*

18) *National Parks Act – Akta Taman Negara, 1980 (Amended 1983)*

19) *National Policy on Biological Diversity, 1998*

20) *Occupational Safety and Health Act, 1994*

21) *Penal Code - Kanun Keseksaan, (FMS Cap. 45), 1948 (Amended 1993)*

22) *Registration of Company Act – Akta Pendaftaran Syarikat, 1956*

23) *Road, Drainage and Building Act – Akta Jalan, Perparitan dan Bangunan, 1974*

24) *State Forest Enactments*

25) *State Forest Rules*

26) *Taman Negara (Kelantan) Enactment, 1938*

27) *Taman Negara (Pahang) Enactment, 1939*

28) *Taman Negara (Terengganu) Enactment, 1939*

29) *Town and Country Planning Act – Akta Perancang Bandar dan Desa, 1976*

30) *Trade Unions Act, 1959 (Act 262)*

31) *Water Act, 1920*

32) *Water Supply Enactment – Enakmen Bekalan Air, 1935*

33) Wildlife Protection Act – Akta Perlindungan Hidupan Liar, 1972 (Amended 1988)

34) Workmen's Compensation Act, 1952.

5.2   Administrative Framework

KPKKT was incorporated on 13th March 1980 and is a wholly-owned subsidiary of Permint Timber Corporation Sdn Bhd (PTC) which is in turn a subsidiary of GPB (Golden Pharos Berhad). The latter is a holding company listed on the main board of Bursa Malaysia (Malaysian Stock Exchange) since 1993, with Terengganu Incorporated as its major shareholder. As a responsible company, KPKKT commits itself to protecting the environment while at the same time positively contributes towards the economy of the state and society by way of overcoming the shortfall in local timber raw material supply and providing employment opportunities for the people.

The Terengganu State Forestry Department (TSFD) regularly guides, supervises and monitors the SFM activities conducted by KPKKT within DTC in order to ensure KPKKT's compliance with:

1)   National Forestry Policy (NFP) 1992;

2)   National Forestry Act (NFA) 1984;

3)   the "DUNGUN TIMBER COMPLEX Agreement"; and

4)   other relevant legislation as well as local and international certification standards, such as those of the Forest Stewardship Council (FSC) to which KPKKT subscribes.

The FSC P&C has determined the following as the criteria for a successful SFM:

(a) the conservation of biodiversity,

(b) the maintenance of productive capacity,

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(c) the maintenance of ecosystem health and vitality,

(d) the conservation and maintenance of soil and water,

(e) the maintenance of forests contribution to the global carbon cycle,

(f) the maintenance of natural heritage, and

(g) the contribution to and maintenance of socio-economic values.

6.0   Impact Assessment

6.1   The Survey

The main objective of this social impact assessment was to appraise the various programmes
and activities conducted by KPKKT and its appointed contractors under the guise of SFM
and SMS within DTC forests with the view of analyzing and evaluating their impacts to the
surrounding communities, so as to enable KPKKT's management as well as the relevant
parties to gauge the relevance and effectiveness of those programmes and activities in terms
of their positive as well as negative impacts to the affected communities. Consequently
through the knowledge and understanding gained from such analyse would help ensure that
the design and implementation of the SFM project within DTC could be further mitigated,
improved and enhanced and encourage relevant interest groups, especially residents of the
surrounding villages and other disadvantaged social groups, to participate in and benefit from
this project, to the extent possible. At the same time, the social assessment also identifies and
analyzes the social risks and opportunities of different interest groups. A set of data and
information of the baseline survey have been established through this social assessment, as a
reference for future monitoring and evaluation. Specifically the SIA was aimed at:

(1)   identifying the project's benefits (and probable adverse effects) for the different
        beneficiary groups and to make suggestions/recommendations on how to enhance
        project benefits while at the same time reducing the potential adverse effects;
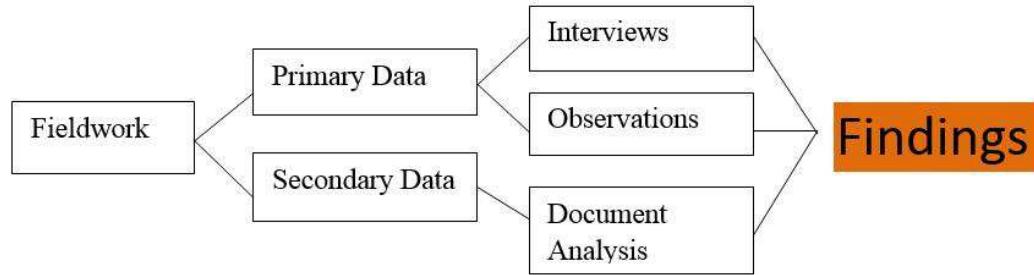
(2)   identifying and understanding the obstacles that hinder local communities from

participating in project activities;

(3)   analyzing and proposing the approaches for mitigating the negative social impacts of

the SFM project;

(4)   analyzing and proposing the stakeholder groups to actively participate in the project.

Data was collected based on questionnaire interviews conducted randomly on residents of

five major villages/ settlements in the vicinity of DTC as in **Table 7**. The interview

schedule is as shown in **Annex 1**. Respondents were chosen at random due to constraints

imposed by time, access, logistics and other factors. This resulted in our team managing to

interview a total of 70 respondents who are distributed almost evenly from the 5 villages.

Fig. 8. Organization of the Study (Adapted from Ramle et al. 2014)

6.2   Socio-economic Profiles of Respondents

Tables 7 – 10 provide summaries of the socio-economic profiles of respondents at the time of the survey. Details of the profiles, when understood in their proper context would provide some indications on the level and quality of life of the respondents, their level of literacy and their social environment which are in turn reflected in their answers to the questionnaires

Nearly 73 per cent of the respondents were males with the remaining 27 per cent females. In terms of age distribution approx. 84 per cent were in the 20 – 60 years old age group; and 60 per cent were married whereas 40 per cent single. In terms of ethnicity 98.57 per cent were Malays and 1.43 per cent was Chinese, which is not surprising given the fact that this part of Malaysia is the heartland of the Malay people. It is interesting to note that despite the poverty level which is the hallmark of the villages in the vicinity of DTC, about 17 per cent of the respondents received higher education up to college and university level; 45 per cent reached secondary education whereas about 37 per cent had had only primary education (see **Table 8**). The rather high literacy rate of the people however did not mean much when a large segment of them still remain in poverty as seen in **Table 9** which shows up to 65 per cent of the respondents were jobless.

Table 7: Breakdown of Respondents by Villages and Age Groups

No	Village	Age Group, Years							%
		15<20	20<30	30<40	40<50	50<60	60++	**Total**	
1	Kg Talong	4	1	3	4	1	2	15	21.43
2	Kg Besol	0	1	4	5	4	3	17	24.29
3	Kg Syukur	0	3	4	3	6	1	17	24.29
4	Kg Pasir Raja	0	5	4	0	1	0	10	14.29
5	Kg Kuala Jengai	0	1	3	3	3	1	11	15.71
6	**Total**	**4**	**11**	**18**	**15**	**15**	**7**	**70**	**100.0**
	%	**5.71**	**15.71**	**25.71**	**21.43**	**21.43**	**10.0**	**100.0**	

Table 8: Breakdown of Respondents by Social Parameters

No.	Parameter		Count	% of Total
1	Gender	Male	51	72.86%
2		Female	19	27.14
	Total		70	100.00
3	Marital Status	Single	28	40.00
4		Married	42	60.00
	Total		70	100.00
5		Malay	69	98.57%
6		Chinese	1	1.43%
7	Ethnicity/ Race	Indians	0	0
8		Indigenous People	0	0
9		Non-Malaysian	0	0
	Total		70	100.00
10		Primary	26	37.14
11	Education Level	Secondary	32	45.71
12		College & University	12	17.14
13		Islamic Religious School	0	0
	Total		**70**	**100.00**

Table 9: Breakdown of Respondents By Main Occupation/ Profession

No.	Sector	Occupation	Count	% of Total	
1		Nil/ Unemployed	46	65.71	
2	Private Sector	Self-Employed	7	10.00	
3	(Non-	Security Guard (Private)	1	1.43	
4	Government)	Student	4	5.71	88.57%
5		Housewife	1	1.43	
6		Farmer	3	4.29	
7		Educator/ Teacher/ Ustaz (Religious Teacher)	3	4.29	
8	Public Sector	Imam (Mosque Official)	1	1.43	
9	(Government)	Policeman	1	1.43	11.43%
10		Government	2	2.86	
11		Clerk	1	1.43	

12	**Total**	70	100.00	100.00

Figures in **Table 9** clearly show that only about 11 per cent of the respondents were employed in the Government sector which include teachers, uztaz, imam or policeman. Those in the "private sector" were either small-time farmers, or self-employed or simply housewives or jobless individuals, which in turn reflects the gravity of the local economic situation of the people who largely live below the official Rural Poverty Line Income (PLI) of RM662.00 monthly for Terengganu in 2004 (Azahari Mohd Raslan 2006). This can be compared with the mean incomes for Malaysia and Terengganu State which stand at RM6,141.00/month and RM4,816.00/month respectively. From **Table 10** it can be estimated that roughly 50 per cent of the village residents live below the Rural PLI. It is not surprising therefore when many of these people had to turn their attention to the nearby forests to gather various forest products such as freshwater fishes (48%), Non-Timber Forest Produce (NTFP) such as vegetables and fruits (32%) as well as timber for construction (5.1%) for their own consumption. To a certain degree our data did reflect the reality on the ground which deserves some urgent attention from the relevant parties.

Table 10: Household Income Level

	Average Income, RM/month	**Count**	**%**
1	<500	26	37.14%
2	500<1000	23	32.86%
3	1000<1500	6	8.57%
4	1500<2000	7	10.00%
5	2000< 2500	3	4.29%
6	2500 ++	2	2.86%
7	Not relevant	3	4.29%
	Total	**70**	**100.00%**

6.3   Forest Usage and Dependency Amongst Respondents

Of the six PRFs within DTC, Jengai followed by Pasir Raja Selatan and Pasir Raja Barat, in that order, were the most frequently visited forest areas by the locals. This can be depicted as follows (Fig. 9):

Fig. 9. DTC's PRF In Terms of Preference by Respondents

Jengai PRF   >   Pasir Raja Selatan PRF   >   Pasir Raja Barat PRF >

Besol PRF / Jerangau PRF   >   Besol Tambahan PRF.

Table 11: Permanent Reserved Forest Most Frequently Visited

	Permanent Reserved Forest (PRF)	Frequency of Visit	%
1	Jengai PRF	31	35.63
2	Pasir Raja Barat PRF	12	13.79
3	Pasir Raja Selatan PRF	18	20.69
4	Besol PRF	10	11.49
5	Besol Tambahan PRF	5	5.75
6	Jerangau PRF	10	11.49
7	Not Relevant	1	1.15
	Total Visitations	**87**	**100.00%**

**Note: Some of the PRFs may be visited more than once, or visitors visited > 1 PRF in a month.

The reasons could range from accessibility, to distance, to the relative abundance/ availability of the desired forest produce (and services). Such knowledge is very critical for KPKKT as the forest managers of DTC and Terengganu State Forest Department to guide them for future planning and implementation, particularly in the area of forest monitoring, protection and control, or, whenever the situation permits, for infrastructure development. Forest areas that are more frequently visited tend to be more at risk of such threats as forest fires, theft of forest produce and illegal logging.

It is interesting to note however that distance was not the sole determinant that influenced respondents' decision to enter a forest. This was due to the availability of vehicles such as motorcycles which is the main mode of transport in rural areas due to its easy availability and affordability. Respondents travelled from as far as 10km or more to enter the forest, mostly entire by foot or on motorcycle or both (Table 12 and 13). It appears that about 86% of the respondents resorted to this method of transport, presumably due to the fast deteriorating condition of the forest road and bridges from abandonment once logging ends. Forest travel by using saloon car and 4-wheeled drive vehicle was not popular due to obvious reasons, and seemed to be confined to the well-to-do, and perhaps more business-minded forest users.

Table 12: Average Distance (in Km) Travelled by Respondents to PRF

	Average Distance To The Forest, km	**Count**	**%**
1	<1 km	8	11.43%
2	1 < 3 km	15	21.43%
3	3 <5 km	16	22.86%
4	5 < 10 km	24	34.29%
5	10 ++ km	7	10.00%
	Total	**70**	**100.00%**

Table 13: Method/ Mode of Transport Used by Respondents to Enter the Forests.

	Method/ Mode of Transport to the PRF	Count	%
1	Walking/ By foot	34	36.96%
2	Motor cycle	41	44.56%
3	Saloon Car	1	1.09%
4	4-Wheeled Drive Vehicle (4WD)	4	4.35%
5	Walking + Motor cycle	11	11.96%
6	N.R	1	1.09%
	Total	**92**	**100.00%**

The survey also revealed that it was not the habit of the villagers to enter the forest regularly on daily, not even on weekly basis despite their low economic condition. Less than 10 per cent entered the forest on biweekly basis whereas only about 13 per cent did that on monthly basis. Most, i.e. nearly 75 per cent entered the forest only irregularly (**Table 14**). The explanation for this phenomenon might come from the fact that most of the villages lie next to, or within easy distance to the nearest rivers from where the residents could safely get their supply of freshwater fishes without having to go through the trouble of travelling to the forest with all the attendant risks, as well as costs. In other words, being not too business-minded, the villagers seemed to be easy-going and contented with their life. This perception is reinforced by the findings in **Table 16** in which fishing for freshwater fishes was offered as the main reason for respondents to enter the forest, followed by collecting Non-Timber Forest Produce at 25.77%.   The latter would cover such activities as catching birds such as punai (pigeon and dove), tiong (mynah) and serindit (budgerigar) as well as such wildlife as sambar deer, barking deer, and mousedeer.   Other NTFP harvested include rattan and medicinal and aromatic plants (MAPs) such as gaharu, kacip Fatimah, mengkudu hutan/ segemuk and ginseng roots, ostensibly for sale.

Table 14: Frequency of Visits to PRFs By Villagers in the Different Villages.

	Village	**Rate/ Frequency of Visit By Villagers to PRF**

		Daily	Weekly	Biweekly	Monthly	Irregularly
1	Talong	0	0	1	1	13
2	Besol	0	3	1	3	10
3	Syukur	0	0	4	1	12
4	Pasir Raja	0	0	0	1	9
5	Kuala Jengai	0	0	0	3	8
	Total	**0**	**3**	**6**	**9**	**52**
	%	**0**	**4.29%**	**8.57%**	**12.86%**	**74.29%**

Table 15: Average Length of Stay in the PRF Per Visit by Villagers

	Village	**Average Length of Stay Per Visit in PRF**			
		1 Day	**2 – 3 Days**	**3 – 7 Days**	**>7 Days**
1	Talong	13	2	0	0
2	Besol	11	5	2	0
3	Syukur	5	9	2	0
4	Pasir Raja	5	3	1	0
5	Kuala Jengai	3	7	1	0
	Total	**37**	**26**	**6**	**0**
	%	**53.62%**	**37.68%**	**8.70%**	

Table 16:   Respondents' Purposes for Entering the PRF

	Village	Purpose For Entering the Forest									
		Official Duties	Fishing	Catching Bird	Animal Husbandry	Recreation	Research	Non-Timber Forest Produce (NTFP)	Construction Material	Social	Other
1	Talong	0	12	0	0	1	1	2	2		1
2	Besol	1	9	1	0	0	1	7	2		
3	Syukur	0	14	4	1	2	0	7			
4	Pasir Raja	0	7	0	0	3	0	4	1		1
5	Kuala Jengai	0	5	1	1	0	0	5			1
	Total	**1**	**47**	**6**	**2**	**6**	**2**	**25**	**5**	**0**	**3**
	%	**1.03**	**48.45**	**6.19**	**2.06**	**6.19**	**2.06**	**25.77**	**5.15**		**3.09**

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Table 17.   Gross Monthly Income Earned by Respondents From the Forest

	Village	**Gross Monthly Income From the Forest, RM/month**						
		<100	**100 < 300**	**300 < 500**	**500 < 700**	**700 < 1000**	**>1000**	**Other**
1	Talong	3	4	0	1	0	0	7
2	Besol	6	2	2	2	0	0	5
3	Syukur	5	9	1	0	0	0	1
4	Pasir Raja	6	0	2	0	0	0	0
5	Kuala Jengai	1	3	2	1	2	1	0
	N.R	4						
	Total	25	18	7	4	2	1	13
	%	35.71%	25.71%	10.00%	5.71%	2.86%	1.43%	18.57%

Given the above-mentioned background, it became clear why more than half (or 53.62%) of the villagers spend only 1 day or less in the forest whenever they enter it, 37.7% between 2 to 3 days whereas only 8.7% would stay between 3 – 7 days, and none was willing to stay longer than 7 days (**Table 15**).

Under the circumstance, it was not surprising when a great majority of respondents (or 71.42%) did not earn more than RM500.00 per month from the forest. This begets the question, whether or not such a situation is fully justified given the forest lying insanely too close to the villagers, and yet they don't seem to benefit meaningfully from it and, what would be the best course of alternative for them and the authorities alike? What would be the potential to use the forest resource to uplift the economic level and living condition of these rural poor?

This study had successfully shown that residents of the five villages surveyed earned very little from the forest in financial terms. This is clearly shown in Table 14 whereby slightly more than 70% of the respondents earned less than RM500.00 per month from the forest.   This is not surprising considering the fact that 51,   or approx.. 73% of the

respondents claimed that the forest produces that they collected from the jungle were for personal use/ consumption, as opposed to 27% who admitted of doing business with them. Unfortunately out of this 27%, more than 18% of them refused to reveal the extent to which the business in forest produce had benefited them.

Fig. 10. KPKKT routinely provides assistance to poor and needy villagers living in the vicinity of DTC as part of its Corporate Social Responsibility (CSR).

The reasons could vary from the desire the keep secret of their earnings to the fear of "opening the can of worms" in the event that they were suspected of engaging in illegal activities such as theft of gaharu or poaching of wildlife. This is despite of our assurance of the confidentiality of the information shared by the respondents.

At this juncture, it is worth pointing out that the Malaysian national median and mean

income levels for 2014 were RM4,585.00/month and RM6,141.00/month respectively of which the corresponding figures for the rural population were RM3,123.00/month and RM3,831.00/month respectively. As for the state of Terengganu the median income was RM3,777.00/month and mean income was RM4,816.00/month (Dept. of Statistics Malaysia, 2015).

6.4   Perceived Social and Economic Impacts of SFM Activities

Respondents were asked for their opinions on various issues that are often raised and talked about concerning forestry operations conducted by KPKKT and its contractors within DTC areas, and ranked these perceptions according to Likert scale of 1 to 5 where 1 means least and 5 means most intense or most severe impact.   The findings from this investigation are summarised in **Tables 18 and 19**.

Whilst the residents of those villages enter the forest out of necessity to supplement their food and supplies of timber, others appeared to be more attached emotionally and culturally to the forests. They were sensitive and aware of the need to protect the environment and the natural forest resources. This is despite their preoccupation with other economic pursuits that generally deprived them from engaging full-time in forest-based subsistence economy. Claiming having no problem with KPKKT, they however did expect more CSR contributions (CSR and Special Assistance scores of below 3 in **Table 18**) towards certain community and "*gotong royong*" activities organized by them by providing them with appropriate tools/ implements and supplies. **Table 18 **also confirms our earlier finding that job and business opportunities in the study area were lacking whereas positive impacts on the environment and supply of clean water from the forests had not been encouraging either. However the question of whether or not the presence of KPKKT could be directly blamed for the lack of jobs and business opportunities for the locals is a subject that is open

to debate. On the other hand, a majority of respondents did agree that KPKKT had managed

DTC successfully and this had to a certain degree helped with the national image in this field.

Concerning the impact of the SFM activities by KPKKT, which has now entered and

well into its second rotation under the Malaysia SMS, respondents were largely

Table 18. Perceived Positive Social and Environmental Impacts of SFM Operations in DTC by
KPKKT (Note: 5 = Very Good, 0 = No Positive Effects)

Village	Job Opportunity	Business Opportunity	Infrastructure	CSR	Special Assistance	Assistance During Natural Disasters/ Emergency	Effects on Environment	Supply of Highland water (Air Bukit)	National Image	Safety
Talong	3.8	3.0	3.4	2.8	2.6	2.5	3.5	3.3	4.0	3.4
Besol	2.9	2.5	2.6	3.4	2.8	3.8	3.4	3.5	3.7	3.2
Syukur	3.3	3.0	3.2	2.9	2.8	3.1	3.2	3.1	3.5	3.2
Pasir Raja	2.6	2.4	3.2	2.9	2.6	1.8	2.9	2.9	3.2	2.4
Kuala Jengai	3.1	3.2	3.1	2.9	2.9	3.3	3.2	3.3	3.3	3.3
Mean	**3.2**	**2.8**	**3.1**	**3.0**	**2.7**	**3.0**	**3.3**	**3.2**	**3.6**	**3.2**

Table 19. Perceived Negative Social and Environmental Impacts of SFM Operations in DTC by
KPKKT. (Note: 5 = Very Severe; 0 = No Negative Impacts)

Village	Water Quality	Water Quantity	Air & Noise	Traffic/ Accidents	Floods	Landslide	Fertility of Agricultural Land	Livelihood of Local Villagers	Threats from Wildlife	Diseases	Conservation	Moral / Ethical/ Religious Values

Talong	3.5	3.8	3.3	2.5	4.7	3.2	2.3	3.1	3.5	2.5	2.7	2.6
Besol	2.6	2.8	2.9	3.0	3.4	2.9	3.2	3.2	2.8	2.5	2.6	2.8
Syukur	3.2	3.3	3.0	1.5	3.9	3.3	1.6	2.6	3.3	1.8	2.1	1.2
Pasir Raja	4.0	3.8	3.2	3.0	4.8	4.1	3.2	4.1	3.8	3.2	3.0	2.6
Kuala Jengai	3.5	3.6	3.6	3.8	4.5	4.3	3.9	4.3	4.2	3.8	3.8	3.5
Mean	**3.3**	**3.4**	**3.2**	**2.7**	**4.2**	**3.5**	**2.8**	**3.3**	**3.4**	**2.6**	**2.7**	**2.4**

unequivocal on the undesirable effects of logging activities on water resources; drinking and non-drinking water, water recreation, fisheries as well as tourism. Sungai Kelemin with its Lubuk Panjang and Sungai Bangang with its Lubuk Kain, along other rivers in the area are known to have spots which attract recreationists from far and wide for their exceptionally beautiful sceneries and crystal-clear water as well as rich fishing grounds.

Uncontrolled and poorly-supervised forest activities are thought to negatively impact the non-timber forest produce (NTFP) and its trade, and the reduced resources would, in the long run threaten the livelihood and job opportunities for forest dependent communities.   On the other hand, little concern was shown on the issues of road safety from the use of timber trucks of public roads. Diseases and social problems from the activities of forest workers and timber truck drivers were not an issue too, so were illegal hunting and disturbance to wildlife (**Table 19**).

6.5   Issues and Complaints

Besides the obvious services and environmental benefits of the natural forest, some of its produce are traditionally known to have high consumption and income values to certain segments of the communities living in its vicinity. While areas of DTC containing these resources may not be designated as HCVF, KPKKT is nonetheless, obliged to institute

appropriate management prescriptions with the view to enhance the values of these forest produces and services and coordinate their utilisation in the context of current legislation governing such uses. KPKKT continues to ensure that all of its SFM activities, particularly selective timber harvesting operations, do not severely damage, and thereby reducing the values of the non-timber resources. At the same time, KPKKT will attempt, to the extent possible, to implement the necessary measures to enhance the quantity and quality of these resources.

On the other hand, the local communities on their part, should shoulder some of the responsibilities to safeguard the resources from being over-exploited while trying to gain economic benefits and services from them. In this respect, KPKKT will continue with the initiative to create and instil awareness about the relevant laws and regulations which govern the collection, keeping and utilisation of these resources. This will be done in cooperation with the relevant authorities which, in turn have their respective areas of responsibility and jurisdictions.

There will be regular consultations between KPKKT, the relevant households and the authorities concerned (incl. TSFD) to discuss on issues related to the collection and use of forest produce. The non-timber forest products, medicinal plants and wildlife are very important for the future not only for the communities but also to the State and the society at large. Efforts in whatever forms, initiated and implemented by any parties will always be given the necessary support for the benefit of all.

The following are the negative opinions brought up by the respondents during the interviews which largely reflect their sentiments on KPKKT and its activities.   These negative opinions were voiced despite of the findings that pointed to the side of the coin:

(1) Logging had caused losses to the villagers

(2) Logging by KPKKT has brought no benefit to the local residents, so it must be stopped!

(3) KPKKT did not fully follow relevant guidelines and specifications

(4) Over-logging damages watershed and water resources

(5) Logging has worsen erosion problems for the locals

(6) Over-logging causes floods.

(7) KPKKT did not conserve fruit trees

(8) KPKKT did not help protect river water quality

(9) KPKKT lacks in the rehabilitation of the logged forests.

7.0   Summary and Recommendations on Mitigation Measures

Based on the findings of this SIA, the following line of actions are recommended to be taken by KPKKT during the days to mitigate the negative impacts and improve its operation:

1) KPKKT is to build up its own database on pertinent social and economic information which will be useful for future reference and decision making process.

2) KPKKT is to develop appropriate strategy to maintain its image as a corporate neighbour that is friendly and socially acceptable to the surrounding communities, while at the same time continuing to maintain its financial strength and viability. This is necessary for the company in its effort to ensure business operational sustainability, protection and conservation of the forest resource, and interests of the forest-dependent communities.

3) KPKKT is to give a high priority towards capacity building and education of its staff as well as public education campaign as part of its CSR and community engagement programmes targeting communities living closest to the forest.

4) KPKKT is to strive to continuously improve its management of the forest and to get DTC being continuously accredited to the standards of established certification bodies such as MTCS and FSC.

5) KPKKT will continue to enhance the quality of its management of DTC by incorporating relevant provisions of Occupational Safety and Health for its staff and workers.

6) KPKKT will continue to undertake assessments of social and environmental impacts of its SFM operations, from time to time and to review relevant reports with the purpose of updating and improving upon those report, which will be followed up by appropriate actions.

7) KPKKT to enhance its cooperation on the matter of SIA and EIA with the relevant authorities and institutions, such as JaKOA, PERHILITAN, JPNT, WWF-Malaysia, UMT, etc.

8) KPKKT needs to be more efficient by cutting down losses through more efficient and less wasteful logging and increasing output of quality timber

9) KPKKT will embark into more aggressive forest rehabilitation programme, possibly through the involvement of local residents

10) There is a need for a better conservation measures by the KPKKT and the parties concerned such as Perhilitan, Forest Department, etc

11) KPKKT needs to improve and refine its working in the forest. About 36 per cent of respondents were aware of terms like ISO, MC& I and FSC and the need and value for their compliance.

12) KPKKT will enhance its public relations (PR) and image with local residents through (a) increased CSR contributions and activities; (b) more active awareness campaign on its activities and the value of conservation; (c) more friendly dialogues with local residence.

13) The authorities concerned need to improve relevant legislation.

14) KPKKT needs to pay particular attention to producing only quality timbers from DTC forests. This is possible through more relevant training of KPKKT's staff and contractors and appropriate enforcement.

15) KPKKT must have adequate forward planning in its management of DTC forests. This can only be done through the cooperation form the State and District forest offices

16) KPKKT may need to install fences around areas of the forest which are considered sensitive and prone to encroachment such as Besol PRF

17) KPKKT should help deepen the rivers which was claimed to have been made shallower by the sedimentation of soils attributed to logging operations upstream. This is a tall order and beyond the expertise of KPKKT. It could only be conducted by the relevant agencies such as the DID (Drainage and Irrigation Department)

18) KPKKT should be considerate to local villagers when conducting its operations

19) KPKKT should contribute to the local villages by constructing more and better infrastructure.

20) KPKKT should abide by the regulations that provides for the protection of fruit trees.

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ANNEX:

SURVEY QUESTIONNAIRES SCHEDULE

PENILAIAN IMPAK SOSIAL OPERASI PERHUTANAN
KEATAS MASYARAKAT TEMPATAN

BAHAGIAN A – MAKLUMAT ASAS KAMPUNG

1. NAMA KAMPUNG: ………………………………………………………...............

2. KEMUDAHAN ASAS: Tandakan √ jika ada atau X jika tiada

| Jalan Tar | ☐ | Api Letrik | ☐ | Air Paip* | ☐ | Balai Raya | ☐ |
| Klinik | ☐ | Sek Ren | ☐ | Sek Men | ☐ | Masjid | ☐ |

*Jika tiada, nyatakan sumber air: ……………………………………………………

3. JARAK KAMPUNG DARI HUTAN SIMPAN KEKAL: ………………………..km

4. Alat Pengangkutan yang lazim digunakan

BAHAGIAN B – MAKLUMAT KETUA KELUARGA DAN ISI RUMAH

1. UMUR: …………………….tahun

2. JANTINA: Lelaki   ☐   Perempuan   ☐

3. BANGSA: Melayu ☐   Cina ☐   India ☐   Lain2 ☐ _____

4. AGAMA: Islam ☐   Kristian ☐   Buddha ☐   Hindu ☐   Lain2 ☐

5. TAHAP PENDIDIKAN:
Tidak sekolah ☐   Sek Ren ☐   Sek Men ☐   Kolej/Univ ☐

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6. TARAF PERKAHWINAN:

Bujang ☐   Berkahwin ☐   Duda ☐   Janda ☐   Bercerai ☐

7. PEKERJAAN: ………………………………………………………..

8. PENDAPATAN BULANAN DARI PEKERJAAN: RM…………………

9. BILANGAN ANAK: Lelaki   …………..orang

Perempuan …………..orang

10. BILANGAN ISI RUMAH: ………………..orang

11. HAKMILIK HARTA: Nyatakan

Ladang getah   …………ekar

Ladang kelapa sawit   …………ekar

Kebun buah2an   …………ekar

Ternakan   …………ekor

(Nyatakan jenis ternakan …………………………………………)

12. PENDAPATAN ISI RUMAH DARI PEKERJAAN, HARTA DAN ANAK:

RM…………………./bulan

BAHAGIAN C – KEPERGANTUNGAN   KE ATAS   SUMBER   HUTAN

1. Nyatakan sumber hutan yang lazim diambil, seperti kayu, rotan, buluh, pokok   ubatan, hidupan

liar, ikan, dan sebagainya, jika ada.

2. Nyatakan anggaran pendapatan bulanan dari hasil hutan, sekiranya hasil hutan tersebut dijual

BAHAGIAN D – KESAN OPERASI PERHUTANAN KE ATAS MASYARAKAT

Berdasarkan kepada pemerhatian dan pengalaman tuan/puan, nyatakan samada operasi perhutanan, khususnya pembalakan, menjejaskan alam sekitar, ekonomi dan budaya masyarakat tempatan, menurut skala: 5 = kesan yang besar; 0 = tiada kesan

1. Sumber air untuk tujuan kegunaan isi rumah, seperti minuman, membasuh, mandi dan sebagainya.

2. Sumber air untuk tujuan pertanian seperti pengairan tanaman, bekalan air untuk kolam ikan, dan sebagainya.

3. Sumber air untuk rekreasi dan ekopelancongan

4. Bekalan hasil kayu dan bukan kayu hutan (rotan, buluh, ubatan, dll) untuk kegunaan sendiri

5. Bekalan hasil kayu dan bukan kayu hutan (rotan, buluh, ubatan, dll) untuk tujuan pemasaran

6. Peluang pekerjaan kepada masyarakat yang diwujudkan oleh industri perkayuan

7. Sumber perikanan sungai

8. Keselamatan masyarakat, seperti kemalangan jalan raya melibatkan kenderaan pembalakan

9. Kesihatan masyarakat seperti penyakit berjangkit akibat pergaulan dengan pembalak

10. Masalah sosial seperti dadah yang mungkin ada hubungkait dengan pembalak

11. Aktiviti pemburuan dan pengambilan hasil hutan secara haram yang mungkin ada hubungkait dengan peningkatan akses melalui jalan hutan

12. Kerosakan kepada tanaman seperti kelapa sawit dan getah disebabkan oleh hidupan liar yang sumber makanan berkurangan disebabkan oleh pembalakan

(Minta responden menceritakan pengalaman peribadi, jika ada, untuk menjelaskan lagi jawapan yang diberi)

BAHAGIAN D – KAWALAN DAN PEMANTAUAN

1. Pernahkah tuan/puan turut serta dalam apa2 program/aktiviti kemasyarakatan yang dianjurkan oleh pihak KPKKT?

2. Pernahkan tuan/puan membuat aduan atau memberi apa2 komen kepada KPKKT berhubung dengan operasi perhutanan yang mereka jalankan?

3. Nyatakan samada tuan/puan bersetuju untuk turut serta dalam program yang dianjurkan oleh KPKKT untuk membincangkan apa2 isu berhubung dengan operasi perhutanan