KUMPULAN PENGURUSAN KAYU KAYAN TRENGGANU SDN. BHD. (KPKKT)

FOREST MANAGEMENT PLAN

FOR DUNGUN TIMBER COMPLEX (DTC) AND CHERUL FOREST CONCESSION (CFC), TERENGGANU, MALAYSIA, 2008 – 2038

(Revised and Updated as of 1st January 2025)

By

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Bukit Besi, Malaysia
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ACRONYMS AND ABBREVIATIONS

AWA	Annual Working Area
AI	Artificial Intelligence
C, Compt.	Forest Compartment
CFC	Cherul Forest Concession
CITES	Convention on International Trade of Endangered Species
CSR	Corporate Social Responsibility
DBH, dbh	Diameter at breast height
DF	Directional Felling
DTC	Dungun Timber Complex
FRIM	Forest Research Institute of Malaysia
GLC	Government-Link Company
GPB	Golden Pharos Berhad
GPFP	Golden Pharos Forest Plantation Sdn Bhd
HCVF	High Conservation Value Forest
FMP	Forest Management Plan
FMU	Forest Management Unit
FSC	Forest Stewardship Council
JPNT,TSFD	Jabatan Perhutanan Negeri Terengganu (Terengganu State Forest Department)
IUCN	International Union for the Conservation of Nature
KPKKT	Kumpulan Pengurusan Kayu Kayan Trengganu Sdn. Bhd.
m.a.i.	mean annual increment
MEI	Measurable Effectiveness Indicator
MTCS	Malaysian Timber Certification Scheme
NFA	National Forestry Act
NFP	National Forestry Policy
NGO	Non-Governmental Organization
OSH	Occupational Safety and Health
P&C	Principle and Criteria (of Forest Stewardship)
PCT	Potential Crop Tree
PERHILITAN	Jabatan Perlindungan Hidupan Liar dan Taman Negara (Department of Wildlife Conservation and National Parks)
PESAMA	Pesama Timber Corporation Sdn Bhd
PSP	Permanent Sample Plot
R&D	Research and Development
RBP	Riparian Buffer Protection
RIL	Reduced Impact Logging
SFM	Sustainable Forest Management
SIA	Social Impact Assessment
SMS	Selective Management System
SOP	Standard Operating Procedure
TP	Timber Production
TPA	Totally Protected Area
TRF	Tropical Rain Forest
VJR	Virgin Jungle Reserve
WWF	World Wildlife Fund

Acknowledgement

We are proud to present this consolidated Forest Management Plan for Dungun Timber Complex (DTC) and Cherul Forest Concession (CFC) both of which are currently under the management of KPKKT.

This document would not have been completed without the solid cooperation and support extended by our dedicated and hard-working staff particularly members of our FSC Committee to whom I am very grateful.

Thank you very much, I look forward to more rewarding and enriching experience working with our great and dedicated team at KPKKT for many more years to come, not only for KPKKT, GPB and the state but also for tropical forestry at large.

Over the years, KPKKT's reputable performance as responsible forest managers has been exemplary and an envy to other tropical forest managers across the world. We are determined to defend this good image and reputation for many years to come by continuing to be certified under local as well as international forest management standards such as the Forest Stewardship Council (FSC) and the Malaysian Timber Certification Council (MTCC).

Thank you.

AHMAD BAZLI BIN RAZALI
on behalf of
Kumpulan Pengurusan Kayu Kayan Trengganu Sdn. Bhd. (KPKKT)

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FOREST MANAGEMENT PLAN (FMP)

For Dungun Timber Complex (DTC) and Cherul Forest Concession (CFC), Terengganu, Malaysia, for the Period 2008 – 2038

(Revised and Updated 1st January 2025)

Executive Summary

This Forest Management Plan (FMP) has been prepared for the two forest concessions namely Dungun Timber Complex (DTC) and Cherul Forest Concession (CFC) that are now effectively under the management of KPKKT since 2020. This followed a landmark decision by the Board of Directors of Golden Pharos Berhad (GPB) the parent company for both KPKKT and Pesama Timber Corporation Sdn Bhd (Pesama) for the management of the said two forest concessions be amalgamated, streamlined and coordinated, in an effort to optimise costs, avoid duplication of activities and achieve greater efficiency. While DTC has been all along under the management of KPKKT, CFC was hitherto under the management of Pesama. In other words, by combining the management of these two forest concessions and placing it under one entity, i.e. KPKKT, it was hoped that the unique tropical forest resources and ecology in both areas could be professionally managed and better conserved in a sustainable manner in perpetuity, *i.e.* in accordance with the prescribed local and international standards and face future challenges.

Under the circumstance since both concessions had had their beginning at around the same time, i.e. 1982/1983 whereas their respective current FMPs still remain valid and effective until around 2037/2038, all there remains to be done is for KPKKT to continue with all the relevant instructions and prescriptions as spelt out within both of the documents and implement them accordingly, *albeit* with some modifications as and when necessary, such as the inventory, management and handling of carbon stock in the context of global warming, climate change and carbon credit trading, and the use of AI (Artificial Intelligence) in forest resource management and administration. This is in keeping with the spirit and tradition that any FMPs are subject to changes and modifications and updating from time to time by incorporating new applicable ideas and latest findings from reliable sources.

Both FMPs cover a period of 30 years, i.e. from 2008 to 2037 for DTC and from 2008 to 2038 for the case of CFC. This means that in both cases the timber stands in question are presently being managed well into the second half of the second cycle of the Malaysian Selective Management System (SMS). Under the circumstance the management of KPKKT is left with few options but remain vigilant and rise up to future possibilities, and be prepared to face the challenges that would be brought up by the upcoming third cycle of SMS of the managed timber stands.

All of the prescriptions contained in both FMPs 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 sustainable forest resource management, biodiversity conservation, technical innovation, social acceptance, climate amelioration and environmental protection. Consequently, all relevant activities and on-the-ground decisions affecting both forest concessions particularly those that concern certifications are being professionally handled by KPKKT including all official businesses and dealings with relevant authorities, silvicultural treatments, protection and enforcement activities, HCVFs (High Conservation Value Forests) as well as international certification under the Forest Stewardship Council (FSC).

The total area of DTC as of 1st October 2024 stood at 106,031ha and that of CFC was 20,243ha, thereby giving a grand total of 126,274ha now under KPKKT's management. While DTC is still being actively managed under the Malaysian Selective Management System (SMS), any timber harvesting activities in CFC is now being put on hold whereby all selective logging activities in it have been put under a "moratorium" pending further supporting data from growth monitoring plots and advise from experts in the field.

Both concessions DTC and CFC support mostly lowland mixed dipterocarp forests which are rich in dipterocarp tree species (e.g. Meranti (*Shorea spp.*), Keruing (*Dipterocarpus spp*.), Balau (*Shorea spp*.) and Chengal (*Neobalanocarpus heimii*) etc) as well as non-dipterocarp tree species (e.g. Nyatoh (*Sapotaceae*), Medang (*Litsea spp*.), Kempas (*Koompassia malaccensis*), Merbau (*Intsia palembanica*), Mengkulang (*Heritiera spp*.), Kelat (*Syzygium spp.),* etc) as well as other non-tree flora and herbs

such as rattans, palms and medicinal and aromatic plants (MAPs). There are also myriads of fauna species, mammals, avifauna as well as aquatic animals. For the purpose of achieving sustainability in the forest management operation by KPKKT, these forest areas are categorised into several "functions" all of which have their own specified roles to play, products and goods to deliver and services to provide to the business operations in particular and the forest ecosystem and society in general, in a balanced and sustainable manner. These include soil protection function, clean water, clean air, climate amelioration, wildlife refuge, recreation and education, research, the need and livelihood of local forest-dependent communities, as well as a sustainable production of quality timber under the selective harvesting protocol of the Malaysian Selective Management System (SMS) that meet the tenets of Sustainable Forest Management (SFM), etc.

For the case of timber production from the Production Forest category, the judicious application of the SMS is carried out by KPKKT's trained and well-informed staff and contractors, under a close supervision by Terengganu State Forest Department (TSFD). Such field operations call for a proper and consistent collection of data from well-organised inventories and permanent growth sample plots, followed by their appropriate analysis, interpretation and use. Once the minimum diameter cutting limits were decided upon, there was the tree marking (TM) and listing operation followed by the establishment of a well-constructed network of forest roads and bridges, then the execution of the reduced impact logging (RIL) which includes among others, "Directional Felling (DF)" in the Production Forest category. The latter is accomplished under the ambit of the SFM protocols which would ensure a balanced and continued existence of these resources in a stable, sustainable and well-managed natural forest environment. These are described in this FMP which focuses on the conservation of species and genetic resources and protection of the environment in line with FSC P&C.

KPKKT looks forwards to more exciting years ahead in managing these two forest concessions under the SFM principle and the precepts of the Malaysian SMS, while meeting the company's business objectives, as well as the high standards of FSC and expectations of the various stakeholders.

Needless to say, this FMP document is subject to revision and updating from time to time as and whenever necessary in keeping with the time and fast-changing technological and social advancement in this field.

CHAPTER ONE

1.0 Introduction

In a landmark decision made in 2019 by Golden Pharos Berhad (GPB) Board of Directors, it was resolved that KPKKT was to take over and manage Cherul Forest Concession (CFC) in addition to the existing Dungun Timber Complex (DTC) which it had been managing since 1983. CFC which has a total area of **20,243 ha** of rich natural mixed dipterocarp forest of Cherul Permanent Reserved Forest (PRF), was hitherto managed by Pesama Timber Corporation Sdn Bhd (Pesama) which is also a GPB's subsidiary company along with KPKKT. With this development, the effective total area of forests under the direct management and responsibility of KPKKT now stands at **126,274 ha,** comprising the following permanent reserved forests (PRF):

1. Six (6) PRFs within Dungun Timber Complex (DTC)**:**
   (i) Jengai PRF (51,640 ha),
   (ii) Besul PRF (6,190 ha),
   (iii) Jerangau PRF (6,841 ha),
   (iv) Pasir Raja Barat PRF (7,320 ha),
   (v) Pasir Raja Selatan PRF (30,680 ha),
   (vi) Besul Tambahan PRF (3,360 ha)

   Total: 106,031 ha
   Of this total, approximately **81,750 ha** (77.10%) has been delineated as "Production Forest" category (**Figs. 1.1, 1.2, 1.3**).

2. Cherul Forest Concession (CFC) which covers a total of 20,243 ha spread over a total of 59 forest compartments. All selective logging activities within CFC has now been put on halt effective from 2023, in order to allow for the managed timber stands to recover and ready for next round of harvesting. The timeline for future harvests from CFC will depend on findings from growth monitoring activities and advise from experts in this field.

Fig. 1.1. Dungun Timber Complex (DTC) Showing the Various Permanent Reserved Forests and Their Extents.

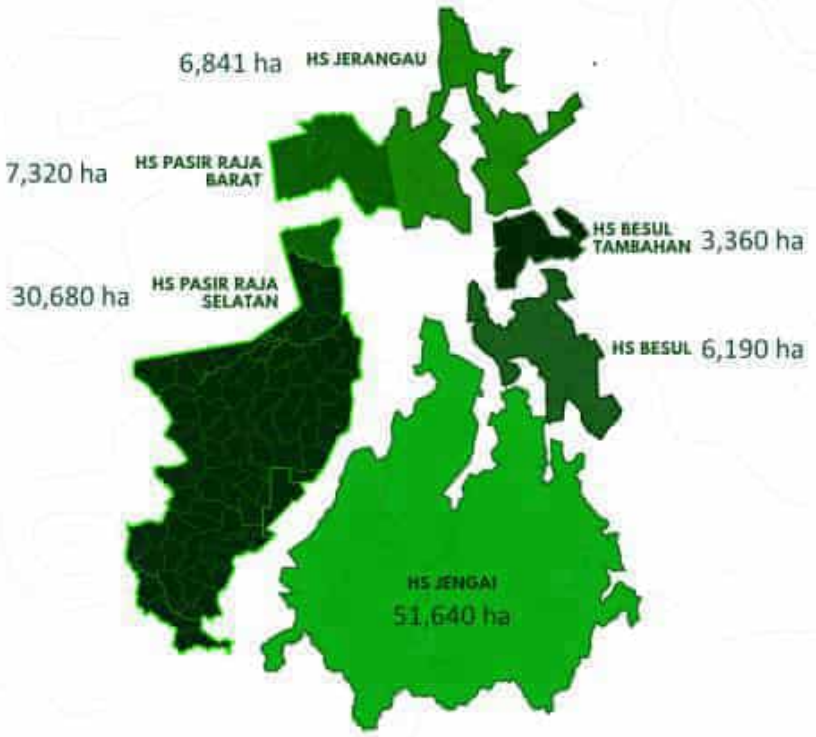
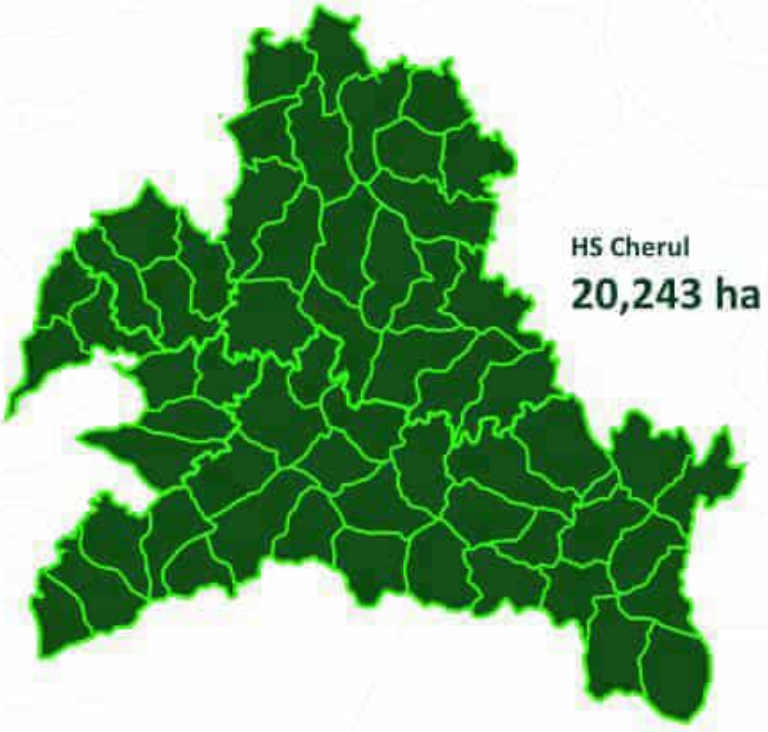


Fig. 1.2. Cherul Forest Concession (CFC)



The decision by Golden Pharos Bhd (GPB) to combine the management of the two forest concessions of DTC and CFC, and subsequently place them under one single management of KPKKT, was made in order to enable the unique tropical forest resources and ecology in both areas to be professionally managed and rehabilitated in a sustainable manner and conserved in perpetuity, *i.e.* in accordance with the prevailing prescribed local and international standards. These include, among others the official businesses and dealings with relevant authorities, forest rehabilitation and timber stand improvement (TSI) activities, forest inventories, research and growth monitoring, protection and enforcement, as well as securing international recognition under the Forest Stewardship Council (FSC).

The management of both DTC and CFC is based on the tenets of Sustainable Forest Management (SFM) principles as laid out in the Forest Management Plan (FMP) documents earlier prepared for each of the two forest concessions respectively. Both FMPs cover a 30-year period: 2008 – 2037 for DTC and 2008-2038 for the case of CFC. This means that in both cases the timber stands in question are presently being managed well into the second cycle of the Malaysian Selective Management System (SMS). All of the prescriptions contained in both FMPs 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 sustainable forest resource management, biodiversity conservation, technical innovation, social acceptance, biomass and carbon stock management, climate amelioration and environmental protection.

1.1 EIA-Compatibility and Compliance

The management of DTC and CFC 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, State of Terengganu Darul Iman. 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 planning and activities and field operations, as guided by the Forestry Department and FSC Principles and Criteria, in order to minimise potential negative impacts of such operations.

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

KPKKT continues to observe and comply with **(1)** the National Forestry Policy 1978 (Amendment) 2021; **(2)** National Forestry Act 1984 (Amendment) 2022, **(3)** the "Forest Concession Agreement of Dungun Timber Complex (DTC)" and "Cherul Forest Concession (CFC)" (SFD TERENGGANU 1982), and **(4)** all 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 was subsequently renewed and extended to cover the present cycle of management, from 2008 to 2037. For the case of CFC, similar arrangements were made by the Terengganu State Government with Pesama Timber Corporation Sdn Bhd whereby the concession agreement was also extended to a further 30 years, from 2009 – 2038.

Both DTC and CFC were recognised and certified by FSC as "Well-Managed Forests", DTC being since April 2008 and CFC since September 2012. During the latest re-certification audit in June 2024 both of these FMUs were again successfully certified as "well-managed forests" by FSC, this time under one single entity, KPKKT. We are determined to continue with his legacy for as long as possible into the future.

Fig. 1.3 Map of DTC and CFC Showing Main Forest Types (Not to scale).

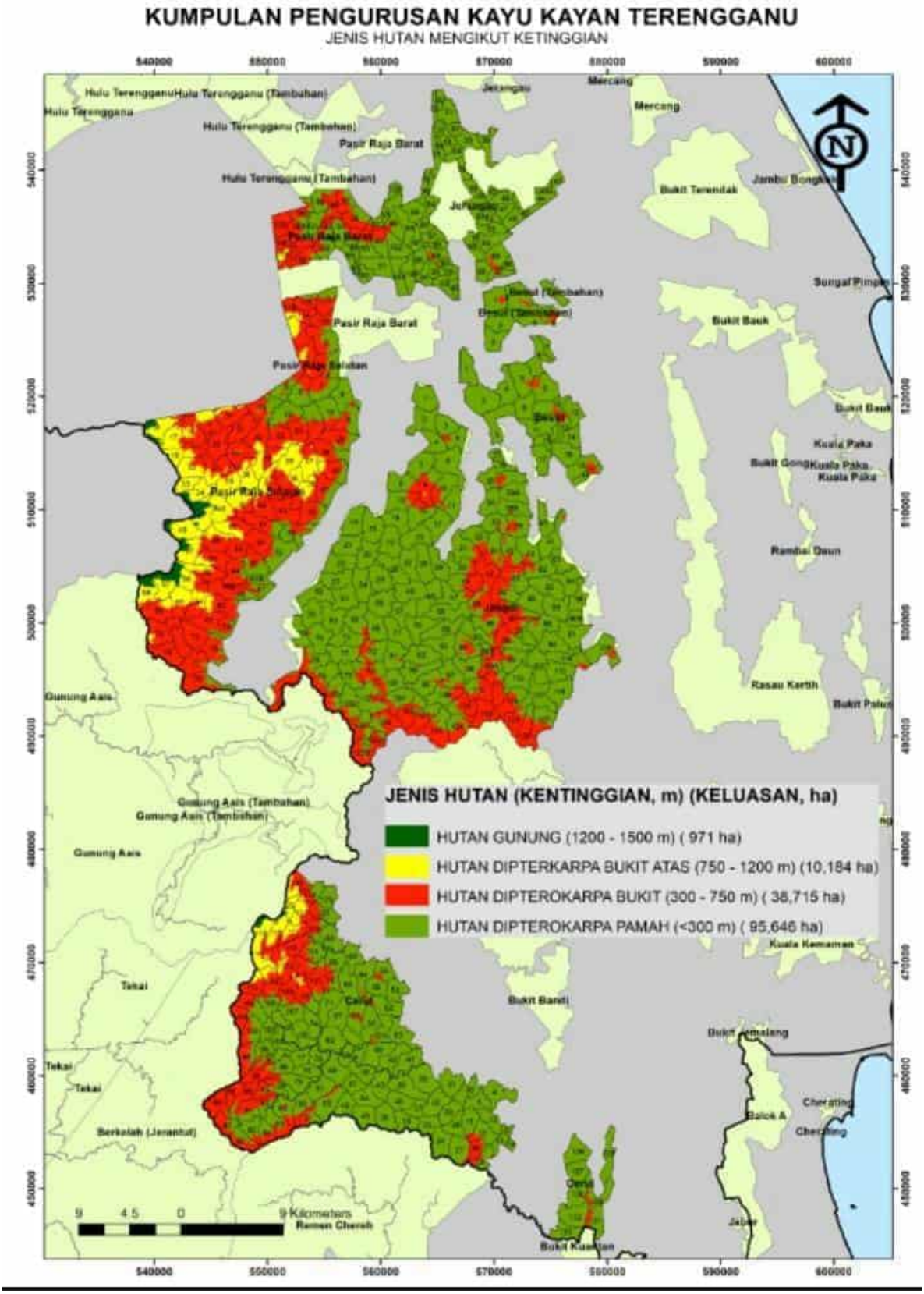
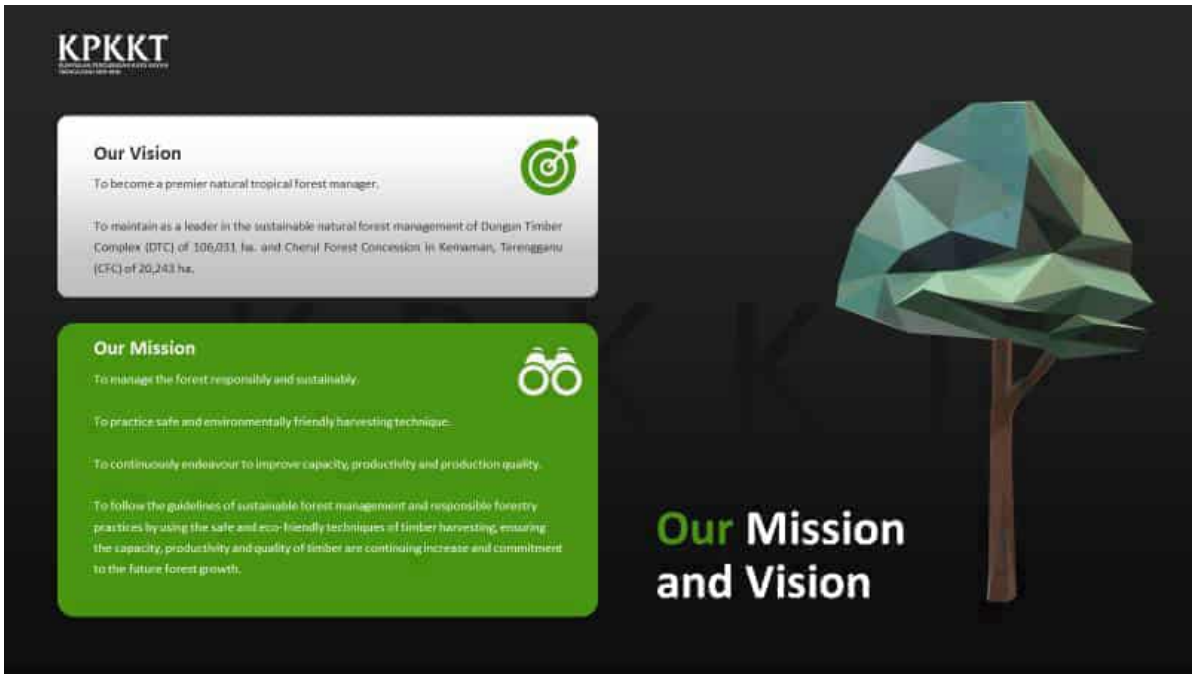


Fig. 1.4. KPKKT's Vision and Mission



1.3 Vision and Mission

As summarised in Fig. 1.4 KPKKT aspires to become the world's premier forest management company in the fields of sustainable forest management (SFM) and conservation of the natural tropical rain forest (TRF). This is being realised by KPKKT maintaining its leadership position in the fields mentioned above by way of its ability to achieve such high standard of performance which are recognised by internationally renowned forest certification bodies such as the Forest Stewardship Council (FSC) and the likes.

It follows, KPKKT's missions in SFM of the TRF are

(1) To manage the forest ecosystems and resources under its charge responsibly and sustainably
(2) To practice safe and environmentally sound, technologically appropriate and economical timber harvesting and forest rehabilitation techniques,
(3) To continuously improve its timber production capacity, productivity and quality
(4) To closely follow the guidelines of SFM and responsible forestry practices by emphasising on quality human resource management, community engagement, minimisation of damage and wastes, data collection and management, and monitoring of growth and yields of timber stands under management.

1.4 Manpower Position

As on 01st January 2025, KPKKT employs a total of 83 staff comprising 69 males (83%) and 14 females (17%). This can be compared to the situation in 2021 during which males constituted 88% and females 12% of the total workforce. A total of 88% of the present staff are on permanent employment while 12% work on contract basis. In terms of ranks 12% of the staff are in the management and executive level whereas 88% work at the non-executive and technical level. The high proportion of technical staff reflects the importance attached by KPKKT on field and R&D operations. Table 1.1 below shows the staffing position by departments and gender.

Table 1.1. KPKKT: Staffing Position as in January 2025.

	Department	Male	Female	Total
1	Administration (HRA, Account & IT)	6	7	13
2	Development & Licensing	21	-	21
3	Operations	15	2	17
4	Compliance & Certification	2	1	3
5	Receiving & Logistics	23	-	23
6	Data Management & Geomapping	2	4	6
Total		**69 (83%)**	**14 (17%)**	**83 (100%)**

Training for staff on a wide range of topics and subjects particularly those related to their daily tasks and responsibilities continue to be arranged and conducted from time to time, both within and outside of KPKKT as summarised in Tables 1.2 and Figs. 1.6 and 1.7). For the future, training in the following areas will need to be emphasised by the company, i.e. in keeping with the current and future trends:

1. Machine operations in environmentally benign and damage-limiting techniques
2. Forest resource inventory, TSI operations, mapping and application of Arc-GIS and Artificial Intelligence (AI).
3. Forest nursery technology and planting stock production.
4. Occupational health and safety.
5. Mentoring programme on forest certification, including FSC.

Fig.1.5 Organisational Chart of KPKKT (January 2025)

Fig. 1.6. KPKKT FSC Committee (2025)

Table 1.2.

Selected Short Courses, Seminars and In-Service Field Visits Organised for KPKKT During 2022 - 2024

2022

No.	Date & Duration	Course Title	Venue	Participation
1.	20/01/2022	Program Keselamatan Dengan Kerjasama Jabatan Bomba & Penyelamat AMBS (Taklimat Pencegahan Kebakaran & Demontrasi Latihan Kebakaran (Fire Drill)	KPKKT	All Staff
2.	07/02/2022 – 08/02/2022	Taklimat berkaitan Sistem Pengurusan Kualiti MS ISO 9001:2015 & Perlaksanaan Pensijilan Hutan MC & I bersama Pelesen di Negeri Terengganu	JPNT	Selected Staff
3.	15/03/2022 – 17/03/2022	Kursus Pembinaan & Penyelenggaraan Jalan Hutan Bil. 1 Tahun 2022	KPKKT	Operation Staff
4.	21/03/2022 – 24/03/2022	Kursus Keselamatan & Kesihatan Pekerjaan bagi Operasi Pembalakan Bil.2 tahun 2022 (Program Kompentesi)	KPKKT	Operation Staff
5.	07/04/2022	Health webinar : "Sayangi Buah Pinggang Anda"	Online	Selected Staff
6.	12/06/2022	An Employee Benefits Programme (Perlindungan Insurans Takaful Malaysia) disampaikan oleh En. Zulkifli bin Ariffin	KPKKT	All Staff
7.	19/06/2022 – 24/06/2022	Lab Semakan Semula Konsep & Amalan Sistem Pengurusan Memilih (SMS) - Siri 2 di Negeri Terengganu	Kuala Terengganu	Selected Staff
8.	29/06/2022 – 30/06/2022	Kursus Latihan Basic First Aid, AED & CPR	Kelab Golf, Bukit Besi	Selected Staff
9.	26/09/2022 – 30/09/2022	Certified Environmental Professional in Scheduled Waste Management (CePSWaM)	Kuantan Hotel	HOD Compliance & Certification
10.	13/10/2022	Seminar Undang-undang Kecil Bangunan Seragam 1984 (Pindaan) 2021 Zon Timur	The Zenith Hotel, Kuantan	Selected Staff
11.	27/11/2022	Program 'Stakeholder Engagement & Mentoring KPKKT' 2022.	KPKKT	Management Staff, Supervisors & Contractors
12.	29/11/2022	Kesedaran Gangguan Seksual Di Tempat Kerja	Online	Management & Office Staff

2023

No.	Date & Duration	Course Title	Venue	Participation
1.	05/02/2023	Taklimat Pindaan Akta Kerja 1955	KPKKT	Management Staff
2.	12/02/2023 – 15/02/2023	Kursus Asas Pengendalian Jentera Logfisher Siri 2/23	Pusat Latihan Perhutanan Terengganu, Kg. Teris	Operation Staff
3.	21/03/2023 – 22/03/2023	Program Pemantapan Usahasil di Kompt. 87 & 88.	KPKKT	Selected Staff
4.	21/03/2023	Seminar Cukai 2023 – Tax Deductible	Hotel Permai Terengganu	Account Dept
5.	05/04/2023	Taklimat Akta KWSP kepada Kakitangan KPKKT & GPFP	KPKKT	All Staff
6.	07/06/2023	Hari Integriti Kumpulan Golden Pharos Berhad	Terengganu Inc	Management Staff
7.	24/09/2023	Taklimat Skim PERKESO	KPKKT	All Staff
8.	19/10/2023	Penilaian Kefahaman Operasi	KPKKT	Operation Staff
9.	07/12/2023	Taklimat Akta Perhutanan dan Proses Pendakwaan Kesalahan Hutan	KPKKT	All Staff
10.	07/12/2023	Taklimat Keselamatan dan Kesihatan Pekerjaan	KPKKT	All Staff
11.	19/12/2023	Stakeholder Engagement KPKKT dan PESAMA 2023	Paya Bunga Hotel, K. Terengganu	Management, Supervisor, FSC Committee & Contractors
12.	13/12/2023 – 14/12/2023	Program Latihan Dalaman Employment Laws for Managers	Pusat Sains & Kreativiti Kuala Terengganu	Managers Level

2024

No.	Date & Duration	Course Title	Venue	Participation
1.	24/01/2024	Latihan Basic Fire Fighting & Emergency Response Plan & Preparedness Tahun 2024	Cherating Holiday Villa, Kuantan	Selected Staff
2.	02/02/2024 – 04/02/2024	Kursus Team Building 2024 Kakitangan KPKKT	Cheringin Hills Resort, Janda Baik	All Staff
3.	09/02/2024	Sesi Taklimat dan Konsultasi Banci Pertanian 2024 Bagi Sektor Perhutanan Dan Pembalakan di JPNT	Terengganu State Forest Department, Kuala Terengganu	Selected Staff
4.	21/03/2024	Forest Stewardship Council (FSC) Mentoring KPKKT 2024	KPKKT	Selected Staff
5.	22/04/2024	Kursus Teknik Tebangan Pokok Secara Berarah Anjuran KPKKT dan PLPT	KPKKT	Operation Staff
6.	21/05/2024	Mef Tax Seminar 2024	Duyong Marina & Resort	Account Staff
7.	26/06/2024	Program TDM Knowledge Sharing Carnival: Kursus Integriti (DIDI)	Pusat Sains & Kreativiti Kuala Terengganu	Selected Staff
8.	26/06/2024	Program TDM Knowledge Sharing Carnival: Ntw24 -As 5 Pillars	Pusat Sains & Kreativiti Kuala Terengganu	Selected Staff
9.	02/07/2024	Invitation To Stakeholder Consultation on Proposed Modifications for The Programme, For the Endorsement of Forest Certification (PEFC) Sustainable Forest Management Standard ST 1003 To Align with European Union Deforestation Regulation (EUDR) Requirement	Kompleks Bangunan Getah Asli, Kuala Lumpur	Management Staff
10.	18/07/2024	Program Perkongsian Bersama Mitigasi Konflik Harimau-Manusia (HTC)	Hotel Tanjung Vista, Kuala Terengganu	Compliance & Certification Staff
11.	25/07/2025	Seminar Pendidikan Perburuhan Peringkat Negeri Terengganu	Drawbridge Kuala Terengganu	HR Staff
12.	28/07/2024	E-Invoice Implementation: Streamlining Bussiness Process and Tax Saving Strategies	Awana Kijal, Kemaman	Account Staff
13.	30/07/2024 – 31/07/2024	Interactive Dashboard Reporting Using Microsoft Power Bi	TD1303, Kuala Terengganu	Selected Staff
14.	12/08/2024 – 14/08/2024	Sesi Pengujian Sistem Perisian E-Balak & KPKKT Timber Tech Software & Dokumentasi URS	KPKKT	Selected Staff
15.	24/08/2024 – 25/08/2024	E-Invoice Implementation	The Qamar Paka, Dungun	Selected Staff
16.	08/09/2024 – 10/09/2024	Osh Coodinator Dosh Trained Person of Occupational Safety & Health Coordinator	Kunang Training Centre Kerteh	Compliance & Certification Staff
17.	24/09/2024	Sesi Latihan Penggunaan Sistem Perisian E-Balak & KPKKT Timber Tech Software	KPKKT	Selected Staff

18.	23/10/2024	Program Taklimat Keselamatan dan Keselamatan Pekerjaan di Sektor Pembalakan Negeri Terengganu 2024	Sumai Hotel, Kuala Terengganu	Selected Staff
20.	03/11/2024	Roadshow PMS & KPI 2024	KPKKT	All Staff
21.	03/11/2024	Sesi Roadshow Berkaitan Program Kecekapan Pekerja Hutan Di Sektor Pengusahasilan	PHDTU	Selected Staff
22.	12/11/2024 – 13/11/2024	Sesi Latihan Configuring Web Apps with Arcgis Experience Builder	ESRI Malaysia, Kuala Lumpur	Selected Staff
23.	14/11/2024	Mastering Esg & Carbon Reporting A Practical Guide For Malaysian Businesses	Wisma Terengganu Inc, Chendering	Selected Staff
24.	19/11/2024	Kursus Operasi Pembalakan	KPKKT	Selected Staff
25.	25/11/2024 – 26/11/2024	Latihan e-Invois	Duyung Marina Resort, Kuala Terengganu	Selected Staff
26.	28/11/2024 – 29/11/2024	Legacy Speaking Workshop on Alternative Dispute Resolution – ADR vs Litigation: Making the Right Choice	Bidong View Beach Resort, Setiu	Compliance & Certification Staff
27.	09/12/2024 – 10/12/2024	Program FSC Mentoring 2024	Kelab Golf Bukit Besi, Dungun	Selected Staff
28.	17/12/2024	Taklimat E-Invois	KPKKT	Selected Staff
29.	19/12/2024	Kursus Stakeholder Engagement 2024	UiTM Dungun	Selected Staff and Stakeholder

Fig. 1.7 Examples of the Training Courses Conducted for KPKKT Staff.

Kursus Asas Pengendalian Jentera Logfisher Siri 2/23

Taklimat Akta Perhutanan dan Proses Pendakwaan Kesalahan Hutan

Hari Integriti Kumpulan Golden Pharos Berhad

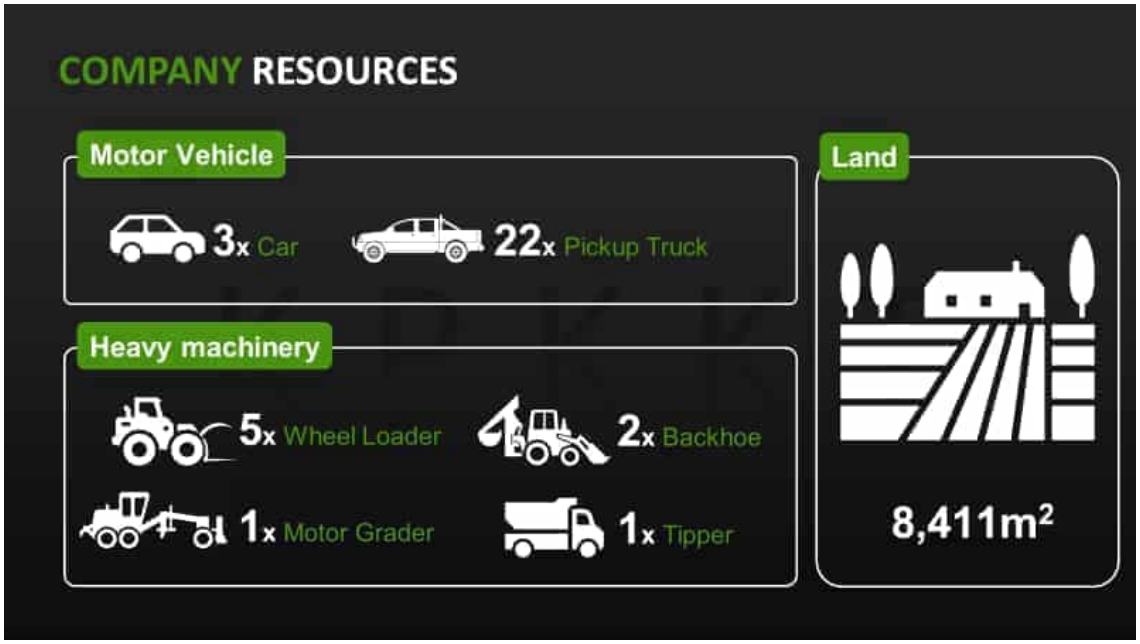
Taklimat Keselamatan dan Kesihatan Pekerjaan

Fig. 1.8 FSC Mentoring

FSC Mentoring 21 Mac 2024

FSC Mentoring 9-10 December 2024

Fig. 1.9. KPKKT's Physical Resources



1.5 Physical Resources

Apart from the host of dedicated, trained and competent human resources, KPKKT also has at its disposal, a range of machinery and landed properties as summarised in **Fig. 1.9**. These include a total of 3 cars, 22 pickup trucks, 5 wheeled-loaders, 2 back-hoes, 1 motor-grader and one tipper truck all of which are vital for communication and transportation purposes and to aid in forest monitoring, engineering, forest rehabilitation, earth work, soil protection, river & stream maintenance and road and bridge construction, etc. These machines are maintained by our dedicated team of technicians at KPKKT's workshop in order that they remain in tiptop condition and good working order. The machine workshop is currently located next to KPKKT's main office complex at Bandar Bukit Besi, within Dungun District.

CHAPTER TWO

Forest Resource Base and Management Strategy

2.1 Policy on Forest Resources Management and Forest Protection

In managing the biologically diverse and precious tropical rain forest resources and ecosystems within DTC and CFC, KPKKT holds on to the three key tenets of the principle of Sustainable Forest Management (SFM) as mentioned earlier, namely:

(1) Business continuity and growth, which include aspects on the economics, profitability and sustainability of the operations, as well as technical competence and innovation.

(2) Ecological and environmental integrity and protection; and

(3) Social acceptability and co-existence with the local communities in the immediate vicinity of the two forest concessions, which takes into consideration the impacts of KPKKT's decisions and conduct of field operations in the context of the company's existence as well as the well-being of the environment, surrounding society and residents and forest-dependent communities.

These are encapsulated within KPKKT's Policy on Forest Protection (*Dasar Perlindungan Hutan*) as shown in Fig. 2.1 & Fig. 2.2.

The strategies towards achieving the SFM targets include, among others:

(1) A strict adherence to locally and globally accepted professional best management practices (BMP) in forestry and environmental protection,

(2) adoption of high-level professional ethics and technical competence, and

(3) seeking accreditation to locally as well as internationally recognised certification standards as "well-managed forest" such as under the Forest Stewardship Council (FSC) and the Malaysian Criteria, Indicator and Standard of Performance of SFM (MC&I).

Fig. 2.1.
KPKKT's Policy Statement on Forest Protection

Dasar Perlindungan Hutan KPKKT
(KPKKT's Policy on Forest Protection)

Kumpulan Pengurusan Kayu Kayan Trengganu Sdn Bhd (KPKKT) telah diberi tanggungjawab oleh Kerajaan Negeri Terengganu untuk mengurus Unit Pengurusan Hutan (FMU) secara jangka panjang dan mapan di Dungun Timber Complex (DTC) dan Konsesi Hutan Cherul (CFC) secara lestari merangkumi keluasan keseluruhan 126,274 hektar.

KPKKT bertanggungjawab untuk mengawal, memelihara dan melindungi kawasan FMU berkenaan dari sebarang kejadian pencerobohan tanah dan hutan atau aktiviti yang tidak sah bagi mempastikan integriti dan kelestarian hutan terus terpelihara.

Dalam aspek pengusahasilan kayu balak dari kawasan FMU, KPKKT adalah komited mengamalkan kaedah Sistem Pengurusan Memilih (SMS) dan Tebangan Berarah serta menjalankan aktiviti pengusahasilan sebagaimana menurut peraturan pensijilan MC&I SFM dan FSC di samping mematuhi keperluan ISO yang ditetapkan oleh Jabatan Perhutanan Semenanjung Malaysia (MS ISO 9001/2008).

KPKKT akan, pada setiap masa melaksanakan usaha pemantauan dan pengawalan ke atas kawasan operasi supaya tidak dicerobohi, dan setiap aktiviti dijalankan adalah mematuhi segala peruntukan dalam peraturan perhutanan dan alam sekitar semasa.

KPKKT akan sentiasa berhubung rapat dengan pihak Pejabat Hutan Daerah supaya dapat bersama-sama menjaga kawasan hutan dan menyalurkan maklumat sekiranya kawasan FMU dicerobohi.

KPKKT akan, dari semasa ke semasa memberi latihan kepada kakitangan yang berkelayakan serta kontraktor mengenai peraturan dan undang-undang perhutanan serta isu-isu dan teknik terkemaskini berkaitan pengurusan sumber dan ekosistem hutan.

Adalah menjadi harapan KPKKT supaya syarikat ini akan terus menjadi badan korporat terunggul di Malaysia dalam pengurusan sumber hutan, serta menjaga reputasi dan nama baik syarikat berhubung perkara ini, serta memeliharanya daripada sebarang ancaman dari pihak-pihak yang tidak bertanggungjawab.

Fig. 2.2. KPKKT's Policy on the Environment and Environmental Management

KPKKT's Policy on the Environment & Environmental Management

KPKKT collaborates with all interested parties and organisations which could help contribute towards achieving its environmental objectives and its heightened level of compliance with existing environmental laws and regulation, and towards the promotion of sound forest management as stipulated under the Forest Stewardship Council Principles and Criteria (FSC P&C) and the Malaysian Criteria, Indicators and Standard of Performance for Natural Forest Management (MC&I).

KPKKT sources its timber supplies mainly from its certified Forest Management Unit (FMU) which comprises DTC and CFC. To this end, KPKKT adopts the Malaysian Selective Management System (SMS) in the context of SFM to manage the timber stands in DTC and CFC and supplies quality round timbers to relevant GPB's subsidiaries. In this regard KPKKT is responsible to manage the two forest concessions in a sustainable manner in accordance with SFM principles to ensure that the natural environment and wild flora and fauna in the two concessions and their immediate surroundings, as well as the downstream ecosystems and communities are well-preserved and well taken care of.

KPKKT subscribes fully to the tenets of MC& I SFM and FSC P&C.

KPKKT also cooperates fully with the state forestry authorities (i.e. Terengganu State Forest Department (TSFD) and the Forest Department of Peninsular Malaysia (FDPM)) as well as other relevant agencies in an effort to realise the Best Management Practices (BMP) in forestry including the minimisation of damage to the ecosystems and disposal of wastes and meeting the requirements of the Malaysian Timber Certification Scheme (MTCS).

2.2 Forest Functions Mapping and Forest Zoning

The natural forests within DTC and CFC have been generally and conveniently classified into functional classifications as defined in the National Forestry Act of 1993 as shown in Tables 2.1 and 2.2. As can be seen the production function in both concessions are less than the total gross area: 77.1% in DTC but 98.15%% for the case of CFC. In other words, about 23% of the forested land area in DTC has been set aside and dedicated for uses other than for selective logging (i.e. non-production) whereas in CFC the figure stands at almost 2%. These non-production functions include such land-uses as soil protection, flood control, water resources safeguards, preservation of species biodiversity, rare ecosystem protection, climate amelioration, recreation, ecotourism, R & D, education, etc. It is to be noted however that some of these forest areas/ zones may accommodate more than one function on any one area for reasons of compatibility, for example, soil protection function may be compatible with water resource safeguard, research and education, and they can all share one similar area/ site. The main point is that KPKKT always bears in mind the need to balance up the different forest functions so that the forest ecosystem would remain pristine and continue to be able to deliver its many services and produces as it normally does, in perpetuity.

Table 2.1. Forest Functions in Dungun Timber Complex (DTC) in relation to the Functions Defined in the NFA 1993

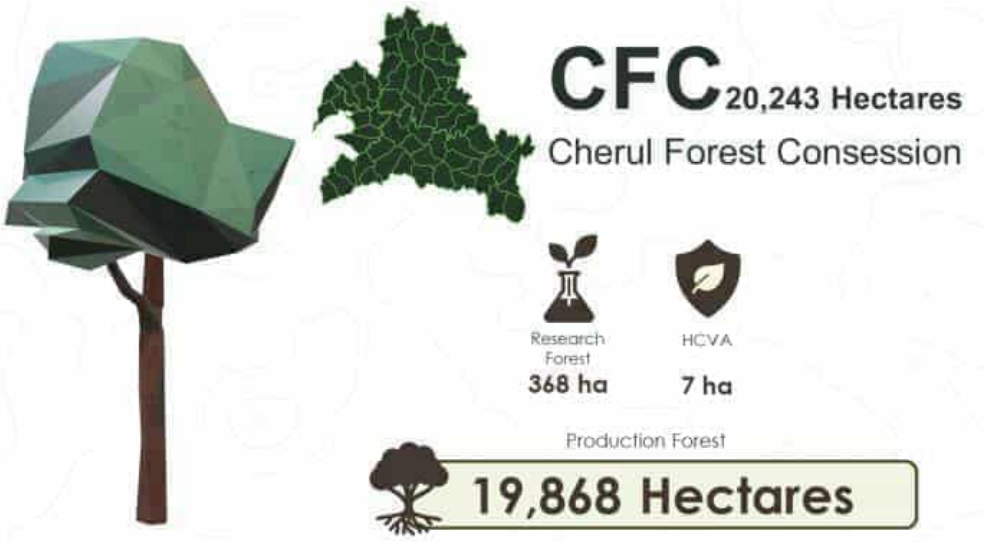
National Forest Policy 1992		National Forestry Act 1993	Forest Zonation in Dungun Timber Complex (DTC)	% DTC Area
Production Forest (81,750ha)		Sustainable timber production (STP)		77.10%
Protection Forest	Soil protection (7,126ha)	Soil protection	Soil Protection (SP)	6.72%
			Soil Conservation (SC)	
		Soil reclamation	-	-
	Flood control	Flood control	Flood Control Conservation (WFC)	-
	Safeguarding of water resources (1,705ha)	Water catchment	Water Catchment Conservation (WCC)	1.60%
			Riparian Buffer Protection (WBP/ HCVF)	
	Preservation of biodiversity (525ha)	Wildlife Sanctuary	Rare Ecosystem Protection (HCVF)	0.50%
		VJR	Protected Area Buffer (HCVF)	
Amenity Forest	Recreation & Ecotourism (1,048ha)	Amenity -	e.g. Chemerong Waterfall	1.00%
Research and Education Forests (added in Rev. 1992) (1,863ha)		Research	e.g Compartment 51 & 54 of Jengai FR.	1.76%
		Education	e.g. Compartment 52 of Jengai FR.	
Forest for federal purposes (12,014ha)				11.33%

Fig. 2.3. Major Forest Functions in DTC (2025).

Table 2.2. Forest Functions in Cherul Forest Concession (CFC) in Relation to The Functions Defined in NFA1984.

National Forest Policy 1992 & National Forestry Act 1984		Forest Zonation in CFC	Area (ha.) & % of total area
Production Forest	(1) Sustainable Timber Production, (2) Safeguarding of Water Resource, (3) Preservation of Biodiversity	Timber Production (TP), Water Catchment, Conservation (HCVF) (Gross Area)	19,868 (98.15%) (Gross Area)
Protection Forest	Safeguarding of Water Resources	Riparian Buffer Protection (RBP): (1) Sg. Cherul (2) Sg. Mas	7 (<1%)
Research & Education F.	ITTO/JPSM Research Forest in Compartment 39		368 (1.82%)
TOTAL (ha)			20,243

Fig. 2.4. Major Forest Functions in Cherul Forest Concession (CFC)



2.3 Management Strategy and Activities in the Production Forest.

Timber stands that fall under the "Production Forest" category within both DTC and CFC were identified, zoned out and managed in the second rotation of the Selective Management System (SMS) of 30 years and estimated to hold an average timber standing stock of **30m^3/ha**, i.e. based on past 12-year production record from 2012 – 2023. During the period under study round timber production varied very widely from as low as **9.17m^3/ha** in 2012 to as high as **64.7m^3/h** in 2017. This can be compared to the figure that averaged **25.54m3/ha** during the period 2014 – 2020.

Under the circumstance, this finding opens a large avenue for improving the stocking of the poorer area through re-planting and rehabilitation with quality tropical timber species. Areas of the forest compartments which are inherently rich and well-stocked must be handled with care so as not to result in over-cutting and over-exposure of the stand. This is being taken care of by the very selective nature of the harvesting system whereby only trees above certain minimum diameter at breast height (DBH) limits were allowed to be cut and removed. The latter is executed through the reduced impact logging (RIL) and directional felling (DF) techniques. On the other hand, areas that were found to be poor and understocked such as in CFC are not harvested pending results from systematic surveys and growth monitoring plots.

Notwithstanding, a general observation would easily point out that forest stands within both DTC and CFC are still biologically rich in a wide array of quality tropical dipterocarp and non-dipterocarp timber species which include, among others;

(1) Balau bukit
(2) Balau laut merah
(3) Balau membatu
(4) Chengal
(5) Kempas
(6) Merbau
(7) Meranti nemesu
(8) Meranti seraya
(9) Meranti sengkawang merah
(10) Meranti rambai daun
(11) Meranti kepong
(12) Meranti tembaga
(13) Meranti sarang punai
(14) Meranti melantai
(15) Meranti langgong
(16) Meranti Pa'ang
(17) Meranti bumbong
(18) Meranti belang
(19) Damar hitam
(20) Damar minyak
(21) Kapur
(22) Keladan
(23) Mersawa
(24) Resak
(25) Gerutu
(26) Keruing kipas
(27) Keruing mempelas
(28) Keruing gombang
(29) Keruing neram
(30) Keruing sarawak
(31) Keruing merah

(32) Resak ranting kesat
(33) Resak letup
(34) Nyatoh
(35) Sepetir
(36) Bintangor
(37) Durian
(38) Jelutong
(39) Kedondong
(40) Kembang semangkok
(41) Giam
(42) Kulim
(43) Merawan
(44) Melunak
(45) Merpauh
(46) Medang
(47) Simpoh
(48) Mengkulang
(49) Kelat, as well as those classified as “miscellaneous species”.

In terms of its short-term and long-term management strategies, KPKKT continues to embrace and practise the Malaysian Selective Management System (SMS) to manage the mixed dipterocarp stands within both FMUs. The company’s commitment to remain viable as it has successfully proven over the past 4 decades, while at the same time maintain the FSC-certified status for the forest concessions, remains unchanged. The strategies towards achieving these objectives can be summarised as follows, whereas the various activities involved are summarised in Figs. 2.4-2.6.

1. Strict adherence to and judicious implementation of all the prescriptions as laid out in this Forest Management Plan as well as other relevant documents and SOPs and through the supervision and guidance of the Terengganu State Forestry Department (TSFD).
2. Commitment to reducing the impact of selective logging on the natural environment by protecting residual Potential Crop Trees (PCTs), natural regeneration, biodiversity, soil, slopes, water resources, habitats and High Conservation Value Forests (HCVFs) and

the human environment, as well as through a judicious placement of forest infrastructure such as roads and skid trails and bridges, etc.

3. Maintenance of ecology and the optimum ratio of the dipterocarp vs non-dipterocarp species composition in the residual stands as in the original forest composition through accurate collection, analysis and interpretation of inventory data.
4. Commitment towards maximum utilisation of timbers of all species and minimisation of wastes through provision of training of relevant staff and contractors.
5. Continued investment in developing appropriate and cost-effective technologies in Reduced/Low Impact Logging (RIL) and forest and environmental protection,
6. Provision of necessary training and mentoring programmes to staff and contractors along with close supervision on the ground on regular basis.
7. Management of DTC and CFC areas as self-sustaining, multiple-use FMUs
8. A full subscription to all FSC's Principles and Criteria for SFM.
9. Commitment towards employing local citizens and contractors, particularly those coming from communities living in the surrounding areas.
10. KPKKT as a globally recognised model of a successful forestry enterprise.

Fig. 2.5. Sustainable Forest Management (SFM) Activities

Fig. 2.6. Monitoring of Selective Logging Activities

Fig. 2.7. KPKKT's Chain of Custody

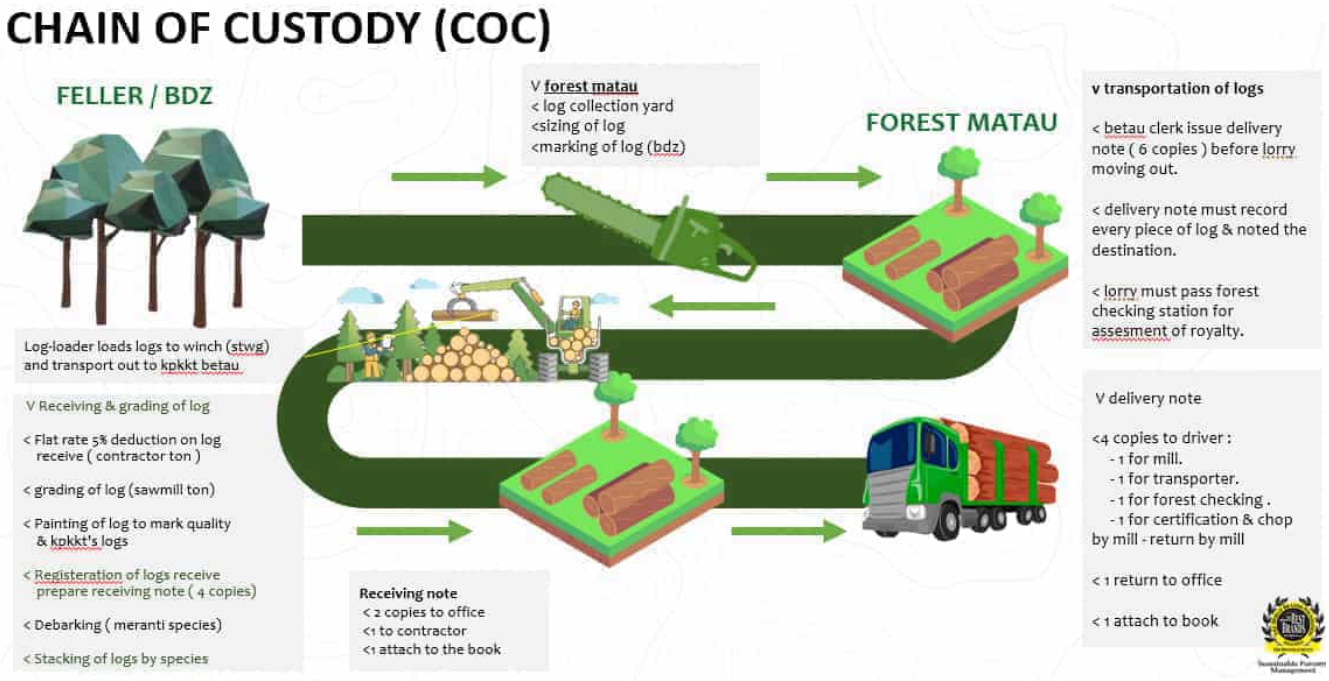


Table 2.3 :

Round-Timber Production From Selective Logging in DTC & CFC During 2019 – 2023

Year	No. of Compartments	Round-Timber Production	
		Σm3	Σtonne
2019	8	44,864.32	24,759.56
2020	9	41,338.61	22,813.80
2021	5	24,640.71	13,598.63
2022	8	40,862.11	22,550.85
2023	11	65,375.13	35,434.96
Annual Average	**8.2 Compt/yr**	**43,416.18**	**23,831.56**

Table 2.4:
Financial Performance (i.e. Financial Revenue) for KPKKT during the Period 2021 – 2024

Year	Financial Revenue (RM, Gross)
2021	22,164,077.18
2022	20,846,638.46
2023	32,663,672.41
2024	23,281,701.41
Annual Average, RM/yr	**RM24,739,022.37**

2.4 Human Resource Management and Development

Training and capacity building involving both KPKKT's personnel and those of KPKKT's contractors, are given very high emphasis in our effort to continue to grow and achieve SFM in the Concession Areas and 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, as mentioned above. The trainings, workshops and courses for staff of all levels are necessary in order to avail them 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 considered and will continue to be arranged from time to time:

1. Training of machine operators in environmentally benign and damage-limiting techniques
2. Training in silviculturally significant tree marking procedures
3. Training in silviculturally relevant stand treatment techniques
4. Training on nursery technology and planting stock production.

KPKKT is committed to employing local Malaysian citizens into its workforce, regardless of origin, gender, ethnicity or beliefs, and appropriate policies to this effect have been finalised and enforced, including procedures for grievances and conflict resolution.

In addition, in an effort to create a safe and healthy workplace environment in which workers would feel duly respected and protected in a spirit of co-existence and close cooperation with each other, KPKKT had formulated and declared appropriate policies on Occupational Safety and Health (OSH) along with policies against sexual discrimination and corrupt practices, etc. The same requirement and standards also apply to all contractors engaged by KPKKT to conduct various work within DTC and CFC, much in line with current policies of the Federal and State Governments.

2.5 Silviculture

KPKKT adopts a pragmatic policy regarding 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. Generally, approx. 20 – 40 seedlings are artificially planted under the TKL programme, i.e. depending on the extent of opening and the total length of skid trails created.

2.5.1 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 in its own right. This is by virtue of the fact that such operations incorporate the following activities:

(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/ instruments 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.

2.5.2 Forest Regeneration and Mother Trees

The SMS considers a forest as being regenerated, if there was a sufficient number of individual PCT above the prescribed minimum 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 and PCTs (up to the size 45.00cm DBH), as well as mother trees in residual stands of all ages.

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

The records of replanting activities conducted for the year 2023-2024 is as follows:

No	Year	Compartment	PRF	Area (ha)	No of sapling
1	2023	88	Jengai	409	10,200
2	2023	67	Jengai	357	3,500
3	2023	87	Jengai	376	2,000
4	2024	7	Jengai	374	5,000
5	2024	92B	Jengai	167	3,340
6	2024	59	Jengai	383	5,000
7	2024	87	Jengai	376	10,500
8	2024	88	Jengai	406	10,200
9	2024	90B	Jengai	245	7,000
		Total		**3,093**	**56,740**

- Total expenditure for planting was **RM255,330.00 or RM4.50/ seedling.**
- Species planted comprises the following:

(1) Meranti rambai daun, (2) Meranti tembaga, (3) Balau, (4) Damar hitam, (5) Meranti sarang punai, (6) Keruing, (7) Merawan, (8) Meranti langgong, (9) Meranti melantai, (10) Meranti nemesu, (11) Kapur, (12) Keladan, etc.

Fig. 2.8

Rehabilitation of Logged-Over Areas Through "Tanaman Kawasan Lapang" Initiatives

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 (Fig. 2.7). The seedlings were either produced in KPKKT's nursery located in Compartment 52 of Jengai PRF or procured through contract suppliers. These internally produced seedlings complement those supplied by the TSFD (i.e. JPNT). 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. Looking into the future, KPKKT would bear in mind the increasing costs of agricultural and forestry inputs such as fertilisers, fuels, labour, services, plastic netting, sheets and polybags and even topsoils and utilities, etc. as these could potentially contribute significantly towards the costs of replanting and resource replenishment.

2.6 Yield Regulation

2.6.1 Standing Stock

Tree Populations

Data and information on the nature of the standing stock; its structure and distribution were gleaned from on-the-ground surveys from Pre- and Post-F inventories, Tree Marking (TM) data, the series of permanent sample plots (PSPs) established over the years as well as data from aerial surveys and satellites.

Based on the Permanent Sample Plots (PSPs) established in PRFs of Besul, Jengai and Jerangau, it was found that the average number of trees per ha of all trees 10.0cm DBH and above ranged from 472 to 596 trees; basal area (BA) ranged between 17.44 to 35.47m^2/ha and standing timber volume ranged from 123.69 to 432.07m^3/ha.

In an inventory conducted in 2022 the standing stock of a track of 20,000ha of a second growth forest in Jengai PRF was estimated by using Sentinel satellite images. For this purpose, drones were flown over the forest for the purpose of collecting detailed data on tree canopies which were then verified by ground truthing using a total of 9 sample plots measuring 25m x 50m each. Among others, findings from this survey could be summarised as follows:

i. Total number of trees of **>20.0cm DBH** in the project area = 1,484,108 or 73.4 trees/ha → **<u>150,812,086,744</u> trees** for the whole of Production Forest in DTC & CFC
ii. Total no. of trees of **>30cm DBH** = 494,959 trees = 25.02 trees/h → **<u>50,296,743,662</u>** trees for the whole Production Forest in DTC & CFC
iii. Total no. of trees of **>55cm DBH** = 288,313 trees = 14.4 trees/ha, → **<u>29,297,434 trees</u>** for the whole of Production Forest in DTC & CFC.

The survey also found that:12.1% of the trees of >55cm DBH grew of slopes <20º,
66.2% on slopes 20º < 40º and
21.7% on slopes >40º

Standing Volumes

In terms of volume

i. For trees >30cm DBH the total standing volume was 672,993m^3 = 34.02m^3/ha. This translates to a total of **68,388,202,674 m^3** for the whole of the Production Forests within both DTC & CFC.

2.6.2 Regulation of Cut

The yield regulations for both DTC and CFC are guided by the dictates of the Terengganu State Forest Department (TSFD) who determined what and where to harvest based on:

i. The present stocking and site conditions of the forest compartment to enter and harvest
ii. Data from Pre-Felling Inventory
iii. Deductions according to the extent of logging damages on the remaining stand
iv. Deductions for unproductive areas within production forest (*e.g.* infrastructure, buffer zones, etc).

For the period 2021-2024, the total area of forest within the DTC licensed for selective logging was 7,333 hectares, or an average of 1,833 hectares per year, which is below the annual allowable cut quota of 1,900 hectares/year for Permanent Reserved Forest as determined by the Terengganu State Forestry Department (TSFD) in the Twelfth Malaysia Plan, 2021-2025. Table 2.5 shows a summary of the forest compartment that were subjected to selective logging during 2021 till 2024 all of which were decided based on minimum diameter cutting limits.

Table 2.5 ANALISIS KELULUSAN HAD BATAS TEBANGAN

TAHUN 2021 HINGGA 2024

BIL	TAHUN	HUTAN SIMPAN	KOMPT	LUAS (HA)	KEPUTUSAN HAD BATAS		
					BUKAN DAMAR	KAUM DAMAR	CHENGAL
1	2021	CHERUL	51	307	55	65	70
			56	379	55	65	70
		JENGAI	59	383	55	65	70
			87	376	55	65	70
			88	409	50	65	70
2	2022	CHERUL	58	209	50	65	70
		JENGAI	7	379	60	65	70
			86	452	50	65	70
			90B	245	50	65	70
			91A	263	55	65	70
			91B	260	50	65	70
3	2023	JENGAI	92A	226	55	65	70
			92B	167	55	65	70
			93	384	55	65	70
			114	348	55	65	70
			46A	228	55	65	70
			46B	225.4	55	65	70
4	2024	JENGAI	112	423	55	65	70
			113	384	55	65	70
			85	362	55	65	70
			95A	253	50	65	70
			68	333	55	65	70
PURATA KEPUTUSAN HAD BATAS (CM)					**54**	**65**	**70**

2.6.3 Permanent Sample Plots (PSPs) for Growth & Yield Monitoring

Results from the series of permanent G&Y PSPs established in various parts of DTC and CFC show that, on average, out of an original total of 526 trees/ha of trees of 10.0cm DBH and above in 2019, a total of 489 trees/ha remained standing and healthy in 2023. This represented a loss (or mortality) of 37 trees or 7.03% over a period of 4 years, or an average natural mortality of 1.75% per annum. Our records show that a total of 70 PSPs each with a size of 1.0 ha had been established in various parts of DTC area during September 1997. An analysis was conducted on data from 18 of these PSPs and the results were summarised in a report by Borhan & Mohd Hakimi (2012). As of November 2016, only four (4) of these plots were managed to be traced and re-measured for the third time (i.e. over a space of 18 years). Among the reasons for the difficulty to re-locate the PSPs were:

- The long lapse in time
- Difficulty to access due to damaged/ collapsed roads and bridges
- Improper recording of plot locations
- Change and/or retirement of staff directly involved in plot establishment
- Lack of maintenance over the years, resulting in severe damages to plots, loss of tree tags as well as defacement of paints and numbers on trees.
- High costs to revisit/re-measure/ maintain the plots.

Under the circumstance, the following line of actions are recommended:

(1) Continue maintaining those PSPs that were able to be identified so far
(2) Close/ terminate those PSPs that are found to be untraceable and/or severely damaged.
(3) Establish new set of PSPs using simpler and more efficient design than the old one.
(4) The new PSPs should be more manageable; determined through the use of the latest technology in mapping, GPS, digital recording and retrieval of data, and reporting.

In November 2019 a set of 4 new PSPs were established comprising 2 PSPs in Besul PFR, and 1 PSP each in Jengai and Jerangau PRFs respectively. Figs. 2.8, 2.9, 2.10 and 2.11 show activities conducted within PSPs with details of marking and measuring of the trees within them.

Fig. 2.9

Marked and measured tree within Growth and Yield PSP

Fig. 2.10

Boundary marking at a Growth and Yield PSP

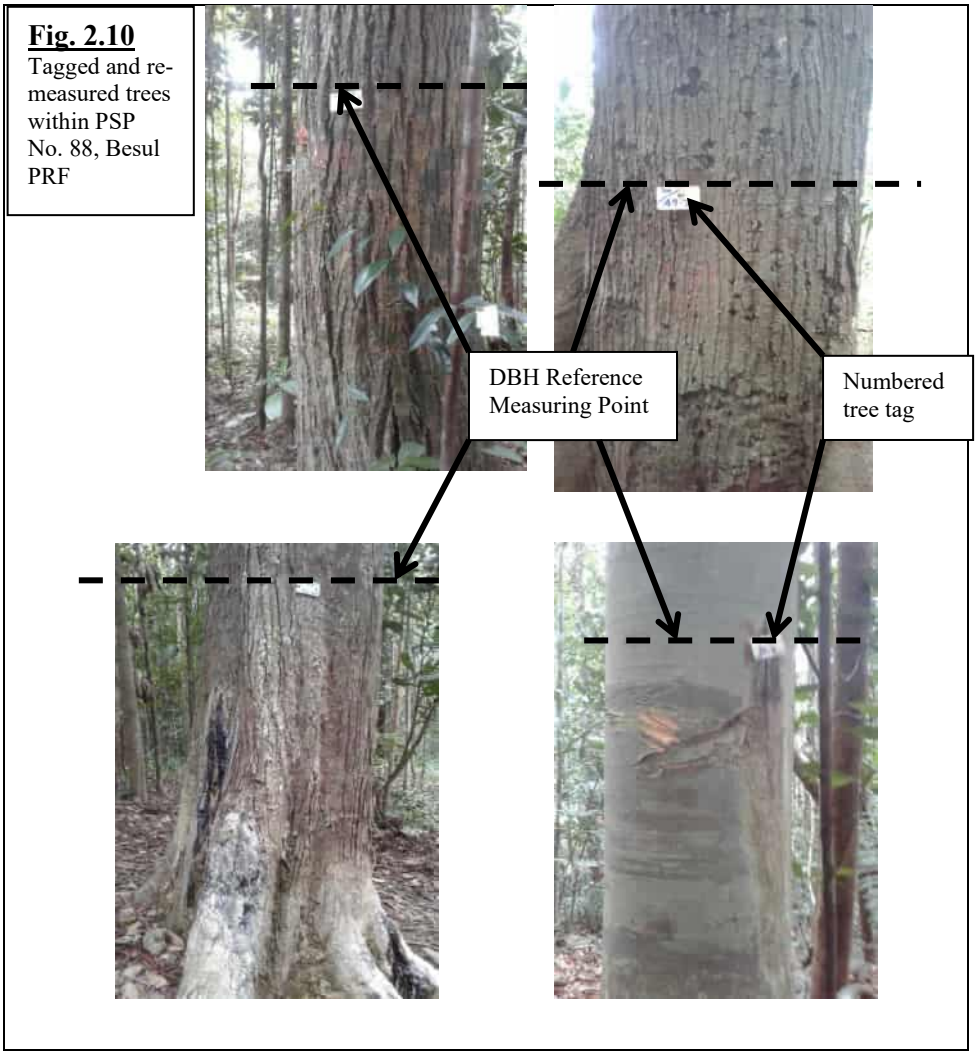


Fig. 2.10
Tagged and re-measured trees within PSP No. 88, Besul PRF

Figs. 2.11
Views of PSP88 showing tagged trees and successfully established wildings of dipterocarp species within the plot.

2.6.4 Summaries of Findings from Growth & Yield PSPs.

Floral and Structural Compositions

Report by Borhan & Mohd Hakimi (2012) informs that the residual stands generally retain their structural and floristic integrity, much in the same way as in the pre-selective logging condition where 60% of the standing trees were in the 30 <45cm DBH size class and nearly 30% in the 45-<60cm DBH class. The PCT stock of 30cm DBH ++ comprised, on average 19 dipterocarps and 74 non-dipterocarp species and genera. The tree species and genera co-exist in such a dynamic balance and form at least 11 forest sub-types dominated mostly by the genus *Syzygium* and family *Dipterocarpaceae*. Other species/genera which showed some degree of abundance and dominance were in the following order: Kelat (*Syzygium spp*) > *Dipterocarpaceae* > Simpoh (*Dillenia sp*.) > Medang (*Lauraceae, Litsea*) > Kasai (*Pometia sp*.) > Perah (*Elateriospermum tapos*) > Minyak Beruk > Penarahan (*Myristicaceae*) > Nyatuh (*Palaquium sp*.).> Rengas (*Mangifera spp., Melanochylla spp*).

In terms of species consociations, the different tree species form alliances or forest sub-types in the following combinations (the most abundant species/ species groups being mentioned first:

(1) *Syzygium - Dillenia*
(2) *Dipterocarpaceae – Syzygium*;
(3) Mixed *Syzygium;*
(4) *Syzygium-Dipterocarpaceae- Lauraceae*;
(5) *Dipterocarpaceae- Syzygium - Dillenia*;
(6) *Syzygium -Dipterocarpaceae- Mangifera*;
(7) *Pometia - Lauraceae*;
(8) *Dipterocarpaceae – Syzygium – Lauraceae*;
(9) *Syzygium -Dipterocarps- Xanthophyllum*;
(10) *Syzygium -Dipterocarpaceae- Myristicaceae*;
(11) *Syzygium -Dipterocarpaceae – Palaquium* sp.

In conclusion, the second growth forests still maintain a reasonable presence and dominance of dipterocarps in the stand after selective harvesting under the SMS. Along with the dipterocarps, the long list of the non-dipterocarp tree species remains the major contributors to the richness and biodiversity of the TRF as well as the immense challenge of managing it.

Tree Growth Rates

The mean dpai for dipterocarp trees was 0.82cm/tree/yr and that for the non-dipterocarp trees, 0.81cm/tree/year.

2.7 Conservation of Biodiversity and Genetic Resources

Biological diversity or biodiversity is the variety and variability among living organisms and the ecological complexes, in which they occur. The overall objective of SFM of the forest concession areas is to reduce the impact of forestry operations on biodiversity in general, and wildlife in particular.

2.7.1 Summary of Findings from Botanical Survey Conducted in DTC

Wherever possible and resource permitting, KPKKT would conduct botanical as well as zoological surveys within DTC and CFC to gather and update information on the multitude of resources in them. This was to enable a better understanding and appreciation of the resources and natural ecosystems in order that their sound and professional management and conservation could be affected in an informed manner. It is appreciated, however, that the various flora and fauna react in various ways, either positively or negatively, to the different external stimuli engendered by the forestry operations and activities.

Based on field observations and actual surveys conducted, the following deductions could be made of the tropical forest ecosystems under management:

1. Majority of the concession area are located on areas lower than 200m asl. and falls within the lowland dipterocarp forest. This forest is rich in flora and fauna diversity with many identified threatened and endangered species. Management of the forest therefore would need to consider the long-term impact on the biodiversity.

2. A combination of best management practices and scientific research on the resource base will be key to ensure the sustainability of the forest. Kapur (*Dryobalanops aromatica*) and peat swamp forest are unique vegetation types found in the DTC and CFC areas. These habitats need to be clearly identified and marked within the

concession vegetation map. Management regimes for these forest types would have to be different by nature of its fragile and sensitive environment, and therefore more research activities will have to take place in these habitat types.

3. As most of the concession areas are already placed under the second rotation cycle of selective logging (SMS), it is pertinent that a strategy/ plan be prepared and put in place to monitor and reduce the impact of biodiversity loss and subsequent extinction of the tree species. In future, timber extraction should be species sensitive (especially for dipterocarp species) to minimize the possible extinction impact of ERT species. Nursery practices also need to be aligned to produce more of the ERT species for enrichment planting and/ or reforestation purposes.

5. Timber species listing from DTC with highlights on dipterocarp species listed under the Malaysian IUCN Red Data list are as follows:

(1) Anisoptera curtisii Dyer ex King; Mersawa Kuning (MA); LC
(2) Anisoptera laevis Ridl.; Mersawa Durian (MADR); LC
(3) Dipterocarpus baudii Korth.; Keruing Bulu (KRBL); LC
(4) Dipterocarpus costatus Gaertn. f.; Keruing Bukit (KR); VU
(5) *Dipterocarpus costulatus* Sloot; Keruing Kipas (KRKP); LC
(6) *Dipterocarpus crinitus* Dyer; Meruing Mempelas (KRMP); LC
(7) *Dipterocarpus eurhynchus* Miq.; Keruing Baran (KR); VU
(8) *Dipterocarpus grandiflorus* (Blanco) Blanco; Keruing Belimbing (KRBG); LC
(9) *Dipterocarpus kunstleri* King; Keruing Gombang Merah (KR); LC
(10) *Dipterocarpus lowii* Hook. f.; Keruing Sol (KR); LC
(11) *Dipterocarpus palembanicus* Sloot; Keruing Ternek (KR); VU
(12) *Dipterocarpus rigidus* Ridl.; Keruing Chogan (KR); EN
(13) *Dryobalanops aromatica* C.F. Gaertn..; Kapur (KPR); LC
(14) *Hopea coriaceae* Burck.; Giam Hantu (GM); EN
(15) *Hopea nervosa* King; Merawan Jangkang (MW); NT
(16) *Neobalanocarpus heimii* (King) Ashton; Chengal (CGL); NT
(17) *Parashorea stelata* Kurz; Gerutu-gerutu (GRGR); LC
(18) *Shorea acuminate* Dyer.; Meranti Rambai Daun (MTRD); LC
(19) *Shorea balanocarpoides* Sym.; Damar Hitam Katup (DHKP); LC
(20) *Shorea brateolata* Dyer; Meranti Pa'ang (MTPA); LC

(21) *Shorea collina* Ridl. ; Balau Merah (BLMH); VU

(22) *Shorea curtisii* Dyer ex King ssp. *curtisii*; Meranti Seraya (MTSY); LC

(23) *Shorea exelliptica* Meijer; Balau Tembaga (BLTB); VU

(24) *Shorea foxworthyi* Sym.; Balau Bukit (BLBT); VU

(25) *Shorea guiso* (Blanco) Blume; Balau Membatu (BLMM); LC

(26) *Shorea laevis* Ridl.; Balau Kumus (BLKS); LC

(27) *Shorea lepidota* (Korth.) Blume; Meranti Langgong (MTLG); LC

(28) *Shorea leprosula* Miq.; Meranti Tembaga (MTTB); LC

(29) *Shorea longisperma* Roxb.; Damar Hitam Bulu (DHBL); NT

(30) *Shorea macroptera* Dyer ssp. *macroptera*; Meranti Melantai (MTML); LC

(31) *Shorea multiflora* Sym.; Damar Hitam Pipit (DH); LC

(32) *Shorea ochrophloia* Strugnell ex Symington; Seraya Batu (BLMJN); VU

(33) *Shorea ovalis* (Korth.) Blume ssp. *ovalis*; Meranti Kepong (MTKP); LC

(34) *Shorea ovata* Dyer; Meranti Sarang Punai Bukit (MTSBT); LC

(35) *Shorea parvifolia* Dyer ssp. *parvifolia*; Meranti Sarang Punai (MTSP); LC

(36) *Shorea pauciflora* King; Meranti Nemesu (MTNM); LC

(37) *Shorea platyclados* Sloot ex Foxw.; Meranti Bukit (MTBT); LC

(38) *Shorea resinosa* Foxw.; Meranti Belang (MTBE); NT

(39) *Shorea singkawang* (Miq.) Burck. ssp. *singkawang*; Meranti Sengkawang Merah (MTSMH); EN

(40) Vatica scortechinii (King) Brandis; Resak Langgung (RK); EN

(41) Vatica umbonata (Hook. f.) Burck; Resak Air (RK); LC

(42) *Dipterocarpus sarawakensis* F.G. Browne ex Slooten; Keruing Layang (KR); CR.

6. Other ERT and Endemic Species found within DTC.

Note: Species highlighted in blue are endemic to the State of Terengganu.

(1) *Adinandra corneriana* Kobuski [Theaceae]; distribution: Tg, Ph, Jh.

(2) *Antidesma pendulum* Hook. f. [Euphorbiaceae]; distribution: Tg, Pk, Ph, Sl.

(3) *Breynia coronata* Hook. f. [Euphorbiaceae]; distribution: widespread.

(4) *Dendrocalamus pendulus* Ridl. [Gramineae]; distribution: Ps, Kd, Pn, Kl, Tg, Pk, Ph, Sl, NS, Ml, Jh.

(5) *Diospyros argentea* Griff. [Ebenaceae]; distribution: Tg, Pk, Ph, Sl, NS, Ml, Jh, Sp.

(6) *Diospyros ismailii* Ng [Ebenaceae]; distribution: Kd, Tg, Ph, Sl, NS, Jh.

(7) *Eugeissona tristis* Griff. [Palmae]; distribution: Ps, Kd, Kl, Tg, Pn, Pk, Ph, Sl, NS, Ml, Jh.

(8) *Globba nawawii* H. Ibrahim & K. Larsen [Zingiberaceae]; distribution: Sg Pertang, Hulu Dugun, Tg.

(9) *Knema oblongifolia* (King) Warb. [Myristicaceae]; distribution: Tg, Pk, Ph, Sl.

(10) *Lasianthus filiformis* King & Gamble var. bracteatus King & Gamble [Rubiaceae]; distribution: Tg, Pk, Ph, Sl, NS.

(11) *Morinda corneri* K.M. Wong [Rubiaceae]; distribution: Tg, Ph.

(12) *Oxyspora bullata* (Griff.) J.F. Maxwell [Melastomataceae]; distribution: widespread.

(13) *Pandanus dumetorum* Holttum & H. St.John [Pandanaceae]; distribution: Tg, Ph.

(14) *Payena maingayi* C.B. Clarke [Sapotaceae]; distribution: Kd, Pn, Tg, Pk, Ph, Sl, NS, Ml, Jh, Sp.

(15) *Pentaphragma ellipticum* Poulsen var. flocculosum (King & Gamble) Kiew [Pentaphragmataceae]; distribution: Kl, Tg, Ph, NS, Ml, Jh.

(16) *Pinanga cleistantha* J. Dransf. [Palmae]; distribution: only known from Ulu Setiu F.R., Tg.

(17) *Piper porphyrophyllum* N.E. Br. [Piperaceae]; distribution: widespread.

(18) *Pothos peninsularis* Alderw. [Araceae]; distribution: widespread.

(19) *Psychotria griffithii* Hook. f. [Rubiaceae]; distribution: Tg, Pk, Sl, NS, Ml, Jh, Sp.

(20) *Psydrax maingayi* (Hook. f.) Bridson [Rubiaceae]; distribution: Tg, Ph, Pk, Sl, NS, Ml, Jh.

(21) *Ptychopyxis caput-medusae* (Hook. f.) Ridl. [Euphorbiaceae]; distribution: Kl, Tg, Pk, Ph, Sl, NS, Ml, Sp.

(22) *Rourea rugosa* Planch. [Connaraceae]; distribution: widespread.

(23) *Saprosma pubescens* Ridl. var. hirsuta Ridl. [Rubiaceae]; distribution: Tg, Ml.

(24) *Shorea collina* Ridl. [Dipterocarpaceae]; distribution: East Coast, Tg southwards.

(25) *Shorea singkawang* (Miq.) Miq. ssp. scabrosa P.S. Ashton [Dipterocarpaceae]; distribution: Tg, Ph.

(26) *Syzygium duthieanum* (King) Masam. [Myrtaceae]; distribution: Kd, Pn, Tg, Pk, Ph, Jh, Sp.

(27) *Syzygium nemestrinum* (M.R. Hend.) I.M. Turner [Myrtaceae]; distribution: Tg, Ph, Sp.

(28) *Tarenna glabra* Ridl. [Rubiaceae]; distribution: Kl, Tg, Pk.

(29) *Thottea dependens* (Planch.) Klotzsch [Aristolochiaceae]; distribution: Pn, Tg, Pk, Ph, Sl, Sp.

(30) *Timonius wrayi* King & Gamble [Rubiaceae]; distribution: Tg, Pk, Ph, Jh.

(31) *Trigonostemon sinclairii* Jabl. [Euphorbiaceae]; distribution: Kd, Kl, Tg.

Other ERT species recorded from past studies include: -

(1) *Agrostistachys leptostachya* (Euphorbiaceae)

(2) *Barclaya moultoni* (Nymphaeaceae)

(3) *Didymocarpus floribunda* (Gesneriaceae)

(4) *Didymocarpus platypus* (Gesnericeae)

(5) *Didymocarpus puncticulata* (Gesneriaceae)

(6) *Eleiodoxa conferta* (Palmae)

(7) *Endospermum diadenum* (Euphorbiaceae)

(8) *Epirhizanthus lowii* (Rafflesiaceae)

(9) *Eugeissona brachystachys* (Palmae)

(10) *Johannesteysmannia altifrons* (Palmae)

(11) *Licuala bayana* (Palmae)

(12) *Licuala fractiflexa* (Palmae)

(13) *Licuala glabra* var. *selangorensis* (Palmae)

(14) *Licuala khoonmengii* (Palmae)

(15) *Licuala malajana* var. *malajana* (Palmae)

(16) *Licuala mustapana* (Palmae)

(17) *Lithocarpus erythrocarpus* (Fagaceae)

(18) *Livistona kingiana* (Palmae)

(19) *Macaranga curtisii* (Euphorbiaceae)

(20) *Macaranga punctata* (Euphorbiaceae)

(21) *Macaranga quadricornis* (Euphorbiaceae)

Table 2.6 Analysis of DTC's Pre-F Inventory Records

Dungun Timber Complex	Compt. No.	Dominant species (Dipterocarp species)	Dominant species (Non-dipterocarp species)
HSK Besul	8A	*Keruing – Balau – Meranti (Mt)	Kelat – Kempas - Rengas
	8B	Keruing – Damar Hitam (DH)	Kelat - Kempas
	10	*DH – *Keruing – *Mt Sarang Punai	*Kelat
	11	*Balau - Keladan	*Kelat
	15	Keruing – Meranti Rambai Daun	*Kelat – *Rengas - *Kempas
	16	*Keruing – *Damar Hitam	*Kelat
	18	*Balau – *Keruing – *Damar Hitam	*Kelat - *Nyatoh
HSK Jengai	39	*Kapur - Keruing	*Kelat - Kempas
	44	*Damar Minyak – *Meranti Nemesu – *Keruing – *Mt Sarang Punai – *Meranti Tembaga	*Kelat - Melunak
	45	*Meranti Sarang Punai – *Meranti Seraya – *Damar Hitam – *Meranti Nemesu	*Kelat - Medang
	60	*DH – *Mt Nemesu – *Balau – *Meranti Sarang Punai – *Meranti Tembaga	Kelat – Kembang Semangkok
	62	*Kapur - Keruing	N/A
	64	*Kapur - *Keruing	*Kelat - Kempas
	65	*Kapur – *Keruing – *Mt Rambai Daun	*Kelat - *Medang
HSK Jerangau	99	*Keruing – Damar Hitam	*Kelat
	101	Damar Hitam - Balau	Kelat
	102	*Keruing – Maranti Langgong	*Kelat – *Nyatoh – *Ajal - *Melunak
	103	*Keruing – Meranti Rambai Daun	Kelat – Kempas – Nyatoh

Note: * signifies significant dominance in terms of timber volume

The inventory exercise in Jerangau PRF within which the *D. sarawakensis* plot is located recorded at least 666 taxa of vascular plants from 123 families and 331 genera. Among them, 568 were Dicots, 58 Monocots, 37 Ferns and Lycophytes, and three Gymnosperms. As shown in **Tables 2.8** and **2.9**, the highest number of species came from the family Euphorbiaceae with 50 species from 24 genera, followed by Dipterocarpaceae (46 taxa), Rubiaceae (37 taxa), Annonaceae (27 taxa) and Palmae (24 taxa). The flora inventory found 59 species that are either endemic to Terengganu or Peninsular Malaysia. **Table 2.10** lists some of the flora species found to be rare and unique to DTC which have special conservation interest. Three endemic species *Scaphochlamys breviscapa (Zingiberaceae), Licuala fractilexa* (Palmae) and *Licuala bayana* (Palmae) are only confined to Terengganu with *L. bayana* being only known from its type locality, Jerangau PRF. **Table 2.11** shows the interesting endemic plants found in Jerangau during the flora survey.

Table 2.7 Endemic Plant Species in Jengai PRF.

Key: PM = Peninsular Malaysia; Trg = Terengganu; * = New finding in Terengganu;
A = Cpt 76,78,79 (11 years after logging); B = Cpt 63 (24 years after logging); C = Cpt 6 (27 years after logging).

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	Moraceae	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

Table 2.8 Ten most diverse vascular plant families in Jerangau PRF.

No	Family	Genera	No. of Taxa
1	Euphorbiaceae	24	50
2	Dipterocarpaceae	8	46
3	Rubiaceae	24	37
4	Annonaceae	14	27
5	Palmae	12	24
6	Guttiferae	5	24
7	Ebenaceae	1	22
8	Anacardiaceae	11	20
9	Lauraceae	7	19
10	Moraceae	4	18

Table 2.9: Six most diverse genera recorded in Jerangau PRF

No	Genera	Family	Taxa
1	*Shorea*	Dipterocarpaceae	24
2	*Diospyros*	Ebenaceae	22
3	*Garcinia*	Guttiferae	12
4	*Ficus*	Moraceae	10
5	*Dipterocarpus*	Dipterocaprceae	9
6	*Syzygium*	Myrtaceae	9

Table 2.10: List of Unique and Rare Flora Species of Special Conservation Interest in DTC

No	Species	GPS Coordinates	Notes
1	*Scaphochlamys atroviridis*	4,478460 N, 103. 045930 E	Extremely rich in Jerangau PRF. Common in both primary and logged stands.
2	*Vatica havilandii*	4.551180N, 103.063339 E	A very rare species in Peninsular Malaysia and first time collected in fruit. It is also found in Borneo.
3	*Dipterocarpus sarawakensis*	4.554640 N, 103.051390 E	This species is only found in Sarawak and Terengganu. Measures are being taken to protect this species.
4	*Shorea collina*	4.478460 N, 103.045930 E	Possibly new species.
5	*Didymocarpus sp.*	4.478080 N, 103.045030 E	Possibly new species
6	*Barringtonia sp.*	4.478000 N, 103.045500 E	Possibly new species
7	*Neobalanocarpus heimii*	NA	Vulnerable (IUCN)

Table 2.11: Endemic Plants in Jerangau PRF (Combined lists of FRIM (2009) and WWF-Malaysia (1998)

No.	Species	Notes
1	Chengal – *Neobalanocarpus heimii*	Endemic to Peninsular Malaysia
2	Keruing Sarawak – *Dipterocarpus sarawakensis*	
3	Bunga Pakma – *Rafflesia spp*.	3 species endemic to Peninsular Malaysia
4	*Salacca flabellate* (Palmae)	Endemic to Terengganu
5	*Macaranga curtisii* (Euphorbiaceae)	Otherwise only endemic to the Main Range
6	*Macaranga punctatai* (Euphorbiaceae)	Otherwise only endemic to the Main Range
7	*Macaranga quadricornis* (Euphobiaceae)	The only record east of Gunung Benom
8	*Agrostistachys leptostachya* (Euphorbiaceae)	A giant shrub of Taman Negara area
9	*Lithocarpus erythrocarpus* (Fagaceae)	Otherwise only known from the Main Range
10	*Eria atrovinosa*	
11	*Licuala bayana*	
12	*Licuala fractiflexa* (Palmae)	
13	*Pinanga beccariana* (Palmae)	

2.7.2 Findings from Fauna Surveys Conducted in DTC and CFC

Activities to survey for fauna in DTC and CFC are far and between. It is high time now for the company to organise such surveys and expeditions through the involvement of other outside parties and NGOs, such WWF-Malaysia, Malaysian Nature Society, FRIM, PERHILITAN, the academia and private individuals, etc.

The last survey jointly conducted by KPKKT and WWF Malaysia on the fauna within DTC was in 2009/ 2010 where detected the presence of fauna species which are either on the IUCN Red List, CITES or the Wildlife Protection Act 2010 as threatened and endangered. Out of these, 8 are listed by the Red List as Vulnerable (VU), 5 as Endangered (EN) and one as Critically Endangered (CR). Nine species are listed in Appendix I and II of CITES while 28 are listed either in Schedule 1 or Schedule 2 of the Malaysian Wildlife Protection Act 2010. The surveys in CFC were much more recent, in 2015 – 2018, based on continuous monitoring by Pesama.

As for the fish fauna among the common species caught and identified from the streams and rivers included the *Kelah, Sebarau, Baung, Lampam and Kelisa putih*.

Table 2.12.

Mammal Species Identified in Jengai Permanent Reserved Forest (PRF)

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 2.13. Avifauna species within DTC.

[Key: Besul (T) = Besul (Tambahan) F.R., P = protected, IUCN = IUCN Red List of Threatened Spp 2010, VU = vulnerable spp, NT = Near Threatened spp. Appx. 1 = Appendix 1 (CITES). Refer to Appendix 1 for scientific name and spp. 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

Table 2.14. Results from Wildlife Monitoring in CFC During 2015 - 2018

Date	Wildlife Species
10/2/2015	Oriental pied hornbill, Elephant, Tapir
13.4.2015	Barking deer, Otter, Jungle fowl
5/6/2015	White-handed gibbon, Helmeted hornbill
22/8/2015	Racket-tailed drongo, Brahminy kite, White-collared kingfisher
07/2/2016	Elephant,
11/2/2016	Tapir, Mousedeer, Tiger
15/5/2016	Elephant
15/8/2016	Gibbon, Wild boar,
15/12/2016	Wild boar, Malayan sun bear, Elephant, Porcupine, Birds, Tapir
15/2/2017	Wild boar, Elephant, Sambar deer, Barking deer, Mousedeer, Tapir, Civet cat
4/3/2017	Civet cat
23/7/2017	Mousedeer, Tapir
11/10/2017	Wild boar, Elephant, Barking deer, Varanus
15/3/2018	Kingfisher, Wild boar, Sambar deer
28/6/2018	Mousedeer
15/8/2018	Kingfisher, Wildboar
14/10/2018	Wild boar, Tapir

Records of Freshwater Fishes in River in Cherul Forest Concession (CFC)

- Kelah
- Peras
- Haruan
- Bujuk
- Baung
- Lampam
- Tapah
- Kawan

Table 2.15 Record of Presence of Wildlife in Compartments within CFC

WILDLIFE SPECIES	COMPARTMENT Nos.
Elephant	35,36,37,42,62,43,48,40,50
Porcupine	30,35,36,37,42,43,48,50
Tapir	30,35,36,37,42,43,48,50
Tiger	30,35,37,42,50,48,62,
Otter	30,35,42,48,50,62,
Hornbill	30,35,36,37,42,43,40,50,
Gibbon	35,36,37,42,43,49,40,50,62
Mouse Deer, & Barking Deer	35,36,37,42,43,49,40,50,62
Mountain Goat	48
Malayan Sun Bear	30,31,42,43,48,35,40

Table 2.16. IUCN, CITES and PERHILITAN Threatened and Endangered Fauna Species in DTC.

No	Fauna Species	Common Name	IUCN	CITES	PERHI-LITAN	Data Source
1	*Arctictis binturong*	Binturong	VU	III	Jadual I	WWF-Malaysia 1998
2	*Bos gaurus*	Gaur	VU	I	Jadual I	WWF-Malaysia 2009, 1998
3	*Bucerotidae spp.*	Hornbills	VU/NT/LC			WWF-Malaysia 2009
4	*Callosciurus prevostii*	Prevost's Squirrel		II	Jadual I	WWF-Malaysia 1998
5		Deer			Jadual2	WWF-Malaysia 1998
6	*Dicerorhinus sumatrensis*	Sumatran Rhinocerous	CR	I	Jadual 1	WWF-Malaysia 1998
7	*Elephas maximus*	Asian Elephant	EN	I	Jadual 2	WWF-Malaysia 1998, 2009, JPSM 2006
8	*Helarctos malayanus*	Malayan Sun Bear	VU	I	Jadual I	WWF-Malaysia 1998
9	*Herpestes brachyurus*	Short-tailedf Mongoose			Jadual I	WWF-Malaysia 1998
10	*Hylabates lar*	White-handed Gibbon	EN	II	Jadual I	WWF-Malaysia 1998, 2009, JPSM 2006
11	*Macaca fascicularis*	Long-tailed Macaque		II	Jadual 2	WWF-Malaysia 1998
12	*Macaca nemestrina*	Pig-tailed Macaque		II	Jadual 2	WWF-Malaysia 1998
13	*Martes falvigula*	Yellow-throatd Marten		III	Jadual I	WWF-Malaysia 1998
14	*Nycteris javanica*	Javan Slit-faced Bat	VU			WWF-Malaysia 1998
15	*Nycticebus caucang*	Slow Loris	VU	I	Jadual I	WWF-Malaysia 1998
16	*Paguma larvata*	Masked Palm Civet		III	Jadual 2	WWF-Malaysia 1998
17	*Panther tigris jacksonii*	Malayan Tiger	EN	I	Jadual I	WWF-Malaysia 1998, JPSM 2006
18	*Panther pardus*	Leopard, Panther		I	Jadual I	WWF-Malaysia 1998
19	*Petaurista petaurista*	Red Giant Flying Squirrel			Jadual I	WWF-Malaysia 1998
20		Porcupine		III	Jad. 2	WWF-Malaysia 1998
21	*Prionailurus bengalensis*	Leopard Cat		I	Jadual I	WWF-Malaysia 1998
22	*Presbytis melalophos*	Banded Leaf Monkey	EN			JPSM 2006
23	*Ratufa affinis*	Cream-coloured Gaint Squirrel		II	Jadual I	WWF-Malaysia 1998
24	Ratufa bicolor	Black Giant Squirrel		II	Jadual I	WWF-Malaysia 1998
25	Cervus unicolor	Sambar Deer	VU		Jad. 2	WWF-Malaysia 1998
26	Sus scrofa	Wild Pig			Jadual 2	WWF-Malaysia 1998,JPSM 2006
27	*Tadarida johorensis*	Northern Free-tailed Bat	VU			WWF-Malaysia 1998
28	*Tapirus indicus*	Malayan Tapir	EN	I	Jadual I	WWF-Malaysia 1998, 2009, JPSM 2006
29	*Trachypithecus obscurus*	Dusky Leaf Monkey		II	Jadual 2	WWF-Malaysia 1998
30	*Tragulus javanicus*	Lesser Mousedeer		III	Jadual 2	WWF-Malaysia 1998
31	*Tupaia glis*	Malayan Treeshrew		II		WWF-Malaysia 1998
32	*Tupaia minor*	Lesser Treeshrew		II	Jadual 2	WWF-Malaysia 1998
33	*Viverra tangalunga*	Malayan Civet			Jadual 2	JPSM 2006.

Source: WWF-Malaysia 2009.

Table 2.16 summarizes the threatened and endangered mammal species found in DTC which are listed on the Red List, CITES and the Wildlife Protection Act 2010 (as required by the *HCVF Tool kit for Malaysia*). The Wildlife Plan for Peninsular Malaysia (DWNP, 1992) lists the Asian Elephant, Malayan Tiger, Sumatran Rhino, Malayan tapir and the Gaur (Seladang) as endangered in Malaysia. DTC contains all five species in its forests.

2.7.3 Recommended Prescriptions/ Actions to be Taken by KPKKT

1. Map and protect the following areas (strictly no logging): (i) Soil Protection areas; (ii) Riparian Buffers; (iii) Swamps (Flood Control and Conservation); (iv) Any other areas identified as having a special value (e.g., an area where a rare species occurs or is known to be especially abundant)
2. Employ RIL techniques, incl. directional felling, appropriate laying and construction of skid trails
3. Minimise soil erosion and loss from road construction.
3. Retain pockets of unlogged forest stand in the larger matrix of logged forest. Such patches of unlogged forest act as reservoirs of biological diversity.
5. Disrupt the tree canopy as little as possible to minimise fragmentation of wildlife habitats (e.g. during road construction).
    (i) Maintain crossing points over roads, where tree crowns on the two sides of the road maintain close contact. This is easier on level ground than on hill slopes, and easier on straight stretches than on curved parts. WWF Malaysia recommends a crossing point every 100m of road.
    (ii) Maintain downstream and upstream access for aquatic fauna by using bridges or open-bottom culverts to cross streams.
6. Map and protect saltlicks.
7. Protect trees important for biodiversity:
    - Over-mature trees (for birds; e.g. hornbills and woodpeckers)
    - Fruiting trees such as fig trees
    - Rare tree species

- When replanting, include a small proportion of tree species that are important for wildlife, such as Petai (*Parkia speciosa*), Kerayong (*Parkia javanica*), Tampoi (*Baccaurea spp*.), Pulasan (*Nephelium spp*.), Figs (*Ficus spp*.), Macang (*Mangifera spp*.), Kerdas and Jering (*Pithecellobium spp*), Durian (*Durio zibethinus*), Asam jawa (*Tamarindus javanica*) and Sesenduk (*Scaphium malaccensis*).

2.8 Recreation and Eco-tourism

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.

2.9 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.*

2.10 Road and Bridge Construction and Maintenance

Road construction continues to be undertaken by contractors with close supervision and control by KPKKT and following the specifications as laid out by the Terengganu State Forestry Department (See Attachment 1).

2.11 Forest Nursery and Forest Rehabilitation

KPKKT's nursery is located within compartment 52 Jengai PRF covering an area of about 0.56 ha. The location is near the main road entrance to Jengai PRF. This nursery is able to accommodate a total of 40,000 tree seedlings at any one time. Plans are afoot to expand the production capacity of this forest nursery, so as to enable it to accommodate a total of 80,000 seedlings, in an effort to increase the rate of rehabilitation and reforestation within DTC and CFC. 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 aromatica* (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 *Scaphium macropodum* (Kembang Semangkok). The seedlings are used in our "open area planting programme" in DTC and CFC upon the seedlings concerned reaching a height of about 2 feet (60 cm). Records show that KPKKT planted an average of 21,650 seedlings under the TKL programme during 2020 – 2023 to rehabilitate the residual forests (Table 2.17). Such activities are set to increase now with the increased capacity of the nursery in Compt 52 Jengai, to raise new seedlings for planting purposes.

Table 2.17. Summary of Open Area Planting (TKL) in 2020 - 2023

Y E A R							
2020		**2021**		**2022**		**2023**	
Compt & PRF	**Total planted**	**Compt & PRF**	**Total planted**	**Compt & PRF**	**Total planted**	**Compt & PRF**	**Total planted**
17 Besol	1,000	4 Besol	3,000 + 400 + 300	4 Besol	7,100	88 Jengai	10,200
11 Besul	5,000	89 Jengai	3,200 + 3,400	88 Jengai	1,050	67 Jengai	3,500
45 Jengai	6,500	50 Cherul	1,000	87 Jengai	50	90B Jengai	7,200
66 Jengai	6,500	19 Besol	4,7	67 Jengai	1,000	87 Jengai	2,000
60 Jengai	5,500	52 Cherul	4,000				
5 Besol	6,500	67 Jengai	3,000				
		88 Jengai	500				
Total	**31,000**		**23,500**		**9,200**		**22,900**

2.12 Forest Biomass and Forest Carbon Management

Of late, interest in forest carbon stock, its quantification and possible monetization in the context of global warming, climate change and carbon trading has grown out of proportion all over the world capturing the attention of individuals from all walks of life: professionals, academics as well as the general public and politicians, etc.

KPKKT being the leading TRF managers in this part of the world could not afford to ignore this trend. Under the circumstance, being a relatively new player in this field, it would be wise for KPKKT to exercise caution and tread the line by constantly weighing the pros and cons of the issue considering the interests of the various stakeholders as well as KPKKT's core business itself.

The fact is, knowledge on all the dynamics and arithmetic involving carbon stock, rates of CO2 sequestration, etc. in relation to global warming and climate change as well as the economic aspect of it is still under intense investigation and debate all over the world.

Under the circumstance KPKKT as well as GPB could do well by considering the following key issues in any future attempts to strategise and embark into this carbon business, and to estimate and evaluate forest carbon stock within DTC and CFC areas.

1. Sampling Design: Field sampling often relies on specific locations and may not represent the entire forest accurately hance a need for proper stratification and inventory design.
2. Measurement Techniques: Remote sensing and Field methods might use different techniques for measuring tree volume, diameter, height, and biomass compared to the standard formulas and assumptions.
3. Biomass Equations: The choice of allometric equations for calculating biomass can be complicated and vary widely between studies.
4. Soil Carbon Measurement: Field methods may include soil carbon assessments, which can differ in depth and methodology,
5. Data Quality and Availability: Field sampling data, laboratory analyses and remote sensing (RS) projections may be subject to local variabilities.
7. Temporal Variability: Carbon stocks above ground and below ground can change over time due to factors like disturbances or growth rates. Field methods may capture these changes more accurately, and should align with the specific ecological context of the forest being studied.

CHAPTER THREE

3.0 RESOURCE C0NSERVATION MANAGEMENT

Forest management activities and field operations if not planned properly and executed in the right manner would affect the natural ecosystems and environment including the forest resources and biodiversity in a variety of ways. KPKKT is mindful of these predicaments and very proactive in handling the potential issues and any undesirable impacts.

3.1 Biodiversity Management Strategies and Plan of Actions

We acknowledge that Dungun Timber Complex (DTC) and Cherul Forest Concession (CFC) occupy special positions and play an important role as parts of a larger forest landscape (**HCV 2**) in the northeastern region of Peninsular Malaysia. They protect the biodiversity by being part of the *Banjaran Taman Negara-Banjaran Timur Forest* complex; and in close proximity to Taman Negara National Park and sharing boundary with Gunung Aais and Sg. Nipah FRs in the south as well as 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**). One potentially threatened and endangered ecosystem (**HCV 3)** identified in the PRFs was the 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 and CFC on a whole suggested that, more than 80% do not depend on the DTC and CFC 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**).

Forest Management practice strictly adhering to Reduced Impact Logging (RIL) guidelines is the single most important action being undertaken by KPKKT in order to safeguard the HCVs identified in DTC and CFC. Retaining healthy, logging-free riparian buffers are also crucial for biodiversity, to protect rivers and avoid erosion.

3.1. 1 Avifauna Conservation

The DTC and CFC areas are rich in bird diversity with 176 near threatened, threatened and endangered (IUCN Redlist) bird species recorded (**HCV 1.2**). Critical temporal use of areas for birds were identified (**HCV 1.4)** and sustainable forest management practices by KPKKT will be important to ensure that these areas are not degraded during logging operations. A further enhancement in wildlife protection, stricter enforcement and anti-poaching measures are the best management options to reduce threats to the HCV species.

Regular patrols along the roads near the borders of the forest reserves could deter hunting activities at the DTC and CFC 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.

3.1.2 Large Mammal Conservation

Survey indicate 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. A total of nineteen threatened and endangered (**HCV 1.2)** mammal species were recorded with the iconic Malayan Tiger, Asian Elephant, Malayan Tapir, Dhole and White-handed gibbon listed as Endangered under the IUCN Red List.

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.

3.2 High Conservation Value Forests (HCVF)

With the merging in the management of DTC and CFC, KPKKT now bears the responsibility to maintain and manage a total of at least five (5) as follows:

1. The Keruing Sarawak (*Dipterocapus sarawakensis*) plot within Compt 31 Jerangau PRF, and
2. The community watershed forest within Compt 52 Jengai PRF.
3. Orang Asli Durian Orchard in Comp. 35 Cherul FR
4. Neram Stream in Compt 35 Cherul FR
5. Animal Saltlick in Compt 35 Cherul FR.

(note: The Animal Saltlick in Compt 35 Cherul FR is currently under close monitoring following a severe damage inflicted to it by the repair works on the forest road closed-by which involved the channelling of culvert water into it just before the Covid19 incidence some four years ago. As a result of this incidence, we decided to close the saltlick temporarily. However during a visit in early May 2024, it was observed that the ecosystem had recovered somewhat, but there was no sign of any wildlife using the saltlick as yet. Under the circumstance, we decided to place this saltlick under close observation with the view of re-including it back under our list of HCVFs).

Detailed descriptions on the five HCVFs are embodied in a separate **HCVF Management Plan** document being prepared for the two forest concessions, which also outlines Future Activities & Plan of Actions to be undertaken within and around the HCVFs concerned.

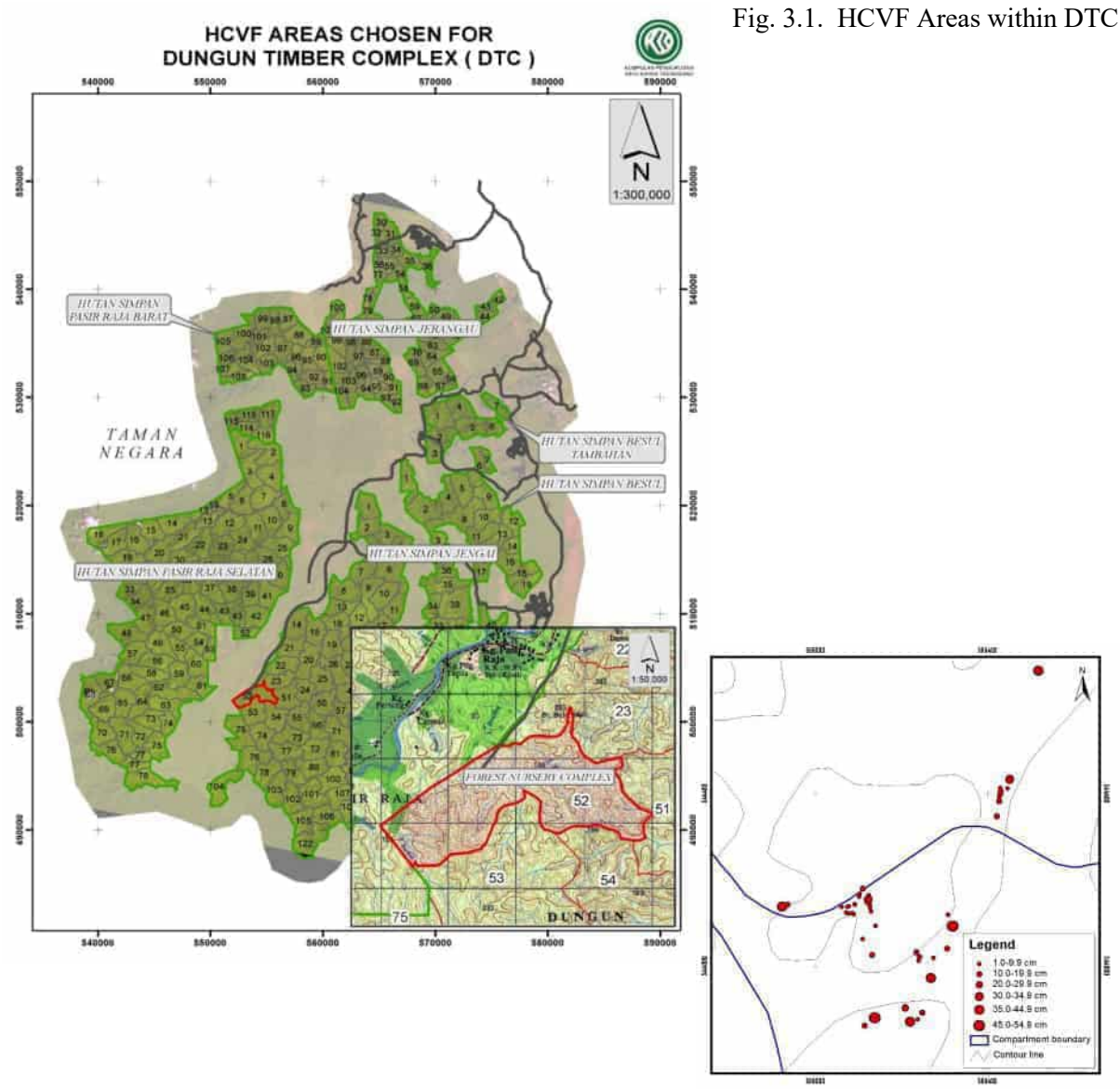


Fig. 3.1. HCVF Areas within DTC

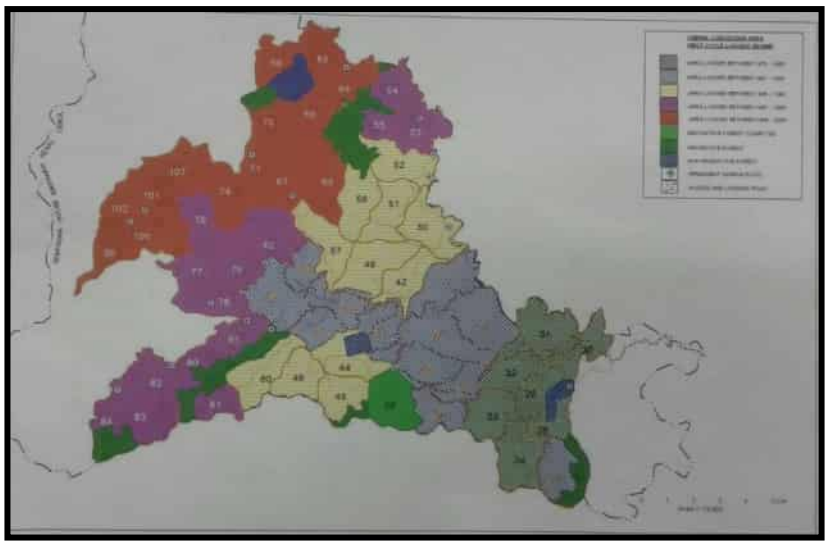


Fig. 3.2. Cherul Forest Concession (CFC) Showing Forest Compartments, where three HCVFs are located within Comp. 35, i.e.

(1) Orang Asli Durian Tree Orchard
(2) Neram Stream
(3) Wildlife saltlick

Fig. 3.3 Periodic Monitoring of HCVF Areas Within DTC and CFC

3.3 Plan of Actions of Activities for the Protection and Management HCVF Areas

(a) Management activities

The following general line of actions are being followed by KPKKT to ensure the continued usefulness and functioning of all identified HCVFs under the new HCVF Management Plan Period 2017 – 2028.

i) Demarcation and maintenance of the boundary of the areas

ii) Conduct Multi-Resource Inventory on the HCVFs

iii) Maintenance of database and documentation and marking on the ground of relevant features and resources

iv) Regular Monitoring of flowering and fruiting and collection of seeds of identified species in the vicinity of the HCVFs.

v) For the Community Water Catchment (CWC) in C52 Jengai (DTC) monitoring activities will continue to be conducted on the water flow and quality in collaboration with the relevant agencies.

vi) Tracking and collection of wildings.

vii) Upgrading and maintenance of the nursery for planting stock propagation, improvement and production.

viii) Re-census of trees and other resources to monitor growth rates, health condition and phenological behaviour.

ix) Continuance and strengthening of the Collaborative Research and Development (R & D) with FRIM and other relevant agencies and NGOs on population biology, reproductive system, pests and diseases, breeding programme, as well as SIA and EIA.

x) For the case of CWC, community engagement will be continued and strengthened from time to time especially with regard to the maintenance and upgrading of the HCV concerned.

xi) To review and update the HCVF Management Plan on an annual basis with the view to, among others, apprise the progress during the preceding year, with emphasis on complying with the relevant P&C of forest stewardship.

(b) Training Needs and Capacity Building

Future training and capacity building needs for the staff would include the following, and continue to be conducted by KPKKT. At the same time, wherever necessary the relevant contractors and their staff would also be involved in some of the training programmes from time to time:

1) Plant and tree identification;
2) Fauna and faunal habitat identification and conservation;
3) Multi-resource Survey methodologies;
4) Monitoring of environmental parameters within HCVF areas;
5) Conflict resolution.
6) Aspects on forest carbon assessment in the context of global warming and climate change mitigation.
7) Artificial intelligence (AI) in relevant areas.

3.4 HCVF Committee/ Core Working Group (CWG)

It is proposed that the management of HCVF within DTC and CFC be overseen by a high-level committee whose members should comprise representatives of the following:

1) (a) Golden Pharos Berhad, (b) Pesama Timber Corporation Sdn Bhd & (c) KPKKT
2) Forestry Department (TSFD and/or FDPM)
3) WWF-Malaysia
4) Research & academic institutions, e.g. FRIM, UPM, UMT, USM
5) PERHILITAN (Dept of Wildlife and National Parks)
6) Malaysian Nature Society (MNS)
7) JAKOA (Orang Asli Affairs Department)
8) Local Forest-Dependent Community
9) Relevant International agencies and donors, etc.
10) Independent Consultants.

CHAPTER FOUR

4.0 FOREST PROTECTION, MONITORING AND CONTROL

4.1 Forest Protection

The four main aspects of forest protection include:

(1) Protection from encroachment;

(2) Protection from pest and disease;

(3) Protection from fire; and

(4) Protection from pollution.

4.1.1 Protection from Encroachment

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

4.1.2 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 before, during and after harvesting activities.

4.1.3 Protection from Fire

The control and protection of the concession forests 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 firefighting skill for staff and workers.

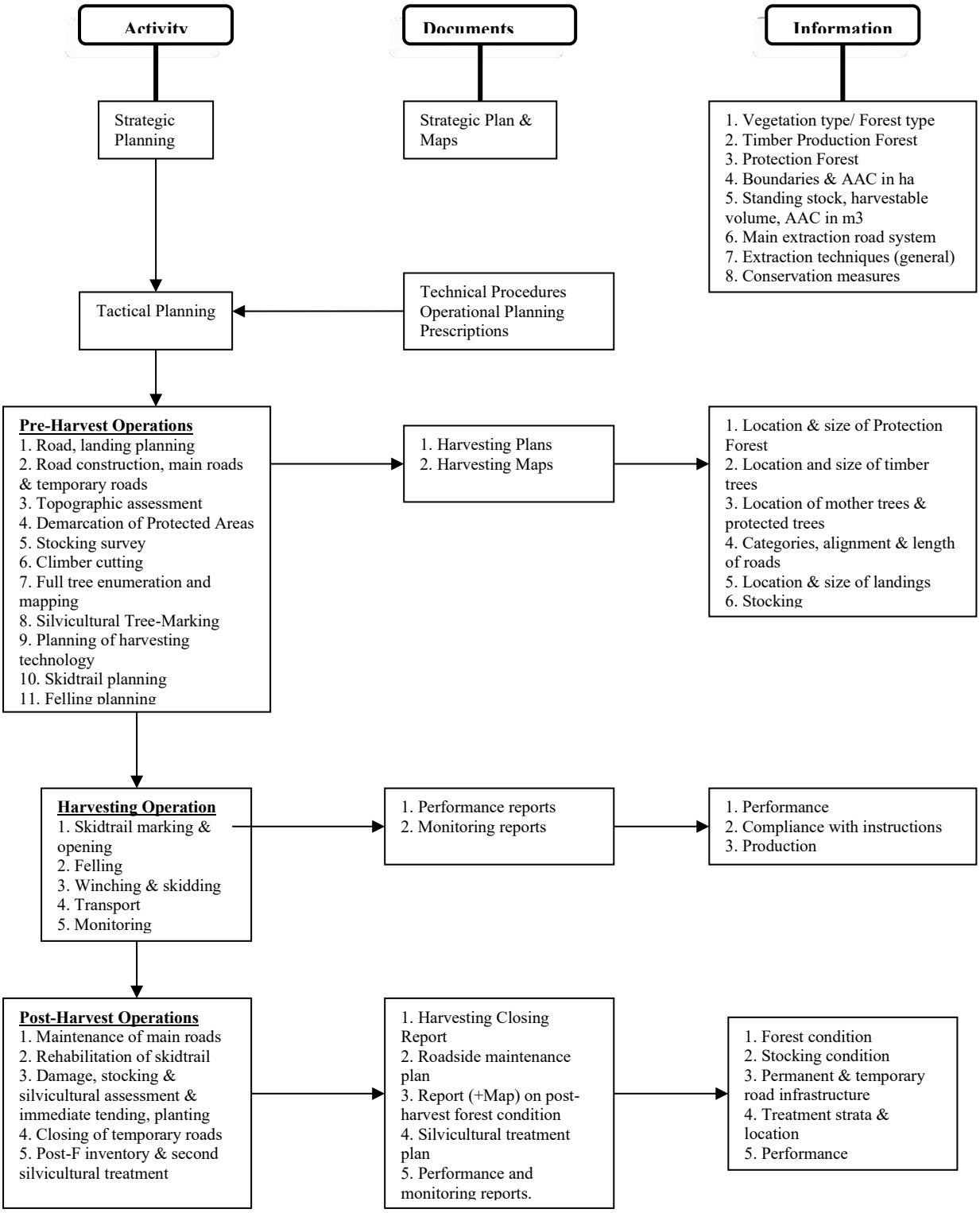
4.2 Monitoring and Control

Periodic reviews of the unified Forest Management Plan for the two concession areas 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 and data 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 4.1 Planning, implementation and monitoring of reduced-impact logging (RIL).



CHAPTER FIVE
5.0 TRAINING NEEDS AND CAPACITY BUILDING

5.1 The Need for Capacity Building and Human Resource Development

Capacity-building refers to the process of developing and strengthening the skills, instincts, abilities and competencies, processes and resources that are required by organizations and communities for them to survive, adapt, thrive and grow in a fast-changing world. An essential ingredient in capacity-building is the transformation and improvement that are generated and sustained over time from within the individual staff and organization, i.e. transformation that goes beyond performing routine tasks into changing the mindsets, attitudes and quality of deliverables.

For the case of KPKKT and, for that matter all companies under GPB, training and capacity building are an on-going process and conducted regularly on all aspects of job-related activities and geared towards enhanced efficiency and increased productivity. KPKKT management holds the views that both KPKKT's personnel at all levels and those of the company's contractors must be adequately availed to the necessary training opportunities for them to work in tandem towards achieving the sustainable management of DTC and CFC and maintain their FSC-certified status as "well-managed forests". As for the contractors and their staff, KPKKT provides the necessary support and incentives for training opportunities by, for instance, roping-in the relevant contractors into KPKKT's training programmes aimed at enhancing knowledge and competencies in planning and field techniques. Among the skills that need to be acquired include, but not necessarily limited to the following:

1) The business of natural tropical forest management, including planning for sustainability;
2) Aspects on forest certification and chain-of-custody;
3) Environmental, biological and social impacts of forest operations, and practical and cost-effective short and long-term measures to mitigate those impacts;
4) RIL concept and practice including aspects of forest road engineering and directional felling;
5) Management of forest for NTFP and forest services;

6) Economic aspects of SFM in tropical rain forest;
7) Conservation and management of biodiversity;
8) Skills in operating logging machines/ tools;
9) Skills in forest inventory, basic survey, tree marking and tree & seedlings/ wildings identification (dendrology);
10) Basic ecology and environmental impacts;
11) The application of biotechnology in nursery management and planting stock production;
12) Fauna and faunal habitat identification and conservation;
13) Multi-resource survey methodologies, including applications of remote sensing
14) Monitoring of environmental parameters within HCVF areas;
15) Public relations and Conflict resolution.
16) Aspects of climate change and global warming.
17) AI applications in forest management and siviculture.

Figs. 5.1 and 5.2 summarise some conceptual ideas on capacity building process and an example of capacity building template, which KPKKT could emulate after the necessary adjustment and modification.

Fig. 5.1. Capacity Building Process.
Source: www.sketchbubble.com

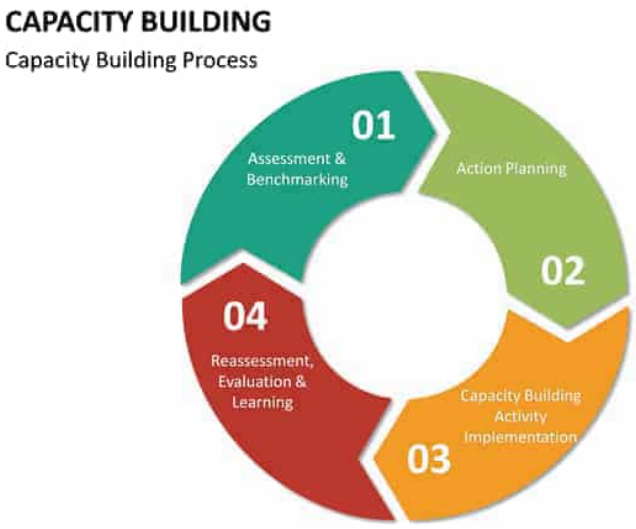
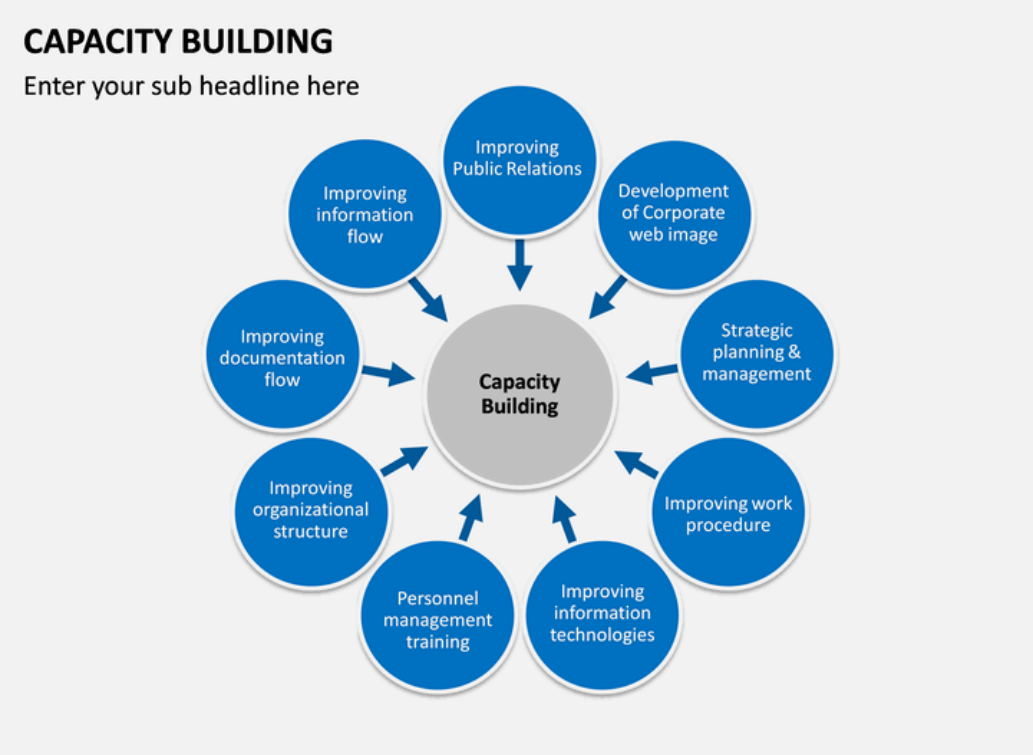


Fig. 5.2. Capacity Building Template.
Source: www.sketchbubble.com



CHAPTER SIX

6.0 SOCIO-ECONOMICS

6.1 General Context

Socio-economic factors are the social and economic experiences and realities that help shape an individual's and community's personality, attitudes, perception and lifestyle in the presence of some internal and/or external stimuli. The factors can also define regions and neighbourhoods such as the Kemaman and Dungun districts of South Terengganu in which GPB and KPKKT operate for approx. 4 decades now. For a population which is largely rural and of low-income, the socioeconomic issues would range from lack of employment opportunities, poverty, low education attainment, human-wildlife conflicts, reduced harvests of NTFPs, lower environmental qualities to ethics of the forest management operations by KPKKT. As was shown in one of our surveys, poverty is a major socioeconomic issue because lack of adequate income for basic necessities could potentially serve as the source of many other socioeconomic concerns.

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 DTC's and CFC's vicinity. KPKKT continues to ensure that all its activities, particularly harvesting operations, do not severely damage, and thereby reducing the values of these resources. In this context, KPKKT should attempt, to the extent possible, engage with the local population and implement the necessary measures to enhance the quantity and quality of these resources and, in the process, contributes positively to their standard of living too.

6.2 Role of KPKKT and the Need for Local Community Engagement

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 engage and empower the local communities for the purpose of creating and

instilling 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 at various levels: federal, state and district, such as the Forestry Department, Wildlife, Environment as well as the enforcement authorities who in turn have their respective areas of responsibility and jurisdictions.

Regular consultations between KPKKT, the relevant households and the authorities concerned (incl. TSFD) must continue to be held to deliberate on issues related to the collection and use of forest produce and services as well as measures to alleviate poverty. In this relation, KPKKT needs to continue to conduct Social Impact Assessment (SIA) on its SFM operations within DTC and CFC areas and identify and apprise their effects on the local communities. KPKKT should also maintain 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 surveys conducted in 2018 and 2024 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. This has subsequently forced a section of the local community to rely on DTC and CFC 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 and CFC forests. A series of other recommendations are also outlined in the SIA reports which would enhance the positive values while mitigating the negative impacts of SFM operations within DTC's and CFC's forests.

6.3 Community Engagement Strategies

A community engagement strategy by KPKKT should be centered around:

- Encouraging the community to believe in KPKKT's, GPB's and government's visions on relevant issues like the concept of Sustainable Forest Management (SFM), environmental protection, species preservation, forest certification and the continued contribution of KPKKT to the local economy and societal well-being.
- Building trust with the community by showing how KPKKT and GPB can help in the above-mentioned issues..
- Improving greater participation by local communities towards each effort.

The above could be realized by KPKKT adopting the following strategies:

1. *Show the community what are the key issues facing them now and in the foreseeable future by giving research-backed data on the issues concerned from time to time.*
    - Regularly conduct SIAs to identify what they think are the biggest problems.
    - Invite community stakeholders for meetings (within smaller groups, if necessary) and listen to whether they agree with KPKKT's assessment.

    The community as a whole will agree that the issues are an urgent problem to be tackled and will be more receptive and willing to participate.

2. *Explain/Demonstrate how KPKKT as an organization can work with the community*

    The vital goal behind this strategy is to encourage the community to believe in and trust KPKKT. That is, it is more a trust and relationship building approach. Even if they recognize the threat (or problem), the community should believe that KPKKT always have their best interests in mind and can effectively execute it.

3. *Encouraging the community to participate through mutual consultation and act in gradual steps, particularly on issues involving conflict resolution.*

4 *Provide impact numbers consistently, listen to feedback, and tweak efforts*

The engagement strategies for this would be for KPKKT to actively listen to the community on the problems they face – as members, and as beneficiaries. It is also essential to consistently encourage them with how far they have come.

CHAPTER SEVEN

7.0 ENVIRONMENTAL MANAGEMENT AND MITIGATION MEASURES

7.1 General Context

Environmental management under SFM is concerned with understanding the structure and functioning of the TRF and the mixed dipterocarp forest ecosystem, and in what way do sound forest management decisions and field operations fit in with them. In this context, being multifaceted, environmental management in DTC and CFC forests is about predicting immediate and future environmental changes that may result from KPKKT's forest management activities for the benefit of the company whilst minimizing (or, avoiding, if possible) any negative impacts on environment.

The process of environmental management involves:

- Identifying the desired environmental outcomes
- Identifying the physical, economic, social, cultural, political and technological constraints against obtaining these outcomes
- Considering the most feasible options for achieving the desired outcomes
- Anticipating, avoiding, and solving environmental and conservation issues.

In regard to its multidisciplinary nature, environmental management includes a diverse set of expertise and stakeholders, for example forest managers and supervisors, contractors, local communities, researchers, academics, policy-makers, non-governmental organization (NGO) workers, company employees, and relevant government authorities.

7.2 Summary Of Environmental Management And Mitigation Measures Undertaken Within DTC And CFC

Table 7.1. Summary of Management and Mitigation Measures in DTC's and CFC's Project Areas

No.		Significant Aspect & Impacts	Mitigation Measures & Compliance
1		Project Concept	➢ Selective Logging conducted in Logging Blocks (LBs) of 100- 150 ha. ➢ Logging Blocks form a subset of the larger forest compartment being licenced for selective harvesting ➢ Tree felling and removal based on "RIL" and Directional Felling with the specific objective of minimising damage to the timber and residual regeneration, natural habitats, soils and water bodies and minimising waste in the context 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 skid trails and area of disturbance along with proper maintenance. Forest roads and forest tracks follow the specifications laid out by the Forestry Department. ➢ All forest roads and other forest infrastructure 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 in road and matau construction. ➢ 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 skid trails are kept to a minimum and within the specified limits. ➢ 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 erosion, mass flows, and sedimentation; maintain riparian vegetation. Facilitation of water flow by clearing streams and culverts from rubbish, waste timbers and silt. ➢ All river crossings are only constructed upon the approval from TSFD. ➢ All natural water courses, rivers and their tributaries are not used as silt traps 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)	*Atmospheric Quality Control* Climate Air pollution	➢ 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 always supervised

	c)	Noise	➢ 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 would likely come from chainsaws, heavy machines (bulldozers, excavators, trucks, generators, pumps, etc). ➢ Old machines are not only extremely noisy and producing a lot of smoke but also a safety 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	<u>*Land Use*</u>	➢ All boundaries for forest compartment and all whole logging block are clearly marked to the specification of TSFD. ➢ Erosion control measures implemented.
	2.7 a) b) c) d) e) f)	<u>*Habitats, Species and Population*</u> Terrestrial/ Aquatic Habitat Endangered, endemic or protected plant species Birds Mammals, reptiles and amphibians Fish and other aquatic life Fruit trees	➢ Periodic Comprehensive survey will be conducted with help from WWF-Malaysia and PERHILITAN to document the changes in 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) of Logging Block to allow animals to move and migrate to other safer, forested areas. ➢ Erosion control measures will be implemented; catchment areas to be preserved. KPKKT staff and contractors will never use poison and explosive to catch fish. ➢ Prohibit workers from cutting down fruit trees and trees known to support animals and birdlife.
	2.8 a) b) c) d) e)	<u>*Human and Socio-Economic*</u> 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. ➢ Employ local residents as far as possible ➢ Avoid from disturbing conservation areas and species; report findings to Museum Department or relevant agencies. ➢ Avoid from operating near local kampung settlements. ➢ Prohibit workers from hunting and poaching of wild animals as well as destroying nesting sites. ➢ Prohibit/ limit access of members of the public into forest area as this may only complicates safety arrangement: their own safety from falling trees and branches, running machines and passing vehicles; ➢ Protect the forest against fire, theft of forest produce, and damage to water sources, etc.
3	a)	Forest Protection	Protection against Pests and Diseases. ➢ Minimise use of chemicals but encourage use of biological means to control pests and diseases.

CHAPTER EIGHT
8.0 CONCLUDING REMARKS

8.1 Compliance

KPKKT's compliance with FSC's set of P&C during the period subsequent to the first certification of DTC 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 for the past 17 years.

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 DTC and CFC forest concessions.
- The 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. The only settlement of indigenous people is Kampung _____ which is located 10km from CFC.
- However KPKKT is sensitive to the needs of these people and render appropriate assistance in the event they trespass through DTC and CFC areas. 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 districts of Dungun and Kemaman is well received, and the company has always been viewed favourably by the local community.

- KPKKT's employment policy has always favoured local residents who are given priority for services, job opportunities and labour contract.
- KPKKT has contributed positively to the economy of the state and the districts of Dungun and Kemaman.
- A joint committee between employer and employee exists and operating.
- KPKKT remains as 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 sound and contributes to add value to the forest areas under its management as well as the timber harvested through various downstream processing under GPB: sawmilling, as well as plywood and solid door manufacturing, etc.
- Favourable rates of growth of second growth forest ensures sustainability of operation into second, and subsequent rotations under SMS.

Principle 6: Environmental Impact (10 criteria)

- Landscape-level EIAs on both DTC and CFC had been conducted and the relevant EIS had been prepared.
- No usage of fire or open burning are allowed 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, plastics, etc is being done properly.

Principle 7: Management Plan (4 criteria)

- A new Forest Management Plan (FMP) document that embraces and caters both DTC and CFC is being finalised and will be operationalized soon
- KPKKT management, contractors and consultants consist 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 ecological and environment sustainability and protection.

Principle 8: Monitoring and Assessment (5 criteria)

- Collaborative research projects have taken place between KPKKT with FRIM, JPSM, UPM, UMT, etc.
- Research and monitoring plots have been established and remeasured at specified intervals.
- R & D capability at KPKKT is being expanded.
- Appropriate training and exposure provided to staff of KPKKT and the relevant contractors

Principle 9: Maintenance of High Conservation Value Forests (HCVFs) (4 criteria)

- HCVF areas have been identified and surveyed on the ground with assistance from WWF-Malaysia and FRIM
- Appropriate plans of action for the management and conservation of 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 data 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 continuously monitor 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.

Attachment 1:

Forest Road Engineering Practices in Dungun Timber Complex (DTC) & Cherul Forest Concession (CFC), KPKKT, Terengganu, Malaysia

By

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Abstract:

A good and well-built forest road network which meets all the specifications laid out by the authorities concerned, i.e. for the case of KPKKT; the Terengganu State Forestry Department (TSFD)) is necessary as part and parcel of a sound management of the forest area without which none of the managerial, operational, silvicultural and protection functions could be executed effectively and successfully. Forest roads are vital to serve as access to the designated forest compartment and logging block, for the purpose of patrolling, inspection and enforcement, stock taking (*i.e.* forest inventory), research and development (R & D) and as conduit for forest workers and supplies, as well as forest produce; timber and non-timber alike. At Dungun Timber Complex (DTC) and Cherul Forest Concession (CFC) the two separate forest areas which are currently under the long-term management KPKKT, forest roads are built with the view to optimize such industrial, economic and operational efficiencies within the framework of the "Reduced Impact Logging (RIL)" protocols which is aimed at maintaining timber stand integrity by avoiding resource depletion and minimizing undesirable environmental consequences and provides for user safety. To meet these objectives, existing roads and bridges are regularly maintained and upgraded, and any new roads and bridges, if they were to be built at all, are not built on unstable or otherwise hazardous terrain.

Building new forest roads necessarily involves clearing of vegetation and cutting and moving of soil and rock in order to develop structures that are capable of supporting heavy vehicles transporting materials and supplies and other machines during all weather conditions. In this article some aspects of the engineering of the forest roads in the two forest concessions are described giving details of their technicalities as well as the challenges faced. The latter would include among others, the need to comply with and pass on the stringent scrutiny of auditors from such international certifying bodies as the Forest Stewardship Council (FSC), besides local authorities mentioned above.

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Forest Road Engineering Practices in Dungun Timber Complex (DTC) & Cherul Forest Concession (CFC), KPKKT, Terengganu, Malaysia

By

BORHAN Bin Mohd

1.0 Elements of Forest Road Engineering

1.1 The Underlying Principles

KPKKT believes that the planning and construction of forest roads in DTC and CFC forest areas must bear in mind the need to balance the *"physical development"* of such forest infrastructure with *biological production* of flora and fauna whose life and survival depend primarily on a stable and functioning ecology and ecosystem of the forest under management. On top of this is the pressure created by conservationists who always argue that any road construction would tantamount to fragmenting the ecosystem and limit a free movement of wild life besides the damages due to soil compaction and mass erosion on cut slopes and embankments. Gulleys and rill erosions along roads on steep slopes are also equally menacing. The net results are the loss of topsoil, inundation of water bodies, lakes and rivers, degradation of water quality and killing of vegetation on lower slopes

Nevertheless, despite these "intrigues" to a sound forest management, they should not in any way distract the forest manager and forest engineer from the fact that a good forest road is still needed which form's part and parcel of a sound management without which none of the managerial, silvicultural and protection functions could be executed effectively and successfully. A good network of forest roads is vital to serve as access to the project area for the purpose of patrolling, inspection and enforcement, stock taking (*i.e.* forest inventory), R & D and as a conduction for forest produce, timber as well as non-timber.

1.2 Forest Road Specifications

The Peninsular Malaysian Forestry Department has issued several guidelines on forest road construction and engineering which are embodied in the "F*orest Road Specifications for Peninsular Malaysia 2010*" and in Chapter 11 of "*Forestry Manual for Peninsular Malaysia 1953 (amendment 1995): Forest Road and Drainage Systems*".

As part of its "best management practices (BMP) approach", KPKKT follows all the major steps and activities as laid out in the official manuals and guidelines which involve decisions on the following:

1) Road planning and alignment – 2) Buffer zones –) These are done both in the office and on the ground

- adequate buffer zones/strips were marked along permanent rivers and water bodies,
- buffer zones on steep slopes and risky/sensitive sites were given special consideration, i.e. on case-by-case basis depending on the dictate of the local site and soil conditions and vegetation cover;

3) Maximum road density and gradients;
4) Right-of-way (RoW);
5) Road formation and camber;
6) Road shoulder;
7) Road drainage (side drains, cross drains, silt traps (sumps), culverts);
8) Bridges;
9) Regular inspection and maintenance of all the above.

Fig. 1, Third cycle mixed dipterocarp forest in DTC managed by KPKKT based on the Malaysian Selective Management System (SMS)

1.3 Forest Road Classifications

Forest roads are usually of three types namely: (i) primary roads or permanent access roads, (ii) secondary (or feeder) roads and (iii) tertiary roads (or skid trails/ forest tracks). See Fig. 2 – 4.

1.3.1 Primary Roads/ Permanent Access Roads

These are the all-weather, main access and primary roads that branch out from the public road system into the managed forest area (forest concession). There should be no sharp corners, but the surface is well compacted, graveled where required and regularly maintained. Good culverts are also used for this type of forest road.

1.3.2 Secondary (Feeder) Roads

These roads provide access from the primary roads into the compartments/ management blocks. Secondary roads which tend to be generally all-weather are constructed mainly along ridgelines or along compartment boundaries. They are well compacted but graveled only in wet places. Typically, secondary roads are constructed just before timber harvesting operation starts, and to serve as firebreaks. The density of this road is always kept at 40***m/ ha*** **with grades not exceeding 1:10.**

1.3.3 Tertiary Roads (Skid Trails/ Forest Tracks)

These roads provide access within the compartments themselves for the purposes of short-distance haulage of timber, supervision, silvicultural operation and maintenance. These tracks

are usually formed by way of blade scraping only to the width of 2 - 2.5 metres. No travelling or major culverts will be required, whereas compaction is totally disallowed. Typically, tertiary roads/ skid trails/ forest tracks are constructed just before harvesting operation.

2.0 Forest Road Construction

The following procedures are followed by KPKKT and its contractors when planning and marking of forest road networks within DTC and CFC:

1) utilize trained and competent engineers/ foresters to conduct road line surveys and supervise construction;
2) construct forest roads which are capable of providing convenient, low-cost access into the forest to serve the needs of forest management and protection while at the same time benefiting local communities;
3) minimize and mitigate attendant soil erosion and reduce sedimentation in streams;
4) utilize natural drainage patterns;
5) avoid passing through areas of cultural, religious, or landscape significance in such a way as to minimize unnecessary and undue disturbance to wildlife or indigenous people and local communities from the presence of heavy vehicles movement.

KPKKT adopts the following approaches and guidelines in constructing forest roads in the project area which are consistent with reduced impact logging (RIL) specifications and those laid out by FD, DOE, DID and other relevant authorities:

2.1 Planning and Marking of Secondary/ Feeder Roads

1) Locate roads preferably on ridges, natural benches, low side slope requiring least soil from cut and fill, and on stable ground;
2) Roads are constructed following the alignment already laid out on topographic map of appropriate scale and the preliminary line (p-line) flagged in the field;
3) Restrict road width to a maximum of 5 metres;
4) Locate road at least 20m away from permanent watercourses and water bodies;
5) Allow a maximum the right of way (RoW) of not more than 12 metres, depending to terrain condition;
6) Rivers or natural watercourses, wet soils and areas of high erosion risks are avoided as much as possible;
7) Roads and other relevant forest infrastructure are kept outside of streamside buffer strips;

Fig. 2
An all-weather Primary Road

Figs. 3a & 3b: Secondary/ Feeder Roads

Fig. 3a

Fig. 3b

Fig. 4a

Fig. 4b

Figs. 4a & 4b: Tertiary Roads/ Skid Trails

Fig. 5: Silt Trap/ Sump

Fig. 6: Side Drain.

8) Trees standing along road alignment and need to be felled and cleared are marked with appropriate flagging tapes or paint of appropriate colour for ease of identification;
9) Roadside ditches (Side drains) are accordingly planned with cross-drains and silt-traps/sumps which are in turn properly spaced for the purpose of channeling water away from the road structure before draining into surrounding vegetation, buffer zones and the river;
10) Culverts and bridges are designed and laid down appropriate to the prevailing condition;
11) Wherever possible road gradients are set as low as possible, with maximum of 20% (11.3^{o}) and with continuous uniform slope distance not exceeding 200m for extreme condition;
12) Wherever possible existing logging roads are maintained, upgraded and continued to be used;
13) The total lengths of all secondary/feeder roads within a harvesting block are to be kept within a density limit of 40m/ha;
14) The distribution of all secondary/ feeder roads is depicted on the forest harvesting map.

2.2 Planning of Skid Trails

1) Skid trails are pre-determined appropriate to the prevailing condition on the ground;
2) Skid trails should not fork more than absolutely necessary and should not join or intersect with each other;
3) No skid trails on slopes greater than 36% (20^{o});
4) Avoid stream crossings, unless absolutely necessary in the opinion of the forest engineer;
6) Limit the width of the skid trail to not more than 4 metres;
7) The total density of all skid trails should be kept to not more than 300 metre/ha;
8) Depict the distribution of skid trails on the forest harvesting map.

2.3 Site Clearing for and Construction of Secondary/ Feeder Road and Skid Trail

2.3.1 Secondary/ Feeder road

1) A majority of the logging compartments (i.e. licensed areas) within DTC and CFC cover an area of approx. 400ha each. These compartments are divided into manageable logging blocks (LB) of 100 – 150 ha in size. All secondary roads within these LBs are constructed prior to the commencement of all logging operation; which is conducted in stages, one LB at a time;
2) Appropriate machines are used, appropriate to the terrain condition to construct feeder roads. In area with gradient exceeding 10% hydraulic excavator is used. However in areas with gradients less than 10% crawler tractor is used;
3) A secondary/ feeder road is constructed according to the approved alignment (L-line), while deviations, if any, are worked on only upon approval of the SDF;
4) Road gradient is kept as low as possible, with a maximum of 20% (11.3^{o}) and a continuous uniform slope distance not exceeding 200 metres;
5) Earth bunds are created only within the available RoW corridor with anchorage being provided by felled logs arranged horizontally and stabilised by log stumps;
6) Soft spots on secondary/feeder roads are surfaced with suitable materials, such as crushed rock, gravel, laterite, sand, crusher run or mining blast;
7) Stream crossing structures, such as bridges and culverts, are designed and built so as to minimize impacts on permanent watercourses and surrounding vegetation;
8) On gentle terrain where little excavation is needed, the maximum RoW of less than 12 metres for secondary/feeder roads is observed. However, additional clearing is provided for in steeper terrain to open cut and fill slopes and in areas of especially high rainfall to allow sunlight to penetrate so that the road will dry out reasonably quickly after rainstorms.
9) Cutting and filling should be minimized. Hydraulic excavator is used to avoid the need to side-cast excavated material. Excavated materials are deposited in stable disposal areas well away from streams.
10) All trees standing within the road RoW are cut and cleared. However, under deserving circumstances, removing standing trees from the inside of road curves is resorted to in order to improve sight distance and user safety on the lower side of the road.
11) All the trees in (10) all felled parallel with the road alignment.
12) All slash and debris are accumulated along one side of the cleared width between the road prism and the standing timber. The woody debris are placed first and compacted by the grubbing equipment, then covered by the stripping material and sufficient mineral soil. Debris is not pushed into standing timber and the piles are properly groomed to be stable and visually acceptable.
13) Road and landing areas are minimized while providing roadside clearings of appropriate sizes that are consistent with the need to allow the roads to dry out quickly after heavy rains.
14) Every effort is made to ensure that the parameters of the constructed secondary/feeder road are within the specification limits as shown in the Secondary/Feeder Road Geometry in **Table 1**.
15) Intermittent cross-road drainage structures are provided in order to channel out flash flood water and to prevent erosion of road surface particularly on continuous steep stretches of the road;

16) Silt traps/ sump are constructed using gabions, logs, branches, rocks, etc.; at (i) culvert outlets; (ii) at the end of diversion drains; (iii) at the out corners of bridges where high flow of water is expected.

2.3.2 Skid trails

1) Skid trails are prepared according to the skid trail network as approved in the forest harvesting plan (RMH – *Rancangan Mengusahasil Hutan*);
2) Any proposal for deviation from the planned skid trails should only be implemented upon approval of the DFO who will records it;
3) Felling of trees along the skid trails should be minimized as much as possible, and slash and felling debris should be left on the skid trail corridor in order to minimse surface erosion;
4) The width of the skid trail is limited to 4 metres, (i.e. that of the tractor blade) on slopes of up to 36% (20^{o});
5) Skid trails are made prepared before tree felling commenced at a logging site;
6) Only minimum blading should be applied, except in situations where the stability of the skidding machine is at risk and need to be assured;
7) No skid trail is allowed to cross gullies or permanent watercourses wider than 5 metres; and;
8) Skid trails were prepared within the specification limits shown in the Skid Trail Geometry (**Table 2**).

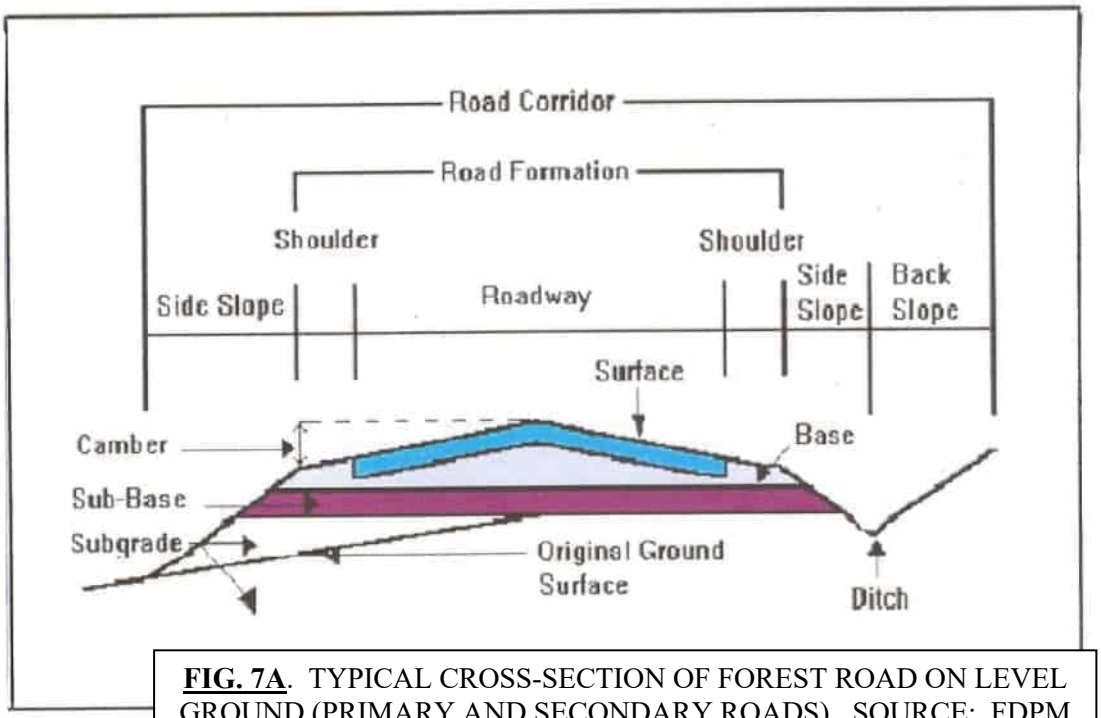


FIG. 7A. TYPICAL CROSS-SECTION OF FOREST ROAD ON LEVEL GROUND (PRIMARY AND SECONDARY ROADS). SOURCE: FDPM

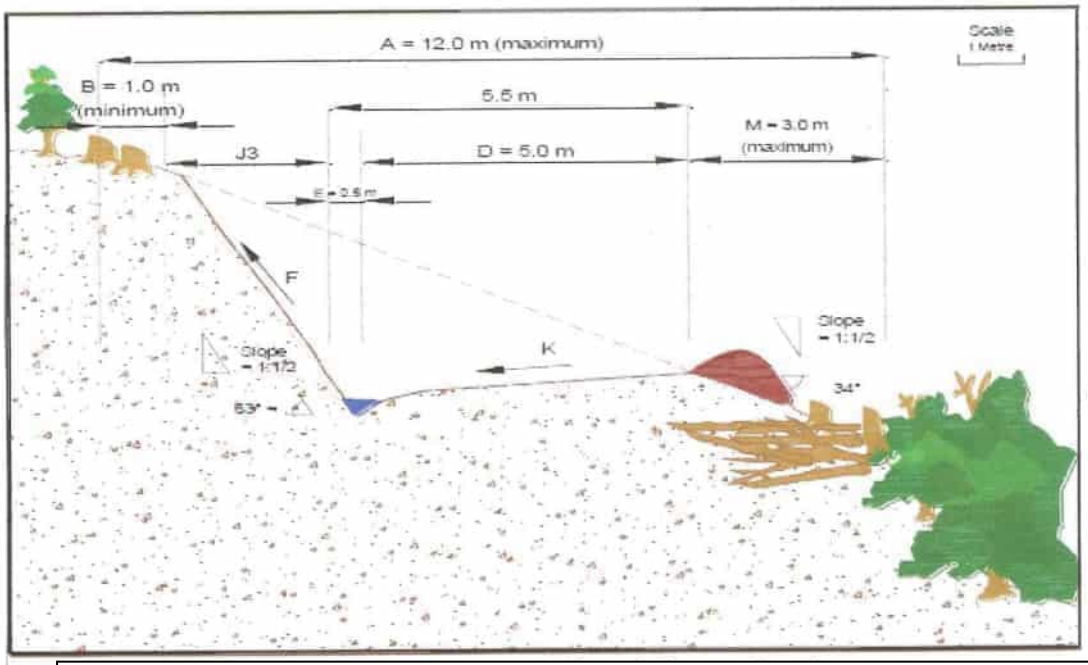


FIG. 7B. TYPICAL CROSS-SECTION OF FOREST ROADS ON SLOPES INVOLVING CUT AND FILL (PRIMARY AND SECONDARY ROADS). SOURCE: FDPM (2010)

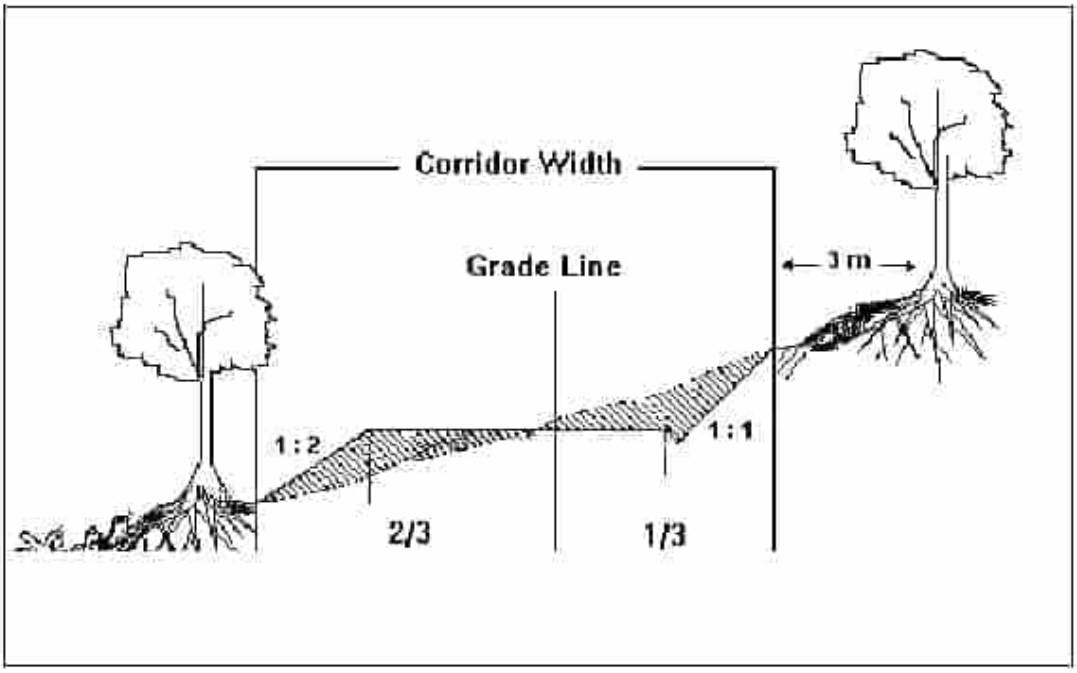


Figure 7c: Clearing Width of Road Corridor

2.4 Road Monitoring and Maintenance

1) Post-construction monitoring and maintenance are a critical step to protect the structural integrity of the road prism and cleared area and to ensure that structures are operating as designed and installed, and that where problems are likely to occur, remedial measure could be appropriately taken.
2) Road surface, roadside ditches, cross drains, and stream crossings are properly maintained.
3) All roads considered essential for management or protection of the forests will continue to be maintained.
4) Road surface should be made free at all times of stagnant water, man-holes and other damages that may compromise the safety of road users.
5) All side ditches and water exit points are maintained so as to enable them to function at all times.
6) Where necessary, overly compacted soil surface (with density exceeding 1.4 g/cm^2) is ripped and scarified before being re-habilitated by planting with fast growing tree species or cover crops under the *Tanaman Kawasan Lapang* (TKL) programme.

Table 1. Secondary/ Feeder Road Geometry

Parameter			Specifications
Density			40m/ha
Carriageway			Single lane
Designed speed			≤20km/h
Cross-section	Right of Way (RoW)		≤12m
	Width of Carriageway		≤5m
	Carriageway Material		Stable Subgrade
	Road Camber		≥1:20 (straight: 5%)
	Cross-Fall		≥1:33 (3%)
Vertical Alignment	Road Gradient		≤20% (11.3º)
	Length of Gradient/Slope		≤200m
Horizontal Alignment	Radius of Curvature		≥20m
	Curvature Widening		≥1m
	Superelevation		1:20 (5%)
Sight Distance*	Non-passing (Stopping)		≥30m
	Passing		≥50m
Drainage Structure	V-shaped Side Drain (Earth)	Top width	≥0.5m
		Depth	≥0.3m
		Bed Gradient	≥2%
	Culvert with stacked logs as Head Walls	Loading	22 tons
		Diameter	≥900mm
		Type	Hollow log/ concrete/ CMP/ HDPE)**
	Bridge with stacked logs as wing walls	Loading	22 tons
		Width	≥3.5m
		Type	Concrete box culvert/ timber/ steel
	Surface cross-drain (hardwood timber)	Width	≥0.5m
		Depth	≥0.3m
		Bed Gradient	≥3%
Side slope	Cut >1.0m height	Earth (stable)	≥1:1/2 (<63º)
	Fill	Earth with logging slash as support	≥1:1 1/2 (<34º)
Earth works	Excess earth		Use to construct lay-bys (passing areas) and compacted bund.
	Silt traps		In erosion-prone areas
Rainy weather	Wet roads		Traffic prohibitef

*Optional: parameters recommended for safety reasons
** CMP: corrugated metal pipes; HDPE: high density polyethylene (plastics)

Table 2. Skid Trail Geometry

DESCRIPTION	SPECIFICATIONS/ MATERIALS
1. Density	<300m
2. Width	<4m
3. Gradient	<36% (20º)
4. Carriageway material	Forest floor

Figure 5-3: A Log Bridge

2.5 Drainage

1) Roadside ditches and appropriately-spaced cross drains are constructed to channel water away from the road structure and into the surrounding vegetation.
2) Side ditches are made to have a uniform gradient of at least 2% to ensure water will flow and not pond.
3) Exit points for water to the right and left of the road are constructed with their locations being determined by the supervising officer.
4) The spacing of surface cross drains is determined based on degree and length of slopes as follows (**Table 3**):

Table 3: Spacing Distance of Surface Cross Drains.

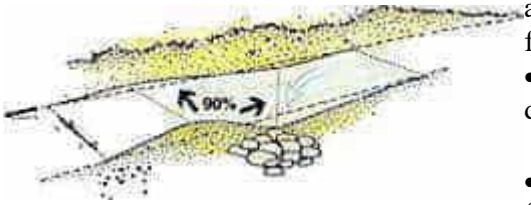
Road gradient	Distance between cross drains
0 – 10%	60 meters
11 – 15%	30 meters
16 – 20%	15 meters

5) Log culverts when used, take into consideration: the opening size, debris passage or trapping requirements, the width of the culvert, superstructure design (stringer or puncheon sizing), substructure design (sills, mud sills and foundation logs), fill and surfacing requirements, and inlet and outlet protection requirements.

Box 1: Drainage from Road Surface.

- Vary road grades to reduce heavy flow in road drainage, ditches, culverts, on fill slopes & road surfaces.
- Provide adequate drainage from the surface of all types of roads by using outsloped or crowned roads, drain dips, or insloped roads with ditches and crossdrains.
- Outsloped roads provide means of dispersing water in a low-energy flow from the road surface. They are appropriate when fill slopes are stable, drainage will not flow directly into stream channels, and transportation safety considerations can be met.
- For insloped roads, plan ditch gradients steep enough, generally greater than 2 percent, but less than 8 percent to prevent sediment deposition and ditch erosion. The higher gradients may be suitable for more stable soils; use the lower gradients for less stable soils.
- Drain Dips: Properly constructed drain dips can be an economical method of channeling surface flow off the road.
- Prevent downslope movement of sediment by using sediment traps, and changes in road grade, .

- Protect the upstream end of cross-drain culverts from plugging.
- Provide energy dissipators (rock piles, logs, etc.) where necessary at the downstream end of ditch relief culverts to reduce the erosion energy of the emerging water.
- Cross-drains, culverts, water bars, dips, and other drainage structures should not be discharged onto erodible soils or fill slopes without outfall protection.
- Route road drainage through vegetative Buffer Zone filtration fields or other sediment settling structures. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream.
- Ditch relief culverts transfer water from a ditch on the uphill side of a road, under the grade and release it onto a stable area, thereby preventing water from crossing the road surface and softening the roadbed.



- Install culverts at least 12" in diameter at a 30-degree downgrade angle to enhance flow.
- Ensure proper slope of at least 5 inches every 20 feet. Seat the culvert on the natural slope.
- Bedding material should be free of rock or debris that might puncture the pipe or carry water around the culvert. Cover with soil, avoiding puncture from large rocks. Compact soil at least halfway up the side to prevent water from seeping around the culvert.
- Rule of thumb for covering culverts: minimum of I foot or one-third the culvert diameter, whichever is greater. Be sure outlet end extends beyond any fill and empties onto an apron of rock, gravel, brush, or logs.

2.6 Preparation of Drawings and Specifications for Bridges and Major Culverts

1) Drawings of bridge superstructure contain the following elements: span length(s), elevation(s) of grade at bridge ends, road and bridge grades, girder and stringer arrangements and connections, deck configuration, connections and component elements, curb and rail configuration, and shop or field fabrication details.
2) Drawings of bridge substructure should contain the following elements: location and sizes of piles or posts, minimum expected pile penetrations, bracing and sheathing configurations, critical elevations of substructure components, location and sizes of bearing members (pads, timber caps, etc), in-stream protection layout and description, including design slope and other considerations of rip rap for scour protection, and abutment wall or pier shaft configurations and elements,

2.7 Bridge and Culvert Construction/ Installation

1) A bridge should have enough span for water to pass underneath during heavy downpour.
2) When culverts or similar drainage structures are used for crossing drains or stream crossings, the proper size and spacing of the structures are determined upon consideration of
   (i) local rainfall patterns and intensity;
   (ii) runoff rates;
   (iii) detailed ground survey;
   (iv) the need to minimize disturbance to the stream during construction.

3.0 Environmental Impacts and Mitigation Measures

3.1 Potential Impacts of Forest Roads

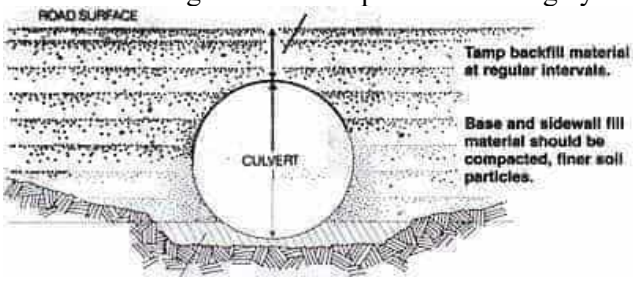
KPKKT acknowledges the virtues of having forest roads which are well-planned, in accordance with their classification and expected function. A badly planned and constructed forest road network may lead to the following:

1) High construction, maintenance, and transportation costs;
2) Inefficient deployment of resources (manpower, machines, time, energy, etc);
3) Short road life relative to its intended use;
4) Excessive stream sedimentation, with potentially serious effects on chemical and physical qualities of the water, aquatic life, and wildlife populations;
5) Excessive soil erosion and soil loss, reduction of productivity in forest areas along the roadways and other affected areas;
6) Increased risk for triggering mass flow and landslides on steep slopes with consequent damage to infrastructure, streams, regeneration and land use;
7) Disruption of habitats, breeding areas or migratory routes of sensitive animal species;
8) High costs for rehabilitation and repatriation of forest ecosystem;
9) high costs for supervision and monitoring;
10) excessive usage of fuels and lubricants;
11) excessive noise and air pollutions;
12) increased risk of accidents among forest road users.

Box 2: Stream Crossings

Installation of Stream Crossings

- Minimize stream channel disturbances and related sediment problems during road construction and stream crossing structure installation.
- Time construction activities to protect water quality and fisheries..
- Do not place erodible material into stream channels. Remove stockpiled material from high water zones.
- Locate temporary construction bypass roads in locations where the stream course will have minimal disturbance.
- When using culverts to cross small streams, install those culverts to conform to the natural stream bed and slope on all perennial streams and on intermittent streams that support fish or that provide seasonal fish passage.
- Place culverts slightly below normal stream grade to avoid culvert outfall barriers.
- Do not alter stream channels upstream from culverts, unless necessary to protect fill or to prevent culvert blockage.
- Install culverts to prevent erosion of fill. Compact the fill material to prevent seepage and failure.
- Armor the inlet and/or outlet with rock or other suitable material where needed.
- Consider dewatering stream crossing sites during culvert installation.
- Use I foot minimum cover for culverts 18 to 36 in in diameter, and a cover of one-third diameter for larger culverts to prevent crushing by traffic.



- Complete the work as fast as possible during a time of year when the least damage can occur.
- The culvert bed is graded to the appropriate slope to conform with the natural stream bed. The bed is either rock- free soil or gravel. Bedding should provide even distribution of the load over the length of the pipe.
- Alignment is critical for the culvert to function properly. Skewed culverts can develop debris problems. Culvert alignment must fit the natural stream channel.
- Place culvert slightly below the natural streambed.
- Start to backfill over one end of the culvert. Then cover the other end. Backfill material must free of limbs, rocks, and other debris that could dent the pipe or allow water to seep around the culvert. Once the ends are secured by backfill, the center is covered.
- Pour backfill material over the top of the pipe. This allows finer soil particles to flow around under culvert sides. Larger particles roll to the outside. Fine soil particles close to the culvert compact more easily.

3.2 Soil Erosion and Sedimentation

The road surface is an important water control element. The undesirable consequences of site preparation, forest road engineering and logging in terms of interference to the ecosystem and loss of soil from erosion and mass flow as well as degradation of rivers and streams from sedimentation can be minimized through a series of mitigation measures such as:

1) In-sloping, out-sloping, crowing, surfacing and creating grade breaks. These measures are incorporated into road design and construction to minimize surface water velocity and the potential for concentrated flows in the ditch-line;

Table 4.. Size (width) of buffer strips along permanent rivers by slopes of riverbanks

Slope of riverbank (%)	Width of buffer strip (m)
0 < 20	10
20 < 40	20
40 < 60	30
> 60	50

2) Riparian reserves and Buffer Zones are laid along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis.

3) The main purposes of the Buffer Zones would be to **(i)** protect the quality and health of the aquatic system and its dependent community and species; **(ii)** provide incidental benefits to upland species, **(iii)** help maintain and restore riparian structures and functions, **(iv)** benefit fish and riparian-dependent non-fish aquatic species, **(v)** enhance habitat conservation for organisms dependent on the transition zone between upslope and riparian areas, **(vi)** improve travel and dispersal/ migratory corridors for terrestrial animals and plants, **(vii)** provide for greater connectivity of late-successional forest habitat and **(viii)** conserve bio-diversity.

4) In the case of areas with permanent water bodies, such as wetlands, large ponds and lakes, buffer zones of at least 50 metres from the lake fringes are demarcated to be reserved and distinguished with appropriate markings and colour and protected. The buffer would serve as the last barrier which filters sediments from entering the water bodies and rivers. Except for times of extreme precipitation and runoff, trees help maintain normal water table along streams.

Contractors and forest workers are accordingly briefed on the importance of and need to continuously maintain the quality of the waters in all of the rivers in the project area;

5) In order to reduce the potential for surface water runoff and sediment delivery into streams, all compacted and bare soil areas on locations along roads and skid trails, log landings, cut and fill banks, within the ditch-line and camp (*kongsi*) sites, etc are re-vegetated with appropriate plant/ tree species under the TKL programme;

3.3 Hydrology and Water Quality

Fig. 9. Well constructed and maintained forest roads result in clear and good quality river water. Besol PRF, DTC.

The efficient cycling of water and water quality within DTC and CFC areas are maintained through KPKKT's adherence to DOE standards and best management practices concerning water quality and waste and effluent disposal. This is in specific reference to Standard "B" of the Third Schedule in the Environmental Quality Regulations (Industrial Sewerage and Effluents) 1979 (*i.e*. Regulations 8(1), 8(2), 8(3) and 11(5)(b)).

Stream waters from an unlogged part of the forest are generally of high quality because the vegetation and associated ground litter layers protect the ground surface from the erosive impact of rainfall while helping to maintain soil infiltration.

Forest contractors and their workers are not allowed to leave unwanted logs in stream channels where they would interfere with the hydrological cycle by obstructing and regulating flow and lead to the formation of debris dams, so further destabilizing the stream channel and causing diversion in water flows. Such logs and debris along with heavy mudflow also posed a threat to infrastructures like roads, bridges and culverts thus endangering human lives if carried downstream during high flows.

3.4 Impacts on Forest Vegetation

The selective felling of trees as practiced in DTC and CFC follows strictly the tenets of the Malaysian Selective Management System (SMS) in which decisions on the amount of timber to be removed and their species mix were made by the Forestry Department and determined based on the data gathered during Pre-Felling Inventory exercise. The standard approach is to prescribe felling regime based on minimum diameter at-breast height (DBH) limits for the two main groups of tree species: Dipterocarp and Non-Dipterocarp. In general, the Dipterocarp trees tend to dominate in the larger size category so much so that any decision on felling would inevitably result in the residual stand being poorer in this group of species. If this happens it was thought that our future forests would be dominated by the Non-Dipterocarps at the expense of Dipterocarp tree species. Under the circumstance, SMS has advocated that in any felling

BOX 3: KPKKT Management Ensures That All Water Or Surface Run-Off Water Leaving The Project Area Shall Contain Total Suspended Solid (TSS) Not Exceeding 150 Mg/L.
All Rivers And Streams Will Not Be Turned Into Silt Traps Or Sediment Traps. These Facilities Will Be Constructed And Dealt With Separately From Natural Watercourses.

decision, the minimum DBH felling limit for the Dipterocarps should always be set at least 5cm higher than the Non-Dipterocarps, whereas for Chengal trees, its minimum felling size should never be lower than 70cm DBH. The main objective was to save as many as possible the Dipterocarp tree population – a move which is still contentious and subject to debate.

3.5 Impacts on Fauna

Mammals such as Kucing hutan (*Felis planiceps*), Gajah (*Elephas maximus*), Babi hutan (S*us scrofa*), Lotong ceneka (*Presbytis melalophos*), and Tupai (*Tupaia tana* and *Tupaia glis*) are expected to temporarily suffer a shock during road construction and logging through temporary displacement before recovering and returning to the area and its neighbourhood. Other smaller vertebrates and invertebrates tend to be similarly affected including the rodents, reptiles, insects and birds.

As for the aquatic fauna and herpetofauna and their habitats, the impacts of road construction and other forest operations are brought about through the changes to water quality generally associated with sedimentation, changes to riparian, bank and substrate habitat which may result in reduced fish and invertebrate productivity, blockage of fish passage, and reduced availability of important habitat. The resulting degradation of their riverine habitats from uncontrolled forest road construction would have a great impact on the breeding capacity of these animals. This however will need to be ascertained and clarified through more detailed studies.

4.0 Monitoring and Protection

The success or failure of the natural TRF management in remaining viable while maintaining the environment and the forest stand lies in the sustainable harvesting of the produce (i.e. timber and non-timber) and rehabilitation and maintenance of the residual stands. These are closely associated with successful road planning, construction and maintenance. Logging operations must be planned and supervised to minimize damage and to optimize the number, length, alignment and placement of forest roads and tracks/ skid trails. **Table 5** summarizes the mitigation measures on forest roads undertaken in the project area by the KPKKT.

Box 4**: Forest roads are built to the specifications and standards laid out by the Peninsular Malaysian Forestry Department and were regularly maintained in order to ensure soil and slope stability.**

*Box 5**: The monitoring of the quality of water released from silt traps as well as that in major rivers is conducted once a month, covering such parameters as: Biochemical Oxygen Demand (BOD); Total Suspended Solids (TSS); Dissolved Oxygen (DO) and Oil and Gas (O & G). The optimal siting of samplers and sampling programme are referred to the State DOE.***

Box 6:

Maintenance of Forest Roads.

- Maintain erosion control features through periodic inspection and maintenance, including cleaning dips and cross drains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.
- Avoid using roads during wet periods if such use would likely damage the road drainage features.
- Grade road surfaces only as often as necessary to maintain a stable running surface and to retain the original surface drainage.
- Avoid cutting the toe of cut slopes when grading roads or pulling ditches.
- Place all excess material removed by maintenance operations in safe disposal sites and stabilize these sites to prevent erosion. Avoid locations where erosion will carry materials into a stream.
- Grading repairs the drainage, by smoothing surface ruts and potholes. However, avoid grading sections of road that don't need it. It creates a source of sediment from the newly disturbed surface. Raise the blade where grading is not needed!

5.0 Summary of Mitigation Measures on Forest Roads

Table 5. Summary of Mitigation Measures on Forest Roads

NO.		SIGNIFICANT IMPACTS	MITIGATION MEASURES & COMPLIANCE
1		Project Concept	☑ Forest roads and skid trails to serve the production and conservation functions of the forest and to be built to the standard specifications of the Forestry Department. ☑ Forest road design, construction and maintenance should also comply with the certification standard of FSC.
2		Project Design	
	2.1	Soils	➢ The design for soil erosion control due to road construction to conform with the "*Manual Saliran Mesra Alam Malaysia*" by DID (2000), and "Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia (DOE, 1996)
	A)	Erosion of soil surface	➢ Proper engineering practices by installing culverts, side ditches, cross drains, diversion ditches, sediment basins, rip rap, silt traps or other facilities. Minimize the total length of roads and areas of disturbance and proper maintenance. Forest roads and forest tracks/ skid trails to follow the specifications laid out by the Forestry Department. ➢ All forest roads were to be closed when not in active use.
	B)	Landslip & slope stability	

			➢ Benching of slopes, diversion, dykes, retention of buffer strips, seeding of grass or cover vegetation minimization of cutting and filling. ➢ Use and movement of heavy machinery to be strictly controlled.
	2.2	<u>Hydrology and water quality control and supervision</u>	
	A)	Water yield, dry season flow and flood response	➢ Conservation of catchment areas; keep density of roads and tracks/ skid trails to a minimum
	B)	Sediment load and turbidity	➢ 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.
	C)	Physical, chemical and biological qualities	➢ To ensure that the total suspended solid (TSS) in surface water run-off from the project site is kept below 150 mg/l. ➢ A monthly monitoring of the quality of water released from silt traps and those in major rivers to be undertaken. This would involve parameters such as BOD, DO, TSS, and O & G. The locations and sampling programmes to be referred to the State DOE.
	2.3	<u>Drainage</u>	➢ KPKKT to utilise natural drainage patterns to reduce sedimentation; maintain riparian vegetation. facilitate water flow by clearing streams and culverts from rubbish, waste timber and silt. ➢ All river crossings would only be constructed upon the approval from the State DID. ➢ All natural water courses, rivers and their tributaries would not be used as silt traps or sediment traps. ➢ No activity whatsoever would be conducted within the river reserve and buffer strips

6.0 Summary and Recommendations

Without properly and soundly planned forest roads whose construction follows the set specifications; none of the development, harvesting, silvicultural, research and enforcement functions of the forest management under the scope of SFM could be executed effectively and efficiently. It is not surprising therefore when forest roads always rank highest in the agenda of many a forest auditor and certifier, along with other certification criteria such as HCVF and social as well as environmental issues. Failure to meet the verification standard on roads usually results in the auditee being given a major CAR (Corrective Action Request). At DTC and CFC, which are presently under the management of KPKKT, forest engineering issues are given their due emphasis in an attempt by the management to achieve the various objectives of management.

It had also enabled the company to comply with and subsequently be certified under the standards of established certification systems such as the world-acclaimed Forest Stewardship Council (FSC) with its set of 9 "Principles of Forest Stewardship". The latter calls for, among others strong engineering commitment in the form of high quality forest infrastructure to achieve the three main goals of Sustainable Forest Management (SFM): economic feasibility, environmental friendliness and social acceptability. The challenge before KPKKT now is to continue with its quality improvement initiatives and BMP in forestry. KPKKT should continue with its certification under FSC and move up the ladder to become a model and champion of SFM of TRF. At the moment some of the grey areas which may hinder its further progress during the coming years includes shortage of professional-level foresters. These are being addressed by KPKKT's management with recent infusion of new talents who will eventually phase out the first generation workers.

Fig. 10

Fig. 11

Figs. 10 & 11 Show luxuriant growth of the selectively logged mixed dipterocarp forests in their 2nd rotation of the Malaysian Selective Management System (SMS).

Abbreviations and Acronyms

BMP	Best Management Practices
BOD	Biological Oxygen Demand
CAR	Corrective Action Request
DBH	Diameter at Breast Height
DO	Dissolved Oxygen
DOE	Department of Environment
DID	Drainage and Irrigation Department
DTC	Dungun Timber Complex
FD	Forestry Department
FSC	Forest Stewardship Council
GPB	Golden Pharos Berhad
KPKKT	Kumpulan Pengurusan Kayu Kayan Trengganu Sdn. Bhd.
O & G	Oil and Gas
P&C	Principles and Criteria
PRF	Permanent Reserved Forest
RoW	Right-of-way
R & D	Research and Development
SFM	Sustainable Forest Management
SMS	Selective Management System
TRF	Tropical Rain Forest
TSS	Total Suspended Solids

References:

FDPM (2010). Garis Panduan Jalan Hutan Semenanjung Malaysia, Jabatan Perhutanan Semenanjung Malaysia, Kuala Lumpur.

Attachment 2: Social Impact Assessment

KEY FINDINGS FROM

SOCIAL IMPACT ASSESSMENT (SIA) OF THE SUSTAINABLE MANAGEMENT OF DTC & CFC, TERENGGANU MALAYSIA

By

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APRIL 2024

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EXECUTIVE SUMMARY

This Social Impact Assessment (SIA) on the sustainable forest management (SFM) on Dungun Timber Complex (DTC) and Cherul Forest Concession (CFC) in the State of Terengganu, Malaysia, represents a follow up to an earlier SIA report prepared in 2009, 2013, 2017 and 2020 for the same site and subject. It has always been the intention of Kumpulan Pengurusan Kayu Kayan Terengganu Sdn Bhd (KPKKT) and Pesama Timber Corporation Sdn Bhd (PESAMA) as the manager and operator of SFM within DTC and CFC 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 and CFC are well-catered for, by following as closely as possible the recommendations laid out in the SIA reports. At the moment, this SIA report will be combined between KPKKT and PESAMA to maximize the data collection and interpretation.

The idea of the SIA is to enable KPKKT and PESAMA 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 and CFC. KPKKT and PESAMA 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 and PESAMA 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 and PESAMA subscribes. Since 2008, KPKKT and PESAMA 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 and CFC 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 and PESAMA for its sound and responsible management of DTC forests. Among the main challenges faced by KPKKT and PESAMA 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 and PESAMA 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.

ACKNOWLEDGEMENT

I would like to extend my deepest gratitude to Golden Pharos Berhad (GPB) for their unwavering support and collaboration over the years. As a stalwart in the industry since its incorporation in 1986, GPB has demonstrated a steadfast commitment to excellence and sustainability. GPB's listing on the Main Board of Bursa Securities Malaysia Berhad since 1993 underscores its dedication to transparency and accountability, serving as a beacon of integrity in the marketplace.

Furthermore, as a Government-Linked Corporation (GLC) of Terengganu, GPB exemplifies a harmonious blend of corporate responsibility and state stewardship. I acknowledge the pivotal role played by Terengganu Incorporated Sdn Bhd and Lembaga Tabung Amanah Warisan Negeri Terengganu, whose significant shareholdings in GPB highlight the synergy between public and private sectors in driving economic growth and development. GPB's diverse portfolio, encompassing forest concession management, wood-based product manufacturing, and architectural panel glass sales, reflects its versatility and adaptability in meeting market demands while upholding environmental stewardship.

I would like to extend my sincere gratitude to the management of KPKKT and PESAMA for their unwavering support and collaboration throughout the duration of this project. Their commitment to excellence and dedication to our shared goals have been instrumental in achieving our objectives to carry out the social impact assessment of the sustainable forest management (SFM) operations within the Dungun Timber Complex (DTC) and Cherul Forest Concession (CFC).

I would like to express my appreciation to operations crew members to encompass the diverse range of programs and activities systematically planned and conscientiously executed on the ground. I would like to thank the ground crew for their valuable contributions, guidance, and expertise. Their insights and assistance have significantly enriched our work and ensured its success. This choice of aims to portray leadership for their vision and encouragement, which have inspired me to strive for excellence and innovation. KPKKT and PESAMA as stewards of responsible forest management, prioritizing sustainability over mere profit-driven logging activities.

I also extend my thanks to all the collective efforts of KPKKT, PESAMA, their staff, contractors, and the Terengganu State Forestry Department (TSFD) exemplify the professionalism and dedication demanded by the discipline of SFM who have contributed directly or indirectly to this endeavour. Their collective efforts have been crucial in overcoming challenges and realizing the aspirations. Besides that, the harmonious collaboration and mutual respect demonstrated by local residents and relevant agencies underscore the importance of stakeholder engagement in fostering sustainable practices.

Over the years, the SIA report conducted by KPKKT in DTC and PESAMA in CFC have not led to any discernible conflicts with local residents. Instead, a culture of mutual respect and cooperation has prevailed, enabling both entities to conduct their business smoothly while minimizing adverse impacts on the environment, wildlife, and communities. The positive rapport between KPKKT, PESAMA, and local villagers serves as a testament to the spirit of goodwill and coexistence, which remains steadfast. It is with profound gratitude that we recognize the KPKKT, PESAMA, and local villagers for their partnership and support, which have been integral to the achievements of this project.

Finally, I would like to thank KPKKT's Deputy General Manager, Mr Ahmad Bazli Razali, as well as General Manager of PESAMA, Mr Hilmi Awang and others who had been of such great help during the preparation of this report.
Thank you.

Sincerely,

Vinotheni Krishnan
April 2024

ABBREVIATIONS AND ACRONYMS

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 Forest 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
PERHILITAN	Jabatan Perlindungan Hidupan Liar dan Taman Negara (Wildlife Protection and National Parks Department)
PLI	Poverty Line 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
UPM	Universiti Putra Malaysia
WWF-Malaysia	Worldwide Wildlife Fund – Malaysia Office

SECTION 1
INTRODUCTION
APPROACH AND METHODS

1.0 Approach and Methods

Social Impact Assessment (SIA) is a systematic process used to evaluate the potential social effects of a proposed project, program, policy, or activity on the surrounding communities, stakeholders, and broader society. The primary objective of an SIA is to identify both positive and negative social impacts and provide recommendations for mitigating adverse effects and enhancing positive outcomes.

Key components of a social impact assessment typically include stakeholder engagements, data collections, impact identifications and assessments, impact predictions, risk opportunity analysis, risk mitigations and management measures, monitoring and evaluations, public participants, ethical considerations, capacity building and reporting and documentations. 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.

Social Impact Assessment (SIA) is a critical process for recognizing and managing the immediate and long-term societal effects of projects. It enhances the Corporate Social Responsibility (CSR) model in forest management by employing tools for measurement, evaluation, and reporting. The goal is to foresee and mitigate adverse impacts while maximizing benefits for local communities and society.

Since 2009, KPKKT and PESAMA have been conducting SIA exercises to address local community welfare concerns. They've tackled issues like subpar river water quality, wildlife-related crop damage, and road safety for school children. KPKKT has developed targeted mitigation strategies through ongoing dialogue with authorities and community members. Committed to continuous improvement, KPKKT annually reviews its impact on social and economic environments to refine its processes.

Since 2008, KPKKT has proudly maintained the FSC® certification for its DTC concession, reflecting its long-standing commitment to responsible forest management. In 2012, PESAMA earned the FSC® certification for its CFC concession, further solidifying the Group's dedication to high forest management standards. For strategic consolidation, to professionally and sustainably manage the distinctive tropical forests in the DTC and CFC concessions, GPB has strategically merged their management under KPKKT. This includes unifying the FSC® certifications, ensuring that both ecosystems and their biodiversity are preserved according to the highest local and international standards.

The Golden Pharos Group is committed to working closely with all pertinent stakeholders and organizations. The aim is to guarantee adherence to the principles of exemplary forest management as outlined by the Forest Stewardship Council (FSC®) and the Malaysian Criteria and Indicators (MC&I) for Forest Management Certification (Natural Forest).

Since April 21, 2008, KPKKT has been recognized with the FSC® certification by SCS Global Services, a global leader in third-party forest management auditing and certification. This certification confirms that KPKKT's Dungun Timber Complex (DTC), spanning 106,031 hectares, adheres to the stringent international FSC® standards, employing a selective cutting strategy that ensures ongoing forest coverage and species diversity.

Furthermore, Pesama Timber Corporation Sdn Bhd (PESAMA) was awarded the FSC® certification for its 20,243-hectare Cherul Forest Concession (CFC) on December 10, 2012, by SCS Global Services. The combined DTC and CFC concessions under KPKKT and PESAMA represent the most extensive forest areas in Peninsular Malaysia to hold the FSC® certification, with DTC being the second natural forest in Malaysia to earn this honour.

In a strategic move to promote efficient, cost-effective, and sustainable management, the Group has unified the FSC® certifications and management of the DTC and CFC concessions under KPKKT. This consolidation, completed on September 5, 2021, aims to ensure the tropical forests' resources and ecology are conserved indefinitely, in line with the highest local and international standards.

At Kumpulan Pengurusan Kayu Kayan Terengganu Sdn Bhd (KPKKT) and Pesama Timber Corporation Sdn Bhd (PESAMA), a series of social impact assessment of the company’s sustainable forest management (SFM) programmes and activities within its 126,274ha, long-term forest management unit (FMU) of Dungun Timber Complex (DTC) and Cherul Forest Concession (CFC) in Terengganu. SIA report been conducted at Bukit Besi, Dungun and Kemaman. At first it was planned to recruit 200 respondents but the management only able to recruit around 181 which is 31 of the respondents is from Kemaman and the remaining respondent is from Bukit Besi, Dungun.

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 and CFC. 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.

Social Impact Assessment (SIA) report is crucial for management as it provides a comprehensive analysis of the potential social impacts of a project or initiative as SIA

helped management to make informed decision making as the report help in strengthen the company and also in conducting community programs. The SIA helps identify potential negative impacts before they occur, allowing for the development of strategies to mitigate risks. It also promotes transparency and accountability by involving stakeholders in the decision-making process, which can lead to better community relations and support for the project. By assessing the social environment, management can ensure that their projects align with sustainable development goals and corporate social responsibility standards. Overall, an SIA report aids management in understanding the social dynamics related to their projects and in taking a responsible approach to business practice.

SECTION 2
BACKGROUND

2.1 Company Introduction

Golden Pharos Berhad (GPB), established in 1986 with total staff of 448 staff, is a public company featured on the Main Board of Bursa Securities Malaysia Berhad since 1993. It operates as a Government-Linked Corporation of Terengganu state, with a 69.092% shareholding through Terengganu Incorporated Sdn Bhd and Lembaga Tabung Amanah Warisan Negeri Terengganu, holding 60.925% and 8.166% shares, respectively. GPB's core operations encompass the management of forest concessions, timber harvesting and distribution, sawmilling, enhancing wood-based products, and the production and marketing of architectural panel glass.

Since its foundation in 1986, Golden Pharos Berhad (GPB) has grown and diversified as an investment holding company, driving economic development in Malaysia's East Coast. Predominantly owned by Terengganu Incorporated Sdn Bhd, the investment arm of the Terengganu State Government, GPB was publicly listed on the Main Board of Bursa Malaysia Securities Berhad in 1993, under the Industrial Products and Services sector. Based in Kuala Terengganu, GPB prides itself on being a distinguished entity, dedicated to enhancing its core operations in harvesting and sawmilling, as well as manufacturing. Forest concession management timber harvesting and distribution managed by Kumpulan Pengurusan Kayu Kayan Trengganu Sdn Bhd (KPKKT) and Pesama Timber Corporation Sdn Bhd (PESAMA).

Kumpulan Pengurusan Kayu Kayan Trengganu Sdn Bhd (KPKKT), based in Bandar Bukit Besi, Dungun, was established in 1980. It manages the Group’s timber concessions, spanning roughly 126,274 hectares of lush tropical rainforest in Terengganu. This includes 106,031 hectares within the Dungun Timber Complex and 20,243 hectares at the Cherul Forest Concession. 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). 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 10 FSC's Principles and Criteria of Forest Stewardship (FSC P&C). This certification was subsequently renewed for a further five years as from 2020. As of the date of this report (April 2024), KPKKT employs a total of 83 staff comprising 70 males and 13 females. Of these, about 12% work at the management level (Deputy GM, Head of Department, Assistant Manager Operation, Assistant Managers and Forest Executives), and 88% 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.

Pesama Timber Corporation Sdn Bhd (PESAMA), founded in 1973 and situated in the Jakar Industrial Area of Cukai, Kemaman, is a fully owned subsidiary of Golden Pharos Berhad (GPB). With a skilled team of over 79 employees, PESAMA oversees key operations such as sawmilling, moulding, kiln drying, and wood treatment. The company's products are sourced from the Group's sustainable forest concessions, ensuring a steady supply of raw materials, and are supported by globally recognized certifications affirming our commitment to sustainable forest management and eco-friendly practices.

PESAMA Timber Corporation Sdn Bhd (PESAMA) has its premise located just on the northern bank of Kemaman River in Kemaman District, Terengganu, and on the right-hand side of the Kuantan – Kemaman trunk road, heading north. The company is one of the subsidiaries of the Terengganu State Government - linked company (GLC) Golden Pharos Berhad (GPB) and manages the 20,243-ha Cherul Forest Concession (CFC) which constitutes part of Cherul Permanent Reserved Forest (PRF), Terengganu since the company's establishment in late 1970's. The current management of the natural tropical rain forest (TRF) within CFC is based on the principles of sustainable forest management (SFM) and follows the dictates of a long-term Forest Management Plan (FMP) which covers a 30-year period from 2009 till 2038.

Pesama's FMP calls for the company to adopt and strictly follow the instructions laid out under Malaysian Selective Management System (SMS), under the guidance and supervision of the Terengganu State Forestry Department (TSFD), and with strong professional and technical inputs from PESAMA's sister company the Kumpulan Pengurusan Kayu Kayan Terengganu Sdn Bhd (KPKKT). At the present going, the practice of SMS within CFC is now well into the second rotation of implementation. The first round (for example, rotation) of timber harvesting under the SMS's first 25-year rotation was completed in 2001 involving virtually all the productive virgin forest stands within the Production Forest category. For the second rotation, it has been decreed by the Terengganu State Forestry Department (TSFD/ JPNT) that, as a precautionary and conservative measure, a new period of 30 years should be used and to be implemented within this FMU.

Due to the professional and sound management of the forest by Pesama, CFC was successfully accredited and certified by the Forest Stewardship Council as a "well managed forest" in 2012. The conduct of this SIA is part of a continued effort by PESAMA maintain its compliance with one of FSC's Principles and Criteria of Forest Stewardship. At Pesama, about 12.66% work at the management level (General Manager, Head of Department, Executive Operation, Assistant Managers and

Marketing Executives), and 87.34% at the technical level (Factory Supervisors 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.

The 7-person management team of PESAMA consists of 1 General Manager who is assisted by 1 HR Executive, 1 Account Manager, 1 Marketing Executives, 1 IT Executive, 1 Operation Executive, 1 Safety & Health Executive. They are supported by 3 clerical-level staff who handle ices in documentation and filing. The tasks in the field are accomplished by a combined team from both PESAMA (4 persons) and KPKKT (3 persons).

SECTION 3
SOCIAL IMPACT ASSESMENT (SIA)

3.1 The Survey

The main objective of this social impact assessment was to appraise the various programmes and activities conducted by KPKKT and PESAMA and its appointed contractors under the guise of SFM and SMS within DTC forests and CFC forest with the view of analysing 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 and CFC 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 analyses 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. analysing and proposing the approaches for mitigating the negative social impacts of the logging area;
4. analysing and proposing the stakeholder groups to actively participate in the project.

Data was collected based on questionnaire interviews conducted randomly on residents of few major villages and settlements in the vicinity of DTC and CFC area as in presented in table form below. The interview schedule is as shown in appendixes. 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 181 respondents who are distributed almost evenly from the few villages in the vicinity of DTC and CFC villages. Figure 13 below shows on how the survey and this report is conducted and organizations of the study.

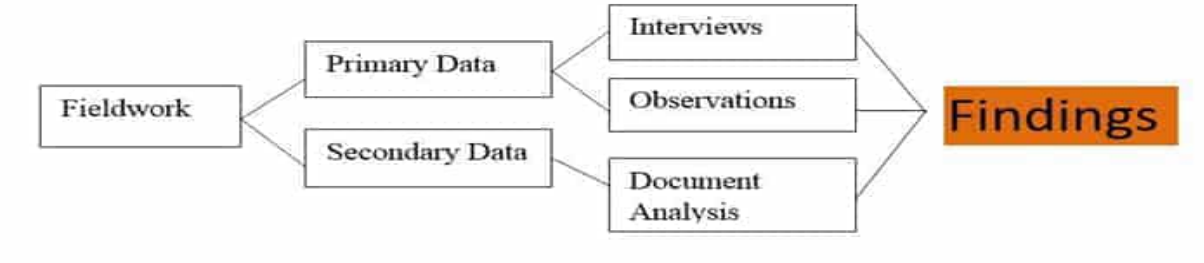

Figure 1: *Organization of the Study (Adapted from Ramle et al. 2014)*

3.2 Section A: Demographic Profile of Respondent

Details of the demographic profile of the 181 respondents in the survey which included their age, sex, race, religion, education level, marital status, type of work, monthly income individual, and total household income 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.

In terms of age distribution, respondent within the range 19 years old to more than 49 years old shows percentages of 95 percent with highest involvement in the survey. Respondent with age 15 years to 18 years old marks lowest involvement in the survey.

In term breakdown of respondent by sex group shows that nearly 65 per cent of the respondents where females with the remaining 35 percent are males that took part in this study.

In terms of ethnicity 99.4 percent were Malays (Islam) and 0.6 percent was Chinese (Buddha), 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 and CFC, about 41.44 percent of the respondents received higher education up to college and university level and about 58.56 percent reached secondary level education and also certification level education.

Most of the respondent that took part in this study are married with 74.0 percent of them are married and the remaining are single with 19.3 percent and the balance were widower/others with smallest percentages with 6.7 percent.

Most of respondent that took part in these studies are working either in government sectors with percentages of 7.7, private sectors with percentages of 28.2 and also self-employed with percentages of 34.3 and a very small percentage is jobless, students, retiree, housewife and others with percentages of 29.8 only.

In term of monthly income, most of the respondent at least earning RM500 to RM2,000 with percentage of 84 percent. Only few of them earns more than RM2,001 which is around 16 percent only.

Most of their family members are between 3 – 6 household's members with percentage of 66.3. less percentages of respondent with 0 -2 with 15.5 percent and 7 – 10 with 17.1 percent which is less than 20 percent. Few respondents with respondent more than 10 household's members.

In term of total household monthly income, it shows that, most of the total household income is around RM500 to RM1,500 only which is too less to accommodate life with percentages of 50. It accommodates half of the respondent of this study. 30 percent of them earning around RM1,501 to RM2,500. The rest earning between the range of RM2,501 to more than RM3,501 with 19.9 percent among them.

3.3 Section B: Respondent Basic Village Information

A total of 30 villages took part in this survey. Most of the respondent are from Kuala Jengai, Dendang, Bukit Besi, Cherul and Felda Cherul 1 & 2 which is accumulated to 44.7 percent. The remaining consists of other villages with lesser percentages.

Most of the villages do have all the facilities such as tar road, electricity, water supply, community hall, clinics, primary school, secondary schools and also mosque. Nearly 70 percent of the villages do have all the above-mentioned facilities at their villages.

Most of village distance is just in range of 6KM distance only with percentages of 73.5 percent. Around 26.5 percent of the villages are between 6KM to more than 10KM.

Villagers' common mode of transportations to work was mostly motorcycles with percentage 77.9 to work and also car with percentage of 59.7 to work. Very less of them uses trucks with percentage of 11.0, boat with percentage of 0.6 and some of them do not use any transportations to work with 1.7 percent.

3.4 Section C: Respondent Dependency on Forest Resources

In terms of villagers' dependency on forest resources, most of them dependence on wood, rattans, bamboos and herbs with mostly half of the respondent dependent on them. Around 45.9 percent of them dependent on marine, aquatics and fisheries. Only small percentages depend on wildlife accounted for 3.3 percent. 15.75 percent of the villagers have no dependency on forest resources at all.As regards the villagers' estimated income from forest resources, most of them only earns up to RM500 only forest resources which is below the poverty line accounted for 93.4 percent. A very small percentages only earns from RM501 to more than RM2,001 with percentage of 6.6 percent. This shows that villager does not earn much with forest resources that available to them.

3.5 Section D: Monitoring Controls

The villagers were asked few questions regarding monitoring and controls department that involved in protecting the forest resources. Most of the villagers heard about KPKKT/PESAMA and most of them have participate in the community program that organized by KPKKT/PESAMA. Most of them also do not make any complaint regarding forestry to KPKKT/PESAMA and most of the villagers agrees to participate in the program organized by KPKKT/PESAMA.

3.6 Section E: Social & Health Welfare

The villagers were asked few questions regarding social and health welfare among them. Most of the respondent agrees that forestry operations increase the health and safety risks of communities. Villagers does not agree that forestry operation cause physical/mental health harm. They also do not agree that forestry operation cause exposure to dust, noise, smell, vibration etc. Villagers are satisfied with physical infrastructure that provided to them. Forestry Operation will not increase crime and violence cases in the area.

3.7 Section F: Economy & Material Welfare

The villagers were asked few questions regarding economy and material welfare among them. Most of the respondent agrees that Forestry Operation increase employment opportunities and the villagers satisfied with cost of living at their area.

3.8 Section G: Cultural Values of Local Communities

The villagers were asked few questions regarding cultural values of local communities among them. Most of the respondent do not agrees that Forestry Operation result in a change in cultural values and forestry operations will affect the natural and cultural heritage values. Besides that, most of the villagers do not agree that forestry operation led to the loss of local languages and dialects.

3.9 Issues for consideration

Besides the obvious services and environmental benefits of the natural forest, some of its produces are traditionally known to have high consumption and income values to certain segments of the communities living in its vicinity. While areas of DTC and CFC containing these resources may not be designated as HCVF, KPKKT and PESAMA is nonetheless, obliged to institute appropriate management prescriptions with the view to enhance the values of these forest products and services and coordinate their utilisation in the context of current legislation governing such uses.

KPKKT and PESAMA 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 and PESAMA 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 and PESAMA 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 and PESAMA, the relevant households and the authorities concerned (incl. Terengganu State Forest Department) 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 PESAMA and its activities. These negative opinions were voiced despite of the findings that pointed to the side of the coin:

a. Logging had caused losses to the villagers.
b. Over-logging causes floods.
c. Over-logging causes erosion problems for the locals.
d. Logging has brought no benefit to the local residents.
e. Over-logging damages watershed and water resources.

SECTION 4
SUMMARY AND RECOMENDATIONS

4.1 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 and PESAMA during the days to mitigate the negative impacts and improve its operation:

a. KPKKT and PESAMA is to build up its own database on pertinent social and economic information which will be useful for future reference and decision-making process.
b. KPKKT and PESAMA 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.
c. KPKKT and PESAMA 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.
d. KPKKT and PESAMA is to strive to continuously improve its management of the forest and to get DTC and CFC being continuously accredited to the standards of established certification bodies such as MTCS and FSC.
e. KPKKT and PESAMA will continue to enhance the quality of its management of DTC and CFC by incorporating relevant provisions of Occupational Safety and Health for its staff and workers.
f. KPKKT and PESAMA to enhance its cooperation on the matter of SIA with the relevant authorities and institutions, such as JaKOA, PERHILITAN, Jabatan Perhutanan Negeri Terengganu, WWF-Malaysia, UMT, etc.
g. KPKKT and PESAMA will embark into more aggressive forest rehabilitation programme, possibly through the involvement of local residents.
h. There is a need for a better conservation measure by the KPKKT and PESAMA and the parties concerned such as Perhilitan, Forest Department, etc
i. KPKKT and PESAMA 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.
j. KPKKT and PESAMA 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.
k. KPKKT and PESAMA should be considerate to local villagers when conducting its operations.
l. KPKKT and PESAMA should contribute to the local villages by constructing more and better infrastructure.

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