Samling Reforestation (Bintulu) Sdn Bhd
A member of Samling Group of Companies

PUBLIC SUMMARY

Forest Plantation Management Plan

for the

MTCS Area within LANA LPF/0006

For the period

1st December 2016 to 30th November 2026

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Chief Operating Officer

1.Related Documents and Systems

There are numerous related documents. These are listed in the Document Register held in the LANA office.

2. The Company

Lana Licensed Planted Forest (LANA) is an industrial tree plantation (ITP) operating under a Sarawak government licence (LPF/0006) issued to Samling Reforestation (Bintulu) Sdn Bhd (SRB) – a subsidiary of Syarikat Samling Timber Sdn Bhd (SST). The licence was subsequently transferred to Timor Enterprises Sdn Bhd which is also a member of the Samling Group. By agreement dated 30th September 2007 the area designated for ITP was sub-licenced to SRB. Samling is head-quartered in Miri, the largest city in the north of the State of Sarawak, East Malaysia.

The use of Samling here and throughout this FPMP refers to the timber and wood products division of the Samling Group.

Samling aims to produce an economically sustainable supply of logs from the LANA ITP which when combined with logs from their other ITP areas and from their natural forest licence areas will support its downstream wood processing activities – plywood, sawn timber, fibre board and furniture components

Samling is an equal opportunity employer that operates an active safety and health management system. Additionally, Samling also recognises the value of and the importance of its environmental and social responsibilities.

3. Malaysian Timber Certification Scheme (MTCS)

3.1 Our Commitment

Samling is committed to develop and conform to the principle of sustainability on all forested land and potentially forested land held under LPF/0006 and, in so doing, to comply with the Malaysian Criteria & Indicators of the Malaysian Timber Certification Scheme (MTCS) - the MC&I SFM – operated by the Malaysian Timber Certification Council (MTCC). It is intended that the ethos of MTCS compliance should be embedded in LANA's management culture for the whole LPF and not just the area proposed for certification under the MTCS.

NB Use of 'MTCS area' throughout this FPMP serves only to identify the area which at the time of preparing the plan was *proposed* for certification under the MTCS. Its use should not be taken as implying that the area was certified at the time of preparation.

Certification of forest plantation management - and therefore of the plantation logs produced for in-house processing – is very important to the future of Samling. It creates potential marketing and economic advantages for its wood-based products and, more importantly, it will help ensure that management of its resources is carried out under MTCS principles thereby helping to ensure sustainability.

3.2 Certification Requirements

The MTCS requires:

1] Practicing the guidelines and requirements set out by the ten principles of the MTCS.

2] Developing a sound policy base derived from the ten principles and ensuring they are communicated and followed in the workplace.

3] Developing open lines of communication involving employees and stakeholders in the development of economically sustainable forest plantation management practices.

4] Using best practice guidelines in its management regimes. This includes the implementation and continues use of sound, proven and economically viable forest plantation management, environmental, financial and social practices that protect the sustainability of the resources.

3.3 Certification Status

At the time of preparing this FPMP LANA LPF was not yet certified under any certification scheme.

The intention is to certify those areas which are eligible under MTCS.

SIRIM conducted the MTCS Stage 1 audit on 2-3 August 2016 following which SIRIM gave approval to go through to the Stage 2 audit which is scheduled for 16-20 January 2017.

3.4 Area Eligible for Certification under MTCS

Under MTCS only those areas of degraded and residual forest cleared on or before 31 December 2010 are eligible for certification.

Section 5.2 and Table 5.1 refer to the determination of the area eligible.

4. Forest Plantation Management

4.1 Statutory Framework

In the main the most recent legislation that effects ITP and environmental management is contained within the Forest (Planted Forests) Rules, 1997 and the Natural Resources and Environment Ordinance, 1993 (Cap. 84).

The outcomes should always adhere to the principle of sustainable ITP management and are controlled in companies such as Samling by the use of these documents as resource consents. These two pieces of legislation therefore act as a method of controlling adverse management effects.

Other are numerous other Acts and Regulations that form the basis of forest plantation management practices at LANA. These are all listed in the document register held in the LANA office.

SST's legal department will advise LANA of relevant changes in existing legislation and of new legislation as appropriate.

LANA keeps "hard" copies of legislation key to its business and management practices on site in the LANA office and at the Miri HQ. In some cases the legislation is held in PDF format where hard copies are not available. However, amendments to legislation are relatively frequent and there is access to up-to-date acts of parliament through the internet. (Full copies of these acts of parliament may be found at www.agc.gov,my and *www.federalgazette.agc.gov.my*.)

4.2 Forest Plantation Management Objectives

The forest management objective is the **economic production of logs for supply to Samling downstream**. This supply is primarily for solid use, i.e., peeler logs and saw logs. However, in achieving this primary objective there are several important supplementary objectives. These are listed below, not in any order of priority:

- maintain the ecological productivity of the ITP – thereby assist to maintain the value of the forest services.
- ensure a sustainable level of log production at the group level.
- conduct forestry operations in a manner that does not impact negatively on the wellbeing of those people living within and nearby the LPF
- safeguard the environment of the LPF - thereby assist to maintain the value of the forest services.
- when harvesting commences to minimise harvest waste

4.3 Forest Plantation Management Strategy

SRB uses the MTCS principles and criteria to formulate the management strategy in order for LANA to achieve the objectives set out above.

As the history of the LPF described in Chapter 5 indicates and as is noted in the EIA, the area has a long history of repeated harvesting. The ITP is established in clearly defined areas of this degraded residual forest.

Special Management Zones (SMZ) have been, and continue to be, identified (see Section 4.4). The SMZs invariably contain residual forest which, as it is protected within the SMZ, has a protective function and contributes to conservation values and the enhancement of bio-diversity. The area under SMZs represents 25% of the total forested area of the MTCS area (Table 5.1).

SRB also recognises the importance and significance of international agreements in its management. It will give governing authorities as much cooperation as possible to enforce the regulations of such agreements.

4.4 Special Management Zones (SMZs) Lana MTCS Area

4.4.1 Zone types occurring in LANA MTCS Area

SMZs are generally, but not necessarily, those areas of harvested and now degraded residual forest which do not form a part of the ITP planted area for reasons other than being designated as SA (shifting agriculture) or under land claim. R&D areas, although under special management, are within the ITP management area. Within Sarawak there are a number of possible zone types but only those listed in Table 4.1 below have been identified as occurring within LANA to date. The burial sites mentioned in the EIA are outside the MTCS area as is the only known salt lick.

Table 4.1: Special Management Zones (SMZs) occurring within LANA MTCS Area

Zone Types
Riparian buffer - mandatory; to EIA prescribed widths determined by the water course width
Swampy (mineral soil)
Rocky (skeletal soils)
Steep areas $\geq 35^{o}$ – mandatory; upper slopes (i.e., outside riparian buffers)
Gulley - steep riverside areas outside the mandatory buffer zone
Conservation – including areas which might be voluntarily designated as such, or which would otherwise have been planted

A zone type may be mandatory, e.g., a riparian buffer zone must be established along permanent water courses – see Table 4.2 – and steep areas in excess of 35^{o} must not be cleared for planting. Elective zone types are those where, for example, at the manager's discretion a wildlife corridor has been demarcated on otherwise plantable land. This would be classed as a conservation area. In reality all the above SMZs are effectively conservation areas and are totally protected from encroachment. And there are 'Hobson's choice' zone types where the physical characteristics of the site preclude the option of planting, e.g., marshland and skeletal soils.

Table 4.2: Recommended Widths for Riparian Buffer Zone

Width of Water Course (m)	Width of Buffer Zone (m)
>40	50
20 - 40	40
10 - 20	20
5 - 10	10
<5	5

Source: Table 4. LANA EIA Jan 2003, Ecosol Consultancy Sdn Bhd

The types are not mutually exclusive: e.g., a riparian buffer may contain marshland and steep areas. By virtue of being demarcated on the ground, GPSd and mapped and then protected from most human activity, SMZs, of whatever type, play a significant role in the conservation of LANA's bio-diversity.

4.4.2 Management of SMZs

The guiding management principles are common to all SMZs that are currently identified in LANA regardless of whether or not they fall within the MTCS area.

The zones are first identified and then demarcated on the ground. Although they must still be demarcated, the boundaries of steep areas, skeletal soils and marshland are more or less self-defining whilst the boundaries of riparian buffers must be carefully located to ensure compliance. Once clearly demarcated on the ground all SMZs are protected and, apart from the removal of any planted merchantable exotic trees and access by local people for traditional purposes (and such use is negligible). There should be no invasive human activity within them. However, incursion can and does take place but most in cases management does not have the authority to take any action other than to make an official report to the relevant government agency.

Following demarcation and the removal of any merchantable exotic trees, no further invasive action in these SMZs is allowed. This protection will allow the SMZs to develop in structure and bio-diversity.

Table 5.1 in the following chapter shows the distribution of SMZ types. The major SMZ type is that of the conservation areas - in the MTCS area these were formerly called green belts (and in the balance of the LPF still are) which cover 2,156ha; this is just over 90% of the totally protected forested area and 23% of the gross MTCS area.

5. Resource Description

5.1 History

This history more or less refers only to the area now known as Lana LPF. Map 5.1 (Click here to access Map 5.1) shows the present boundaries of the LPF.

5.1.1 Forest Timber Licences

An area that included what is now LPF/0006 was licenced as Forest Timber Licence T/0570. This was issued on 11 July 1977 to Unitek Forest Products Sdn Bhd for 25 years expiring on 10 July 2002. T/0570 was replaced by T/3077 issued to Bena Lumber Sdn Bhd on 26 May 1981 with the same expiry date. T/3077 was then replaced by T/3173 issued to Sertama Sdn Bhd [a member of the Samling Group] on16 April 1987. Under T/3173 the cutting cycle was reduced to 20 years and the licence therefore expired 10 years after issue on 15 April 1997. The licence was then renewed to 15 April 2012 and again until 15 April 2017 but at this last renewal with the area of LPF/0006 specifically excluded.

5.1.2 Past Harvesting

Sometime between the 1920s and the1940's the Borneo Company undertook limited harvesting in parts of what was to become LPF/0006 when they used elephants, and probably tractors, for extraction. In the mid-1970s an extensive system of hand prepared contour skid trails for use by the elephants was still in evidence, although the elephants had long ago moved on (and died).

In the late 1960s an area known as Industrial Unit 1 was demarcated, mapped and inventoried as part of a Sarawak wide FAO project. From Table 2 of the Rajang –Kakus Management Plan it can be seen that less than 10% of the forest area was classed as remnant MDF. Under the FTL conditions the minimum tree size was 18 inches [45cm] OB RD. It was mandatory to fell any tree of minimum size or larger of a species listed as obligatory that would yield one or more merchantable logs. Any tree that was not a protected species and was not listed as an obligatory species could be harvested irrespective of its diameter. T/0570 was replaced by T/3077 issued to Bena Lumber Sdn Bhd on 26 May 1981 with the same expiry date. By this time the Pelagus HEP scheme had been proposed with an expected completion date

of sometime in 1990. No diameter limit was to apply for the areas planned for inundation (which were not defined).

Elsewhere the conditions applying to T/0570 were to apply, i.e., protected species were not to be felled, minimum 45cm RD for obligatory species and no limit for all other species.

When T/3173 (replacing T/3077) was issued to Sertama Sdn Bhd in April 1987 Harbour-View Realty continued to harvest Coupes 4B, 5B, 6B, 7B and 8B and further, some 10,000ha of "… mainly logged over forest in the southwest…" were included in the area of the new licence.

Under the general timber licence (FTL) conditions trees of non-dipterocarp species of 45+cm RD OB and dipterocarps of 60+cm RD OB that will yield one or more merchantable logs must harvested or a penalty will be imposed. (In T/3173 the minimum RD for all obligatory species was 45cm OB.) Anything from 25 to 100 m3/ha of merchantable logs might be removed in the harvest operation. There is inevitably some degree of damage to the remaining trees and saplings. The actual degree of damage is more or less proportional to the volume removed. Thus, the structure of post-harvesting forest will rarely if ever approximate that of the undisturbed 'natural forest' or the 'native ecosystem' or to use the more common term, the 'primary forest'. If the area has been subject to more than once cycle of harvesting in past few decades, then its structure and diversity will be further compromised.

5.1.3 Conversion of primary forest

As has been noted in the preceding section the natural forest within the LPF has been subjected to repeated heavy logging for almost forty years to the extent that no primary forest was known to remain at the time the LPF licence was issued – 1998. This means that no primary forest has been converted to ITP within the LPF area. Furthermore, no primary forest remains for conversion.

5.2 Determination of the Area Eligible for Certification under MTCS

5.2.1 LANA LPF not eligible in its entirety

Consequent of the changes required by PEFC's endorsement of the recent revision of the MC&I Forest Plantation under which the MTCS operates LANA LPF is no longer eligible for certification in its entirety. This has led to a very unsatisfactory situation whereby Samling must ensure that it secures the largest possible area for certification but in doing so this inevitably meant that the MTCS area is geographically fragmented. NB The MC&I SFM is not a stand-alone document but must be interpreted with the MTCC's guidelines to hand. These guidelines are known as GD-FP 2/2016.

5.2.2 The Eligible Area

The area recorded as cleared and potentially plantable is 6,442ha. This area and the SMZ areas together comprise the MTCS area the location of which is shown on Map 5.3 (Click here to access Map 5.3).

5.3 Geology and Soils

Reference should be made to the EIA which gives a very concise overview of the geology of the LPF. It also gives a quite detailed, useful summary of the soils although these have only been documented at reconnaissance level.

5.4 Land Use

LPF/0006 was issued on 8th December 1998 for a period of 60 years. LPF/0006 is located in the Belaga District of the Kapit Division. (See Map 5.1) The area designated for MTCS lies entirely within LPF/0006 (See Map 5.2). A statement of land types and land use for the MTCS area is given in Table 5.1. The whole MTCS area represents less than 12% of the gross LPF area, however the conservation area of the MTCS area represents almost 16% of all the greenbelt/conservation area in LPF/0006.

Table 5.1 Area Statement for MTCS Area within LANA (LPF/0006) at July 2016

Rev 18-Jul-16

Gross Area (ha)	Non-Productive[5] Area											ITP Productive Area			
	Non-Forested Areas					SMZ Totally Protected Forested Area					Total				
	SA	Water	Road line	Other[1]	Total	Conser-vation	Buffer Zone	Gully	Steep	Total		Planted[2]	Plantable[3]	Poten-tial[4]	Total
9,393	0	0	135	445	580	2,156	64	42	109	2,370	2,950	4,673	72	1,697	6,442
9,393	***0***	***0***	***135***	***445***	***580***	***2,156***	***64***	***42***	***109***	***2,370***	***2,950***	***4,673***	***72***	***1,697***	***6,442***
% Distribution - MTCS Area	0%	0%	1%	5%	6%	23%	1%	0%	1%	25%	31%	50%	1%	18%	69%
% Distribution - Non-productive[5] & ITP Areas	0%	0%	5%	15%	20%	73%	2%	1%	4%	80%	100%	73%	1%	26%	100%

Sources: LPF Licence *Layer used : l06_eligible_mtcs_area_p_utm49n_union3;* Excel file: LANA FPMP Tabs 5.1 & 5.2

1) Rocky, swamp

2)See note in Chapter 5 re discrepancy between this figure & that in Table 5.2

3) Cleared under PEC Op. 5 on or before 31 December 2010; assessed as plantable but still not recorded as planted at map record date.

4) Cleared under PEC Op. 5 on or before 31 December 2010 but status & capability not yet confirmed by ground survey.

5) Non-productive as in not producing industrial timber.

5.5 Industrial Tree Plantation (ITP) Resource in the MTCS

Table 5.2 shows the major species and year of planting **(**YOP) for the MTCS ITP resource at 9th September 2016 as extracted from the Block Master at that date. There are two important points to note regarding Table 5.2:

1: There is a less than 10% discrepancy between the area shown as planted in Table 5.2 and that stated in Table 5.1. This is because the areas in Table 5.1 are derived directly from the GIS system whereas those in Table 5.2 are summations of the individual block areas listed in the block master. Whilst in theory these totals should be more or less identical, they are not because the block master is in the process of being updated as block areas are revised following re-GPS. New GPS data are reflected more or less straight away in the GIS system but there is no link to the block master which must therefore be manually revised. This gives rise to the discrepancy – which should more or less disappear over time.

2. A significant area was planted *after* 31st December 2010 on land cleared *before* 31st December 2010 i.e., on degraded residual forest cleared *before* the cut-off date. An area of cleared residual forest still remains unplanted. Ground survey is required to identify the actual plantable area, following which it will be decided whether or not it is practicable to plant now or to wait until harvesting starts in the nearby area.

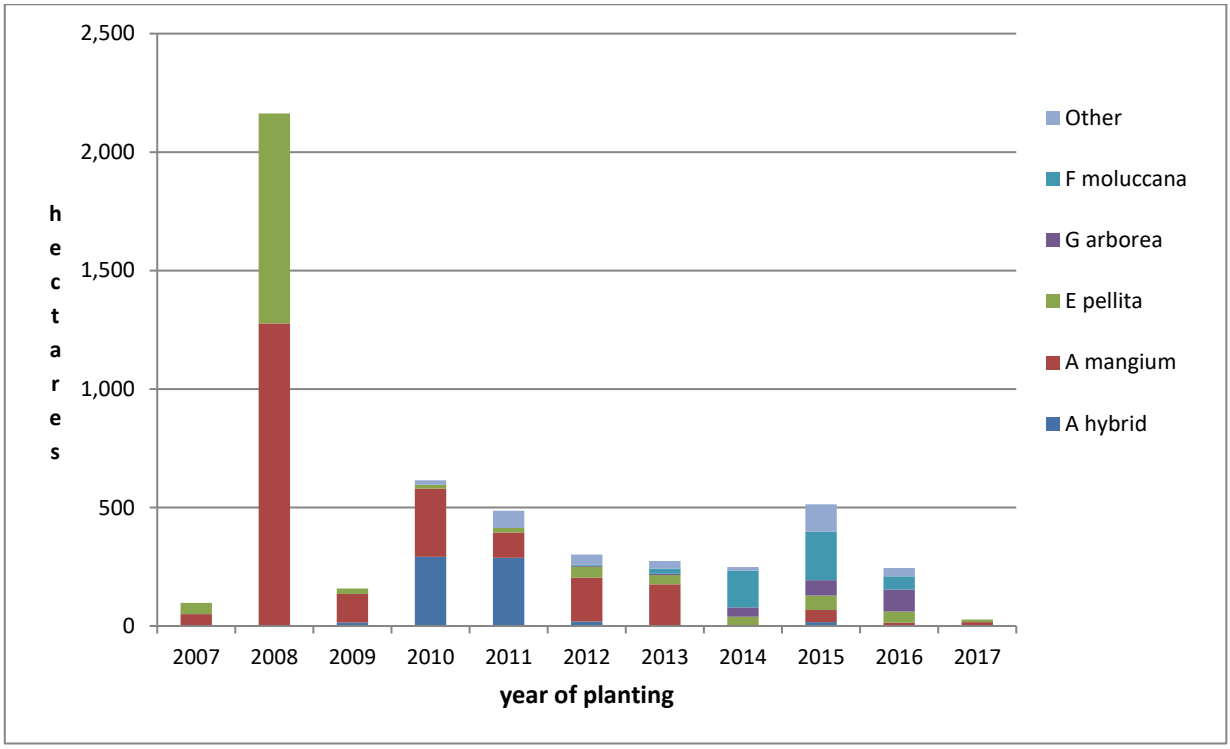
Two species, mangium and pellita, comprise almost 70% of the planted area with *Acacia* hybrid contributing a further 12%. Falcata is included as it is an increasingly important component of the species diversity in LANA as well as in other Samling LPFs.

Table 5.2: Species and Year of Planting for LANA MTCS Area at 9th September 2016

Species	Year of Planting (year runs July to June) on areas cleared on or before 31st December 2010 (hectares)											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	All
A. hybrid			14.9	292	287.4	18.8			17.1			630.2
A .mangium	50.8	1,277.20	120.8	288.1	107.1	185.8	175.3		50.1	14.4	16.7	2,286.30
E. pellita	46.2	885.3	22.7	16	18.6	45	39.6	39.1	61.5	47.1	10	1,231.10
G. arborea						5.3	4.9	39.1	64.7	93.1		207.1
F. moluccana						3.9	22.6	155.2	205.2	54.4		441.3
Other				19.5	73.9	42.9	31.5	15.8	114.6	36.1		334.3
All	97	2,162.50	158.4	615.6	487	301.7	273.9	249.2	513.2	245.1	26.7	5,130.30

Source: Lana BM September 2016; file: LANA FPMP Tabs 5.1, 5.2 & 5.3

Figure 5.1: Age Class Distribution for the Major Species - LANA (LPF/0006) 9 September 2016



Source: LANA Block master. Excel file: LANA FPMP Tabs 5.1, 5.2 & 5.3.

Figure 5.1 clearly shows the highly skewed distribution of the age classes. With a weighted average rotation age of 8.9 years the annual area that would be harvested on a normalised forest would be about 580ha. The harvesting plan will take this into account, together with Segan's experience that mangium goes into decline at about twelve years old, when determining the annual cut. The annual cut from the MTCS area alone might not be sustainable but that of the whole LPF certainly will be. When considering sustainability, it should be kept in mind that Samling's downstream will eventually be supported by several of their own ITPs. It is therefore the total log flow that must be sustainable and not necessarily that of an individual LPF.

6. Environmental Considerations

6.1 Environmental Limitations

There are few environmental limitations for ITP in the LPF area. Similarly, so for the MTCS area where the main limitation is the broken terrain with short, steep slopes on relatively fragile soils leading to a potential for increased erosion. A further limitation is that the combination of high rainfall and broken terrain gives rise to intricate networks of small streams. There are thus numerous water courses that must be buffered with protective strips of residual natural forest or unplanted land of widths determined by the prescription set out in the EIA and shown in Table 4.2.

The average annual rainfall recorded over almost 8 years at LANA nursery is 4,426mm. It has ranged from 3,966mm (2012) to 4,986 (2011) and has averaged 19 rain days a month and 233 days a year. Any given month in the year might be either the driest or the wettest in that year. The driest (84mm - March) and wettest (795 mm - January) were both recorded in 2014. This relatively high annual rainfall with frequent rain days and no truly distinct season impacts heavily on the efficient use of both labour and equipment and thus on operational costs.

The high level and frequency of the rainfall and steep terrain makes access to some areas difficult, and even impossible at times, especially during the wetter season (November to March inclusive) when ungravelled roads can quickly become slippery and temporarily unusable. Because of this it is not realistic to plan for reliable harvesting and transporting on a year-round basis. To ensure a regular log supply log stocks will have to be built up at an all-weather depot, or at the mills, before the onset of the wetter season.

Harvesting will be predominantly by shovel yarder with shovel extraction close to the roads. This combination makes for reasonably efficient extraction in the broken terrain whilst minimising the environmental impact, especially soil disturbance that can lead both to compaction and to increased erosion. Ground skidding will used in the few areas where the access and topography restrict the efficient use of shovel yarding and shovel extraction but must be kept to the absolute minimum to avoid serious site damage and compromising the growth of the next crop.

6.2 The Environmental Management Plan (EMP)

The EMP (DOC015) is a stand-alone document to which reference should be made for details. Elements of the EMP are referred to in various sections of this FPMP. Some of the essential points regarding environmental impact mitigation measures are restated in Section 6.3.

6.3 Environmental Impact Mitigation

6.3.1 Soil erosion

Mechanised operations in areas of steep slopes and high rainfall inevitably give rise to increased soil erosion. This is kept to a minimum firstly by using the most appropriate harvesting systems. Secondly, where new roads must be constructed, by ensuring good road alignment and by construction that conforms to the FDS standards – which is necessary in order to obtain a PHC (Permit to Harvest Coupe). Thirdly, by ensuring that any extensions of spur roads and clearing of new landings to facilitate extraction and loading are kept to the minimum necessary for efficient operation.

Section 10.2 describes the shovel yarder system that is the main extraction method. The use of this system minimises soil erosion and compaction by reducing the need to enter the harvest block with ground-based machinery. Where the terrain allows, operation efficiency requires the use of shovel extraction (excavators with grapples) to extract from roadside strips.

6.3.2 Water quality

Maintenance of water quality is in part achieved by minimising soil erosion (6.3.1) and by keeping fertiliser leaching and herbicide run off to the minimum. Fertiliser use is exceptionally low - less than 70kg/ha. The herbicide load is also low with 4 to 5 litres/ha applied each round. The active ingredient of the main herbicide used is glyphosate which is generally considered to be toxicologically and environmentally more benign than most of the other herbicides currently available.

Water quality is monitored by means of water sampling whereby samples are taken quarterly from sampling points identified by the EIA. These samples are analysed by an external laboratory with the results submitted to NREB and presented within the external consultant's quarterly Environmental Monitoring Report (EMR). Reference to these reports will confirm that, to date, the results have always been within NREB acceptable parameters or in other ways compliant with the standards set in the EIA. (The most recent results appear in the Samling website.)

6.3.3 Riparian buffer zones (also known as river buffer zones) – RBZ

Riparian buffer zones are established in accordance with the EIA recommendation (See the EMP and Table 4.2). The objective is to establish a well-defined strip of land - a buffer - that will help to protect the riverbank and the riverbank eco-system at least for the currency of the LPF. This will reduce soil erosion and thereby reduce the amount of sediment moving into the water courses. Establishing and then protecting riparian buffer zones also maintains, and over the longer term enhances, the biodiversity of the area. There is currently 64 ha of RBZ within the MTCS area. It is expected that this area will increase following re-demarcation prior to the first harvest: this has been the experience in Segan.

6.3.4 Zero burning

There will be a 'zero burn policy' for the preparation of second rotation sites for re-planting after harvesting. This practice has the benefit of reducing air pollution, conserving the organic carbon content of the top soil and improving the overall nutrient status and condition of the soil. (Where the first crop was Acacia, burning for second rotation site preparation usually results in very dense natural regeneration of acacia seedlings. This gives rise to very heavy competition for the planted seedlings.)

6.3.5 Use of chemicals

Apart from the insecticides and fungicides used, unavoidably, in the nursery only herbicides and fertiliser are used in the plantation. As stated in 6.3.2, both are used at low, or very low, rates of application. Chemicals containing organo-phosphates are not used.

6.4 Environmental Safeguards

6.4.1 *Environmental Monitoring Report (EMR*)

Ecosol Consultancy Sdn Bhd is contracted to monitor and review LANA's compliance with the recommendations set out in the EIA. The results of their findings are presented in Environmental Monitoring Reports (EMR) which are produced four times a year: January to March, April to June, July to September and October to December.

6.4.2 *Use of chemicals*

As stated in 6.3.5 chemicals are used in both in the nursery and in the blocks (only herbicides) but at very low rates of application.

LANA acknowledges that under current best practice, applications of herbicides are necessary to ensure an acceptable survival rate as well as prevent increment loss through the competitive effects of weeds. The ERP (Enterprise Resource Planning) system records the type and quantity of chemicals used in forest operations and the rate of application is recorded on a block-by-block basis with the results reported monthly in the Block Consumption Report.

However, LANA will always actively seek management practices that reduce the amount of chemical entering the environment of its LPF. This is of benefit not only to the environment but also to SRB as chemicals are expensive to procure and apply. Reducing these activities would have a substantial financial as well as environmental benefit to LANA.

Training also provides best practice guidelines and protocols for the proper use of chemicals in terms of human and environmental safety and economic application and for the safe disposal of the containers in which chemicals were supplied.

6.4.3 *Water course quality*

As mentioned in 6.3.2 under the LPF licence conditions LANA is required to monitor water quality of the LPF's water courses. This is done four times a year with analysis undertaken by an independent laboratory and the results reported in the EMR.

6.4.4 Monitoring exotic plant introductions

LANA's management is aware of the potential problems that might arise from the introduction of exotic species. However, no exotic species grown by SRB has been identified as an invasive plant pest by any Sarawak government agency. Furthermore, only four exotic genera (*Acacia, Eucalyptus, Gmelina* and *Falcataria* (syn. *Paraserianthes*) are currently planted commercially (as opposed to trialled). All four are known to regenerate naturally, to a greater or lesser degree, under LANA's conditions but this is not considered to be an adverse environmental impact.

To date no exotic species is known to have invaded areas outside either the LPF or the MTCS area. Mangium is a pioneering, short lived light demander and is only known to regenerate in open areas, e.g. burnt over SA. In the hill padi cropping cycle areas of SA regeneration of mangium might be considered as beneficial because it both protects and, as a nitrogen fixer, improves the soil. As the local demand for mangium logs increases this might also create economic opportunities for LANA's communities. If the Samarakan pulp mill should ever eventuate this could improve local opportunities even more as the local communities might be able to participate in supplying chip logs. (This is the case for those living near the Sipitang pulp mill and in the Hijauan Benkoka/Acacia Forest Industries area – both which are in Sabah.) Even in the event that they should germinate then pellita seedlings will find it difficult to compete with the strong weed competition. Gmelina, whilst it does regenerate naturally in Sarawak, is not known anywhere to be invasive. Falcata (batai), although a pioneer light demander, has not been known to be invasive under Sarawak's conditions.

Monitoring is by observation.

6.5 Conservation of Bio-diversity

This has been briefly referred to in Section 4.4. Conservation of the bio-diversity as represented by the gene pools of LANA's flora and fauna and of the ecosystems in which they are found is very much dependent on the residual natural forest in the riparian buffer zones and the conservation areas which together represent more than 23% of the gross area of the MTCS area. There will be, as yet unidentified, contributions to bio-diversity from the *planted* forest areas. Indeed, even the areas of SA in their various stages have a part to play in contributing to the overall bio-diversity of an area.

As stated in the EIA report and mentioned in Chapter 5 harvesting in the residual natural forest has been very wide spread and at varying degrees of intensity for several decades. No natural forest type has been identified within LANA LPF that is not also widely represented elsewhere within Sarawak. As already mentioned, the residual or remnant forest falls into several mapping units which together are termed Special Management Zones (SMZ) – see Table 4.1 - all of which are protected to the extent that the LPF management's authority.

When harvesting starts sometime in 2017 the process of re-demarcating SMZ areas on the ground and their subsequent GPS tracking will be carried out with far greater diligence than was the case in the early years of clearing and establishing the planted areas of the LPF. This in part due to the wide spread availability of GPS devices – some of the original blocks were established using chain and compass. As is the case in SEGAN LPF, as harvesting proceeds through the MTCS area the re-survey of the coupes and blocks will result in a small increase in the area of RBZs & possibly of other SMZ types.

As stated in Section 4.2.2 the SMZs are protected areas. This protection should ensure that the current level of bio-diversity does not diminish; indeed over time the diversity of the flora should increase with the arboreal component developing in terms of DBH and height (i.e. structure) with the species composition becoming, albeit very slowly, more diverse (see 6.6 Residual Forest). The LANA plantation maps show that the SMZs are widely distributed throughout both the LPF and the MTCS area. Currently they represent more than 25% of the MTCS area - (Table 5.2). It is expected that this percentage will increase a little over time as the pre- and post-harvest GPS surveys better define the land categories.

6.6 Residual Natural Forest

6.6.1 Background

The history of the LPF referred to in Section 5.1 clearly shows that the original MDF was subjected to very heavy harvesting in the past. This means that the residual, or remnant, MDF forest is very much secondary in physical structure and in terms of genetic diversity its flora is probably somewhat changed. However, as no study was undertaken prior to harvesting the natural forest to establish baselines, the original diversity levels of both the flora and of the fauna of the no longer extant primary forest type(s) remain unknown. It is now a question of protecting those areas of residual forest that have been designated as SMZs. Continued protection should, over many decades, allow the forest to recover in terms of structure: i.e., only time will allow the full expression of those species that are genetically pre-disposed to grow to a large size. Similarly, over time genetic diversity might increase – slowly – as species that might have disappeared are recruited back into the SMZs by various means of seed dispersal.

7. Socio-Economic Context

7.1 Contribution by Current and Future Forest Operations

The net plantable and potentially plantable area of the MTCS area is less than 6,500ha. This is almost negligible when viewed against the state's previous planting target of one million hectares or even against the area currently planted state wide. However, small as this area might appear the LANA resource is important to Samling and to the District's economy. All the log production will go to Samling's own downstream operations: peeler logs for Samling's plywood mills and saw logs and chip logs for Samling's Grand Paragon Sdn. Bhd in Bintulu. The sawn timber will be further processed by Samling Housing Products Sdn Bhd (located at Kuala Baram). Grand Paragon now has a dedicated small-log sawmill adjacent to the fibre board mill. Chip logs and residues from processing plantation logs by both the sawmill and the plymill are used by Grand Paragon for the manufacture of fibre board. The fibre board is further processed in-house into door skins - primarily for export. Thus, the entire log production from LANA ITP will be utilised locally, i.e., primarily within the Bintulu District.

Harvesting of mangium is planned to start in 2017. Given the very skewed age class distribution (Figure 5.1) and the fact that mangium can start to show negative increment at around 12 years old it will not be possible to generate a sustainable yield from the MTCS area alone. However, when combined with the LPF it should be possible to aim for a more normal forest plantation structure thus ensuring greater stability of production and thus of employment opportunities.

Maintaining a sustainable flow of logs suitable for Samling's solid wood downstream requirements is a key management objective of SST. The MTCS area and the balance of the LPF must both play their parts in achieving this.

The determination of the annual cut is based on:

- areas of mangium in the MTCS area that will be over age and have a low or negative increment; and
- the need to start the normalisation process for the LPF.

Whilst Samling has a mangium yield table for Segan that incorporates the PSP data from plots approaching 14 years old this is not applicable to Lana where the growth rates are lower. The yield table for Lana includes PSP data up to and including Age Class 7 but for Age Classes 5, 6 and 7 the data inputs are still weak. There are no PSPs in Age Class 8 and above.

Based on a long term, sustainable cut objective, the AAC must be reviewed on an annual basis. The objective is to ensure a sustainable harvest volume from the whole LPF whilst trying to limit the losses that arise from the increased mortality associated with over-age mangium in the MTCS.

7.2 Employment and Services

At 31 September 2016 LANA employed 17 full time staff at supervisor level and above, one of whom is an expatriate. A further 29 Sarawakians are employed in administration, R&D, nursery and operations

with the balance comprising 75 Indonesians on two-year contracts. The competition for local workers from offshore oil and gas employment and the oil palm industry (both own planting and estates) is strong. However, almost 100% of the LANA's Sarawakian work force can be considered as 'local', e.g., from Punan Bah and other long houses not too far away.

The contractors provide further employment but as with in-house workers, their workers are predominantly Indonesian.

LANA is an equal opportunity employer: of the Sarawakian work force 30 are male and 15 are female.

The establishment and maintenance work in LANA is done using in-house workers and contractors. The greater part of the logistical support is supplied locally from Bintulu, e.g., engineering, spares, and supplies.

7.3 Adjacent Land

The planted area of MTCS area and that of the balance of the LPF were established primarily on much degraded residual forest land. Most of the land adjacent to these areas has a similar history. About 14km of the MTCS area boundary to the north is shared with LPF/0012 (operated by Pusaka KTS). Then, apart from a very short distance in the south-east where the MTCS boundary is common with Samling's Sertama timber licence (T/3173) the remainder of the MTCS area boundaries fall within the LANA LPF.

No one is actually full-time resident within the MTCS area although a few locals have built *langkaus* along the road at the western edge of Coupe 17. There are no neighbouring or nearby suburban or residential developments which require the consideration of aesthetic values and additional safety considerations during forest operations. Belaga, the nearest township, lies at the confluence of the Balui and Belaga rivers and is some 30km upriver from the eastern edge of the LPF.

7.4 The Value of Forest Services

The following extract from Section 3.5 of the HCV Assessment gives a clear picture of the lack of demand for forest services *"…The practise of hunting and fishing activities are done during free time and seasonal. This is due to the adaption to a modern lifestyle as most of them are working, both in private and government agencies…The two most visited areas for collection of jungle produces are the shifting agriculture area and Bah-Sam Forest area, which are very far from Lana FMC* [LPF]… *for own use only…Reliance on timber products for building materials is very minimal as most of the locals shift to build up modern, concrete houses…….those .. using planks …usually get them from…Bah-Sama Forest Reserve…The locals usually go to the nearest shifting agriculture area, oil palm plantation and Bah-Sama FR to hunt…they usually fish in Sg Bah and Btg Rajang…"* The Assessment concludes: *"…As far as the Lana FMC [LPF] is concerned none of the area is fundamental in meeting basic needs of the locals…"*

Clearly there is little need, and hence little current demand, for forest services in the form of products such as fish, wild meat, honey, boat and house building materials, rattan etc. in the whole LPF in general and in the generally more remote MTCS area in particular.

In the EIA assessment undertaken 13 years ago it was noted that "… *a significant number of residents, especially the younger and more able-bodied people, have left the settlements and are now working elsewhere.*

As an ever-increasing percentage of the population becomes wage earners and entrepreneurs either locally - especially in Samling's ITP and oil palm plantations - or more probably, after migrating to urban centres, demand for these services will continue to fall.

8. Establishment and Silvicultural Systems

8.1 General

Planting started in LANA LPF in 2006/2007, mainly with mangium. The establishment regime for mangium is well known but the most appropriate silvicultural regime required for solid wood products, as opposed

to chip logs, has yet to be proven. There is little information available in terms of the methodologies and economics of such practice from either the private sector or government agencies[1].

Samling's Segan is a leader in developing the management practices required to satisfy the objective of producing logs for solid wood use. (The SPF objective is to produce chip wood - for a pulp mill that has yet to be built near Samarakan.)

The Sarawak Timber Association (STA) has a Plantation Committee on which SST is represented. This committee is charged primarily with representing the industry in meetings with government to discuss, improve and resolve technical and common management issues. It also provides a valuable forum for discussion and exchange of ideas and practices. STA also organises overseas study tours that present a useful opportunity to learn from longer established ITP based industries. Late in 2012 a tour was made in Sabah and in 2013 a study tour visited New Zealand. A study tour of the growing and utilisation of eucalyptus in Guangxi, China, was undertaken in 2015. In the past, apart from the STA plantation committee meetings, there was only limited interaction between ITP companies in Sarawak although SST was proactive in trying to widen the interaction in order to observe, discuss and exchange ideas on forest plantation management practices. This situation changed somewhat in 20015/16 with SFC taking a leading role in R&D with members of the industry as active participants in joint R&D trials. The results of these trials will be shared between participating members.

8.2 Choice of Species

8.2.1 Background

When Samling started planting in Segan in 2000 the management objective was to produce only chip wood. This objective was revised 3-4 years later to the current Samling objective. At that time mangium was the species of choice throughout Malaysia. The perceived wisdom at the time was that mangium would *'grow well - anywhere'*. Time has clearly shown that this is not correct. Mangium has also not performed very well in LANA to date and is well below the forecasts made prior to start-up of the LPF.

Mangium suffers from high early mortality. This is in great part due to a high susceptibility to root rots (*Ganoderma* spp.) which experience elsewhere indicates increases in severity with each succeeding rotation. Whilst *Ceratocystis* is undoubtedly potentially a very serious problem it cannot yet be considered to be serious in LANA.

The early promise of *Acacia* hybrid has not yet been realised. Whilst the form and branching habit is quite good the growth and survival (susceptibility to pink disease) are generally not. The MAI of both Year Class 4 and 5 was below 10m3/ha. The PAI was a little higher but not sufficiently high to lift the MAI to an acceptable level. Clones 1 to 14 of the 28 Acacia hybrid clones brought in as tissue culture material from Sabah in 2012 were planted in LANA. Not one of the fourteen clones planted is performing well and the form is generally very poor. (Not one of clones 15 to 28 planted in Segan has performed well.)

The initial dependence on a single species is recognised by Samling - and by much of the ITP industry in Sarawak - as a flawed policy and R & D's search for alternative species continues with a recently increased momentum. R&D's aim is to achieve a degree of species diversity that will help mitigate the risk from pest and disease attack whilst still meeting the objective of economically producing peeler logs of acceptable size and quality.

However, other than *Acacia mangium*, *Eucalyptus pellita, Falcataria moluccana, Gmelina arborea* and perhaps *A. crassicarpa*, not one of the more than 90 or so species trialled (both native and exotic, see Appendix 1) by Samling to date has shown any promise for use in solid wood ITP.

[1] "The Establishment & Management of *Acacia mangium* for solid wood products." by Boden, D. and Molony, K. (August 2015) was commissioned by SFC. It contains little factual information that is applicable to Sarawak regarding growing mangium for solid wood use. The authors conclude that growing mangium for this use cannot be recommended at present!

8.2.2 Site species matching

There will no doubt be subtleties provided by differing chemical characteristics of the various series and compound associations of the mineral soils but Samling's recognition of any such subtleties and the ability to make use of them is some way off. There are two main soil mapping units in the MTCS area - and six within the LPF. The Merit and Kapit series dominate the LPF and the MTCS area but the compound association (i.e., a mix of two or more soil series) that form the soil mapping units are all capable of supporting ITP species.

Over time the planted species diversity might better reflect the diversity of planting sites available. But any successful increase in species diversity will require: a] a wider range of economic species than has currently been identified; and, b] a much greater knowledge of both the soils and of the requirements of the economic species that might be best suited to them. Soil maps are available from reconnaissance level surveys at a scale of 1:250,000. The EIA makes reference to soil maps at 1:50,000.

8.2.3 Planting of native species

The Sarawak Forest Department has long extolled kelampayan (*Neolamarckia cadamba*) as an ITP species. Without doubt the form, growth rate and peeling qualities of this are all very positive attributes of this species. However, in Sarawak to date there is insufficient knowledge of seed sources and related genetics, nursery practice through to ITP silviculture for this species. There has been at least one relatively large-scale failure; success in Sarawak at an operational ITP level seems to be unknown - to Samling at least. However, it is still planted in LANA as is the related *N. macrophylla,* on selected sites.

Pterygota alata was introduced in 2011 and from the outset suffered badly in SEGAN from an insect defoliator. In LANA a few individuals performed well but the good early day performance shown generally failed to follow through. Similarly, with *Alstonia macrophylla* where the good early day performance was not sustained. In 2013 *Endospermum malaccense* and *Dyera costulata* were brought in as tissue culture ramets but did not progress beyond the Segan nursery.

Durian has been planted but not in a formal trial. It scores well for form and for peeling and sawing timber properties. It is said by some fruit growers to grow '*quite quickly'* and it could be reasonably P&D resistant.

In Chapter 9, Plantations, in '*A Review of Dipterocarps'*[2], Weinland restates a conclusion drawn by Kollert *et al* (1994) "…The establishment and management of [dipterocarp] plantations are uneconomical on financial terms alone.'' This conclusion was drawn more than 20 years go. With the changes that have occurred since, particularly in wood processing technology, the possibility that one or more of the dipterocarps, e.g., *S. parvifolia,* might prove to be an economic plantation species is recognised by Samling. There is however more than 100 years of literature on the subject of dipterocarps as plantation species and a review is required before addressing the problem of sourcing seed and then moving to trials can be considered.

Samling has spent much time and money on trials of native species. However, at the present time neither Samling nor - so it would appear - any other company in Sarawak has accessed sufficient and reliable information on the use of Sarawak native species in ITP to implement any other choice of species scenario than that described here.

8.2.4 Utilisation of species selected – end uses

Table 8.1 shows the end uses for the species that will be harvested during the currency of this FPMP. Also shown are the possible end uses for the two species which have recently become operational species. Gmelina has already been subject to downstream peeling trials and was satisfactory. It is known to be a versatile species for processing and is a medium quality sawn timber. Falcata is well known in Java as a

[2] Eds. Appanah, S & Turnbull, J. M. 1998 CIFOR

peeler species but downstream will need to run tests to confirm acceptability for sawing and use in high density fibreboard.

Table 8.1: End uses of operationally planted species

	Plywood	Sawn timber	HDF/door skins
Long Established			
Mangium	Yes	Yes	Yes
Acacia hybrid	Yes	Yes	Yes
Pellita	Yes	Yes	Yes
Recent			
Gmelina	Yes	Yes	Yes
Falcata	Yes	Yes?	BD (kg/m3) - 270 cf mangium 460 Possibly too light?

8.2.5 BORNEOTEAK®

Acacia mangium is listed as 'Mangium' in Table 8.1. Samling has successfully registered it with the Registry of Malaysian Trademarks under Classes 19 and 31 as BORNEOTEAK®. It is sold under this name to Samling's downstream.

8.3 Current Establishment and Silvicultural Regimes

8.3.1 Acacia mangium

As may be noted in Table 8.1 the intention is to produce logs that will be suitable for peeling and for sawing. The determinant of suitability is primarily small-end diameter – currently >15cm sed - with grading for roundness, straightness and internal defect (centre rot and hollow) undertaken after felling. Logs that are unsuitable for solid wood use will be sent to Samling's HDF mill.

Good Quality Stock

As a matter of course LANA will only plant selected stock with good genetic characteristics with preference given to seedlings from in-house collections of Superbulk seed from elite trees or from the clonal seed orchard which comprises only clones of elite Superbulk trees. (Superbulk is the name given to some of the mangium seed produced by Borneo Tree Seeds Sdn Bhd in which Samling has a holding.)

Site Preparation and Establishment

Before planting takes place, some site preparation is necessary. This usually involves a herbicide application to kill any emergent weeds, particularly natural regeneration of mangium, thereby reducing competition to newly planted seedlings. Labour shortage often results in the time elapsed between completion of harvest and the commencement of site preparation being overly long. This means that prior to spraying the site must be slashed and time allowed for new growth to flush so that spraying can be more effective.

LANA plants 1,110 stems per hectare (3m x 3m) and considers a block to be established when a survival rate of 90% or more is achieved 30 days after passing planting QC.

Maintenance

Conditions are very conducive to vigorous weed growth. Circle weeding, slashing and herbicide spray are all used at a frequency that is determined by the rate of weed growth relative to that of the trees.

Silviculture

The intensive silviculture regime with four pruning lifts is intended to produce trees with a significant volume of "clear wood" in the pruned length. Live knots would be restricted to a small DOS core along

the pruned length. This should reduce the amount of veneer repair required, allow a proportion of face and back veneer to be produced and also improve sawn timber recovery.

The rationale behind pruning 80% of stems to a height of 6.0m is to produce a butt log with a minimum small end diameter (sed) of >15cm that will yield two peeler logs each of 8 ft (2.5m) with an allowance for end splitting. Pruning above 4.5m might prove to be uneconomic but until PSP data on older trees in unthinned blocks are available and more information is produced by downstream both as to their intentions regarding equipment and the likely recovery rate at various log diameters it is difficult to evaluate the economics of pruning.

8.3.2 Eucalyptus species

As originally planned the value of the unthinned eucalyptus resource would be maximised by:

> *aiming to produce a crop that has a stocking of 600 to 700[3] SPH of good form and which have at least 80% of these stems pruned to 6.0m.*

The regime designed to achieve this is essentially the same as that for mangium except that the rotation length might be 12 years. Where performance is particularly poor the rotation might shortened. Only when a sufficiently large number of PSPs have been established in blocks of 10 or more years old and when there is grade recovery information from downstream will it be possible to determine the economic rotation age.

Good Quality Stock

As a matter of course LANA will only plant improved genetic material. Seed is currently from Samling's own elite tree section. The extensive pellita breeding programme is now well in hand on three sites. The first recommendations for improved seed have been made and it is expected that SPA seed will be available from these areas in 2020/21.

Site Preparation and Establishment

Before planting takes place, some site preparation is necessary. This usually involves a herbicide application to kill any emergent weeds, particularly natural regeneration, therefore reducing competition to newly planted seedlings. Labour shortage often results in the time elapsed between completion of harvest and the commencement of site preparation being overly long. This means that prior to spraying the site must be slashed and weed growth allowed to time to flush with new growth before spraying.

LANA plants 1,110 stems per hectare at 3m x 3m and considers a block established with a survival rate of 90% assessed 30 days after passing planting QC.

Maintenance

Conditions for weed growth are excellent. Circle weeding, slashing and herbicide spray are all used at a frequency that is determined by the rate of weed growth relative to that of the trees.

Silviculture

The objective is to produce primarily peeler logs. Samling downstream has undertaken peeling trials of SEGAN pellita logs at 5.6yrs old. The results were satisfactory. There was negative comment only on the small diameter and the existence of dead knots; both of which can be influenced by silviculture. The results of both the sawing and KD trials were also strongly positive.

The intensive silvicultural regime with four pruning lifts was designed to produce trees with a significant volume of "clear wood" in the lower stem. Logs from the lower stem would have primarily green knots restricted to a small DOS core along the pruned length and should yield a significant proportion of face and back veneer.

[3] This is considerably higher than the conventional stocking for solid wood ITP – a direct result of the 'no thin' policy.

As with mangium the rationale behind producing stands with 80% of stems pruned to 6.0m is to allow pruned butt-logs with a minimum small end diameter (sed) of >15cm to yield two peeler logs each of 8 ft (2.5m) with an allowance for end splitting.

With a 'no-thin' regime a residual stocking of around 600 to 700 stems per hectare is expected to remain after natural mortality has taken its toll through to Year 12. Whilst this high stocking will restrict branch size in the logs above the pruning limit it will also restrict "clear wood" production over DOS (diameter over stub) in the pruned stem length.

Pruning above 4.5m might prove to be uneconomic but until PSP data on older trees is available and more information is produced by downstream both as to their intentions regarding re-equipping and the likely recovery rates at various log diameters it is difficult to evaluate the economics of pruning.

In early 2013 a stem canker (*Botryosphaeria*? sp.) was confirmed as widespread in *E. pellita* in Samling LPFs including LANA (see Dr Lee, S.S. internal report,12 August 2010). Pruning of eucalypts stopped in mid-2013. Subsequent R&D trials have shown that green pruning (that is the removal of branches before they die) reduces the incidence of stem canker arising from what is termed *branch associated stem fungal irritation.* Green pruning has now restarted. It also reduces the incidence of dead knots and should more or less totally eliminate them if correctly practiced. Green pruning had a marginal negative effect on DBH increment in the first two years of the trials. Continuation of the trials will show if this impact is maintained or not.

8.3.3 Other species

Acacia hybrid was planted operationally but planting stopped when it's generally poor growth and susceptibility to pink disease (*Erythricium salmonicolor syn. Corticium salmonicolor*) became obvious. Batai (*Falcataria moluccana* syn. *Paraserianthes falcataria*) and to a lesser extent *Gmelina arborea* are now planted operationally. At present the regime for gmelina follows that of mangium and the provisional regime for falcata similar.

8.4 Scheduling of Silvicultural Operations

Apart from the need to ensure that early competition from weeds is kept to minimum the key driver behind the silvicultural schedules of those species to be pruned is the timing (but see below). As LANA is aiming to produce clear wood material in order to maximize veneer recovery and quality, the minimisation of the knotty core (determined by diameter over stub, or DOS, at time of pruning) is essential.

In order to have an easily measured criterion that reduce the dangers of both over-pruning (which can impact significantly on increment, particularly on eucalyptus) and under-pruning (which results in an increased DOS and loss of log quality) the 5cm gauge standard was introduced in 2010 and applied to Prune 1 and 2 scheduling. Scheduling for Prune 3 and 4 is by manager's visual assessment pending development of a standard criterion.

Schedules are produced by the LANA LPF manager and checked by the visiting HQ manager.

The recognition of *Ceratocystis* sp. in mangium and a stem canker in pellita – both in 2012 - means that the progress in the relationship between pruning and the incidence of these two diseases must be closely monitored.

8.5 Alternative Plantation Regimes

It is acknowledged that ITP silviculture for the production of mangium logs, as well as logs of other species, for solid wood, as opposed to chip, use is a new subject both to SRB and within Sarawak, and indeed within Malaysia, and that there is much that is not known. A flexible approach is therefore taken towards the use of a particular establishment or silvicultural regime. Although there are core regimes (set out above) there is very much a "horses for courses" dynamic in place at LANA. If a block or species warrants a different, seemingly more appropriate, regime to be used then it might well be used.

A good example of this is on the some of the older mangium blocks where the final pruning lifts had not been done by Year 4 and it was decided that no further pruning would be done. It was considered that the investment of time and money into these blocks in an attempt to produce some additional high quality clear wood product was not justified.

LANA is committed to employing the best practice for all its resource. It is open to employing new or innovative ideas if they are proven to be appropriate and they exceed the performance boundaries of currently accepted best practice.

9. Monitoring Plantation Forest Growth and Dynamics

9.1 Permanent Sample Plots

LANA is active in the use of permanent sample plots (PSPs) to monitor the growth and to develop growth models. The LPF licence conditions require that one plot be established for every 20 hectares planted. From the start of PSP measurement this was reduced to one plot per 5 hectares, and this has been maintained in order to build up a strong data base in reasonable time. PSPs are established when trees are 24 months old. The PSP data are used to construct yield tables, to model the growth in order to update estimates of the allowable annual cut (AAC), to determine which blocks should be harvested in any one year to achieve the AAC and for long term production forecasts. P&D information is also collected at the time of PSP assessment.

LANA has established, maintains and regularly measures an intensive allocation of PSPs to monitor forest growth and dynamics. There are currently some 900 plots distributed over the LPF. A high proportion of these are in the MTCS area.

Following initial establishment of the PSP subsequent re-measurement should be done on the anniversary of the first measurement over the length of the whole rotation. As the data base strengthens the need to continue the current, very high, level of sampling intensity will be reviewed for each species.

Each plot is randomly (with some restriction) located within the area of the block that the GIS shows as planted before field work commences. In the field, regardless of where it falls, the plot centre is established at the predetermined GPS point. The only exception allowed being to ensure that a plot does not encroach on to a road-line or any non-productive area that has been GPSd and excluded from the productive planted area statement.

PSP measurements are recorded on a paper-based system and then entered in to Excel for processing. Migration of the process to ATLAS is in progress.

9.2 Taper Functions and Volume Equations

A taper function has been developed for *Acacia mangium* (mangium) based on SEGAN volume sample trees and an interim volume equation has been developed for Eucalyptus *pellita* (pellita).

Taper functions will be developed for Samling's pellita and other species when there is a sufficient number of representative trees old enough to provide the required full DBH range of sample trees.

At a later stage of plantation development, it will be necessary to test the applicability of a single taper function for each species to all LPFs.

9.3 Monitoring Plantation Tree Growth, Site Productivity and Yield

9.3.1 Introduction

As mentioned in Section 9.1, a strong system of PSPs is in place to monitor the tree growth of the whole of LANA LPF using. Consequently, as the MTCS area forms a part of the monitored area, the yield tables developed are applicable to the whole LPF and therefore the MTCS area. Tree growth, expressed either as m3/ha or dominant height at a given age is an effective indicator of site productivity. The yield is what

the area produces. It can be expressed as standing volume or delivered to mill. The latter is, in some ways, a more meaningful metric and is the one used in Table 9.1.

Table 9.1 compares the growth and yield for Lana LPF with that of Segan, which is used as the benchmark for these metrics.

Table 9.1: Growth and Yield - LPF comparison with the benchmark Segan LPF

Species	Source	Graph	Year Class	Rotation	Lana as % of Segan
Am	Model	G.10 & G.20	8	1	58.1%
Am 2mx3m	Model	G.xx & G.20	3	2	69.5%
Ep	Model	G.11 & G.21	10	1	97.3%
Species	Source	*Table	Av. Age for LPF	Rotation	Lana as % of Segan
Am	Prod'n records	T. 16L	12.1	1	54.8%
Am	Prod'n records	T. 16S	13.6	1	
Ep	Prod'n records	T. 16L	12.9	1	98.2%
Ep	Prod'n records	T. 16S	12.6	1	

Sources: file: Productivity LPF; Yield models; Trucked Yarded files

* L – Lana; S – Segan

9.3.2 Mangium

The results of more than 1,000 plot measurements have been used to develop a yield table. The table is quite strong up to about half rotation age. New measurements will allow the development of the yield table to rotation age. The yield table is under continuous revision as PSP data continue to be captured. Growth - as expressed by m3/ha - is highly variable.

In Table 9.1 it can be seen that the growth of mangium (Am) is significantly lower in Lana LPF for both the first and second rotations. This is difference is, as might be expected, reflected in the yield of Rotation 1 when harvested at more or less comparable ages.

9.3.3 Pellita

There are more than 800 plot measurements. The growth of pellita is highly variable with large differences between the PSP results for plots of the same age. The increment between sequential measurements of the same plot can also vary widely from one year to the next. The harvest age has yet to be determined. It will probably be 12+2 years. Much depends on the approach taken be downstream to handling small diameter logs.

In Table 9.1 it can be seen that the growth of pellita (Ep) is more or less the same for Lana LPF as that of the Segan baseline. This similarity is, as might be expected, reflected in the yield when harvested at more or less the same age.

The determination of rotation length is, in part, dependent on a robust PSP data base. Despite the more than 800 plot measurements, data are still lacking in the older age classes. Growth to date has been disappointing, although there does appear to be an improvement in the CAI of the older stands. The rotation length will be continually reviewed as more PSP data from older trees become available, both from LANA and Samling's other LPFs, and a detailed log recovery-small end diameter (sed) analysis is undertaken by downstream.

10. Sustainability: Annual Cut, Harvesting Plan & System, Financial

Sustainability: an enduring value*. Sustainable [forest] management is a beguiling term and open to many interpretations. It contains many uncertainties and ambiguities. ♦ Duncan Poore, 2003*

10.1 Allowable Annual Cut (AAC)

The AAC for LANA LPF has yet to be determined. However, given that new areas are still being planted outside of the MTCS area, that there is a requirement in the LPF licence conditions to replant harvested areas and that improved planting stock will be used, whatever level of AAC is first determined when harvesting starts it will surely increase over time. The MTCS area is a significant contributor to the AAC, but the volumes produced from this area will fluctuate quite widely from year to year as a result of the highly skewed area distribution by year of planting (Fig. 5.1).

Given that downstream has been developing the processing of mangium logs and the marketing of mangium products for some time it would be ideal if the mangium log supply – as well as the total log supply - could be sustained. However, the severe mortality caused by *Ganoderma* has determined the present policy of planting only first rotation areas with mangium and second rotation areas with eucalyptus, gmelina and falcata. A sustainable supply of mangium will only be available in so far as new areas continue to be planted. A means of combatting *Ganoderma* at an operational level is still some way off.

10.2 Harvest Plan

The harvest plan has yet to be prepared. It will follow the established Samling harvest plan style and be dynamic and held in soft copy format only. This allows for easy and, more important, for continual revision as new and revised PSP information is generated. It consists of a register of blocks planned for harvest in each of the next ten budget years; the blocks listed against each budget year will be the source of that year's AAC. The register is updated to reflect the reduction factor that takes into account the variance of the actual yield from that estimated for harvest planning purposes.

A management objective for LANA LPF is to eventually achieve a normal forest age class structure as the basis for a sustainable yield whilst targeting a AAC that should continue to increase until LANA is fully planted. This might mean that some blocks should be harvested when considerably older than their ideal rotation age. In mangium this would result in negative increment. Therefore, despite the long-term objective of creating a normal plantation age class structure the mangium harvesting rate might have to be increased to avoid any significant financial losses that would result from negative increment.

10.3 Harvest System

Because of the steep, broken terrain yarding is the primary harvesting system to be used at LANA is cable. As well as being economically more efficient the use of this system also helps to protect the fragile soils and in particular reduce erosion and compaction. Avoidance of the latter effect is of particular importance when replanting with eucalypts.

Currently LANA uses a mix of semi-mobile integral tower skyline yarders of its own manufacture and shovel yarders. Both these are cable systems that enable partial or full suspension of felled trees when yarded to a landing for partial processing. LANA will follow the SEGAN model and use a combination of in-house and contractor crews. Economics demands that extraction of trees harvested near the roadsides must be ground based. Site damage will be limited by the use of shovel mounted grapples.

Other benefits of a yarding system include:

- reduced disturbance to soils on steep erodible sites.
- reduced compaction when compared to a ground-based system.
- it can be used from high vantage points minimising construction of new road infrastructure (this helps maintains water quality and minimises site disturbance); and
- it allows access to otherwise economically inaccessible areas.

LANA will be harvesting the first rotation of ITP that was planted on residual and degraded MTH areas. Full use will be made of existing logging roads and skid trails and little new roading will be required other than the extension of access spur roads. These are constructed only following approval by SFC and prior to obtaining approval to harvest - (Operation 5 in the current PHC system).

10.4 Financial Sustainability

The LANA MTCS area is a very small part of the LANA LPF and an even smaller fraction of the ITP area operated by the Samling Group. The Group has clearly been financially supportive of LANA for the past 11 years, and of its other ITPs since their start-ups. It is reasonable to assume that this will continue to be the case for the foreseeable future. However, now that harvesting has started the net revenue from internal log sales will contribute significantly to the ongoing costs of new planting, replanting and overheads costs.

11. Spatial Information and Management System

11.1 Spatial Information

With the ArcGIS Samling has a GIS that contains detailed spatial information for the LANA LPF. Data are captured by the QS team using Garmin 76CSx. LiDAR commissioned by Samling covers part of the area. GPS tracks are downloaded using OziExplorer. Tracks are then cleaned and processed using Quantum GIS. GIS data is then held by ArcGIS for further processing and mapping. The GIS allows Samling to produce a variety of maps displaying an array of information including legal, coupe and block boundaries, protected areas, land-use and related spatial information, such as contours and transportation features. Harvest planning will be done manually on maps generated from the GIS and where available - with LiDAR providing contours at 5m intervals. Currently, purchase of IFSAR data for those areas not covered by LiDAR is under consideration.

GPS tracks are backed up at LANA. After arrival at Miri HQ tracks are checked and cleaned and then saved on both Refor hard drives and Samling's local server.

Paper based copies are held as further "backup" should the electronic systems fail.

11.2 Management Systems

Samling uses the ERP system for financial control and the ATLAS GeoMaster suite to manage block records.

12. Conservation, Conservation Areas and High Conservation Values

12.1 Conservation and Conservation Areas

Given the past history of wide spread, heavy harvesting with multiple re-entry it is not surprising that undisturbed primary forest has yet to be identified within the LANA LPF.

This history, its small size and occupations of its neighbours all mitigate against, but do not necessarily preclude, LANA MTCS having much relevance to conservation in general and as a haven for endangered, rare and threatened species (ERT) in particular. This is of course especially true for larger animals. But, however limited the potential might be LANA recognises it has an obligation and commitment to incorporate into its management practices a system that takes into account the need for conservation awareness and for the identification and protection of ERT species. It also recognises the importance of indigenous biodiversity and the need to protect some areas of indigenous vegetation which might have the potential to recover, albeit over a long time, in both structure and biodiversity, to something approximating that which existed prior to the start of natural forest harvesting.

Attempts to obtain information for the adjoining ITP LPF (KTS-Pusaka) in order to identify actual or potential cross border conservation areas and areas in which ERT species have been identified have not yet been successful. Once obtained this information on possible cross-border wildlife corridors will be incorporated into the LANA GIS

As mentioned earlier no areas of undisturbed primary forest have been identified in LANA. Those areas of remnant forest that have been designated as conservation areas, as opposed to riparian buffer zones (the establishment of which is a mandatory), will be protected as SMZs. Full protection of the conservation areas and other SMZs will allow them to continue to recover and develop their biological diversity. These areas will also provide refuges and ecological corridors for the wildlife in other parts (non-MTCS) of the LPF and adjoining areas.

It is Samling's policy that anyone working in LANA should have a positive approach to conservation and be involved with the process of protecting ERT species. Contractors are asked to note, either verbally or in writing, the location and type of any rare or threatened species they come across in their day-to-day activities.

For example all new contracts and those renewed for establishment, silviculture and harvesting work contain the following clause:

"Sites which are known to be culturally sensitive or are known to contain rare or endangered species are surveyed and placed on LANA maps. If these areas are identified on any map(s) issued with the Work Order, it is the responsibility of the Contractor to ensure his workers have been informed of them before work commences. Any new sites or species encountered will be reported to LANA management immediately."

Where a current contract does not contain this clause then the contractor is required to acknowledge and to agree in writing that he will comply with this clause.

As a forestry company, and with its Sarawak ITPs increasing in significance in terms of log production, Samling also views its forest plantations as a contributor to reducing pressures on the harvesting of MTH in Sarawak and Malaysia (and therefore globally).

The EIA identified some of the protected and totally protected flora and fauna that occur within the LPF and the HCV assessment (Section 12.2 below) contains further information. These reports should be referred to for detail.

12.2 High Conservation Values

12.2.1 Assessment

SFC undertook an HCV assessment in mid-2016 and produced a report entitled *'High Conservation Value Assessment (HCV) [*of] *FMC area within Lana Reforestation LPF/0006, Sarawak'* (DOC017). The assessment followed the WWF Toolkit for Malaysia[4] and gives a detailed summary of the HCV status of LANA.

The main headings are given below to reinforce management's awareness of the breadth of the HCV assessment. (For details the above report should be consulted.)

HCV 1 Biodiversity Values *Forest area contains globally, regionally or nationally significant biodiversity values (e.g., endemism, endangered species, sites of critical temporal use)*

HCV 1.1 Protected Areas
HCV 1.2 Threatened and Endangered Species
HCV 1.3 Endemism
HCV 1.4 Critical Temporal Use

HCV 2 Landscape-level Forest *Forest area contains globally, regionally or nationally significant large landscape level forest where significant populations of most if not all naturally occurring wildlife species exist in natural patterns and abundance.*

HCV 3 Ecosystems *Forest area contains or is part of a threatened or endangered ecosystem.*

[4] First Edition 2009 WWF-Malaysia

HCV 4 Services of Nature *Fores*t *area provides basic services of nature in critical situations.*
HCV 4.1 Watershed Protection
HCV 4.2 Erosion Control
HCV 4.3 Barriers to Destructive Fire

HCV 5 Basic Needs of Local Communities *Fores*t *area is fundamental to meeting basic need of local communities.*

HCV 6 Cultural Identity of Local Communities *Fores*t *area is critical to local communities' traditional cultural identity.*

12.2.2 Assessment Analysis

It might be noted that:

1. the area had generally been very heavily disturbed by logging prior to the issue of the LPF licence;
2. further salvage logging took place prior to the release of coupes for LPF Op.5 (clearing & site preparation;
3. the LPF has been in continuous operation for 7 years;
4. a relatively large oil palm estate has been established within the LPF;
5. a high percentage - almost 25% - of the forested LPF area (excluding forested belukar) is designated as SMZ. This means there is already a very large forested area under protection; and
6. hunting by Samling employees and contractors is prohibited and there is not much interest shown by locals in hunting and fishing for their own consumption within the MTCS area.

The first four points above are, without doubt, 'conservational negatives' but it is quite clear from the EIA and the HCV report that, despite these negatives, an interesting degree of biological diversity has been maintained.

The fifth point - that such a high proportion (25%) of the area has SMZ status and is therefore already protected from invasive human activity – together with the sixth point will surely lead to the existing diversity, already quite considerable, being quantitatively and qualitatively further enhanced over time.

The SFC report shows that:
For **HCV 1 and 2:** the LANA MTCS area does have some HCV attributes, e.g., the existence of ERT species and of some species endemic to Borneo. However, when the qualitative and quantitative aspects of these attributes are viewed in the context of relevance either to national and Sarawak state needs or to those of the LANA LPF itself, there is no justification for elevating any of LANA MTCS conservation areas from their current protected status and according to them HCV status under either HCV 1 or HCV2. This point is reinforced by the SMZs providing an equal level of protection for both mammals and birds that are free ranging, i.e. not confined to limited areas of habitat, as would be accorded to an area declared as an HCV area.

For **HCV3:** reference is only made to riparian buffers the designation and protection of which are mandatory under the conditions attached to the EIA Report Approval certificate.

For **HCV4:** reference is made only to Terrain Class IV which is present to only a very limited extent in the MTCS area but is all within the designated Conservation Areas and is thus fully protected.

For **HCV 5:** the SFC report shows that there is now no dependence on the forest products provided by the MTCS area or indeed on those provided by the whole LPF. What activity there is – primarily hunting and

fishing - now verges on the purely recreational. Timber and timber products are bought rather than self-collected. It is abundantly clear that there has been little socio-economic impact of the LANA MTCS area on the communities. However, identifiable positive economic impacts have been (a) the employment provided for 45 Sarawakians, most of whom are local, directly employed in LANA ITP and (b) provision of road access to Bintulu Town and (c) road access to the Samling's Lana Oil Palm mill.

For **HCV 6:** the MTCS area has no sites of cultural significance. The one salt lick identified lies well outside the MTCS area but is in any case fully protected by a buffer zone, albeit the locals are allowed to hunt there for their own consumption.

13. Social Multiple-Use

13.1 Local Population

Hunting is prohibited other than by members of the local communities and then only for personal consumption. The opportunities for fishing within the MTCS area are extremely limited.

Whilst not multi-use of the *forested* area, the use of the long-established SA areas within the LPF (but which are excluded from the plantable area statement in LPF licence) still continues. There is however no SA within the MTCS area.

13.2 Others

Samling has entered into a long-term R&D co-operative agreement with SFC. LANA LPF is an active participant in this R&D and is host to one of three Samling sites for the *Eucalyptus pellita* breeding program. Whilst the R&D site is adjacent to and not within the MTCS area as a part of the LANA LPF the results should benefit the MTCS area in the way of improved genetic material in time to come.

14. Cultural and Historic Values

No sites of cultural or historic value were identified within the MTCS area by the EIA. None has been subsequently identified on the ground and local knowledge indicates that there are none. However, there are graveyards located within the LPF, but they are lie outside of the MTCS area. They have all been GPSd and mapped.

The EIA did not identify any salt licks within the LPF. However, a small salt lick was found in April 2016 by LANA LPF staff. Located on in the north of side of Block 61 in Coupe 4A it is now protected by a 100m buffer.

15. OCCUPATIONAL HEALTH AND SAFETY AND ENVIRONMENT

15.1 Introduction

In the conduct of forestry operations, a safe and healthy work place, as far as practicable, is assured by compliance with the Occupational Safety and Health Act 1994 and the relevant legislative regulations and guidelines that are applicable to the respective work places.

15.2 Health, Safety and Environment (HSE) Policy Statement

The management is committed to the following principles:

- Provision of systems of work, work environment, plant, equipment and the maintenance of the same, in so far as practicable, that are safe and without risk to health and adverse impact to the environment;
- Provision of adequate welfare, religious and recreational facilities for all employees without adverse impact to the environment;
- Provision of a safe means of access, egress to and from work places, emergency response (ERT) for rescue, control of environmental spill and natural disaster in so far as practicable;
- Provision of information, work instruction, training and supervision for all staff to enhance work competencies, skills and awareness in HSE, and the implementation of Best Management Practices (BMPs) in the industry;

- Review the HSE standards and practices periodically to ensure continued relevance and appropriate to the organisation.

15.3 Safety Practice Guidelines for Forestry Activities

Safety practice is the responsibility of both the management and employees regardless of level or job designation. All employees must be mindful at all times of the Safety Practice Guidelines (Appendix VII).

However, the camp management is required to play an active role in carrying out measures to ensure the safety and health of all employees in the work areas.

Within the framework of the Safety Practice Guidelines, camp management must take due consideration of all employees' health and safety during tree felling, skidding, log handling and scaling, land and river transportation, road construction and maintenance, and of those working in the camp office and workshop or in any of Samling's working areas located within the FMU. Where practicable relevant salient points reflecting those set out above, will be incorporated into work instructions.

15.4 Training of Forest Workers

As required under The Forests (Trained Workmen) Rules, 2015, workers who are engaged in any one of the following: tree felling, log extraction or log loading, must be trained by STA Training Sdn Bhd trainers or by other STA or SFC approved trainers.

15.5 In-house Training for Occupational Health and Safety and Environment

15.5.1 Health, Safety and Environment Committee

A Health, Safety Environment and Committee (HSEC) comprises: (a) Chairman; (b) Secretary; (c) representatives of employer; and (d) representatives of employees. The functions of the HSEC are as follows:

15.5.2 DOSH Guidelines

DOSH's *Guidelines for Occupational Safety and Health in the Logging Industry* are used as the basis to develop the Safety Practice Guidelines for the better prevention of injury and health problems in harvesting operations.

16. Monitoring

16.1 Introduction

The MTCS area of the LANA LPF was certified in May 2017.

16.2 Elements to be Monitored

The following elements are monitored:

a) Yield of forest products (logs) harvested is monitored through the daily trucking reports based on weighbridge records used for royalty assessment.
b) *Ad hoc* records of observations by LPF staff in conjunction with formal visits by Samling's Environment Team are used to assist in monitoring changes in fauna and flora.
c) (i) Environmental: Data from the HCV assessment will be used to assist in monitoring fauna in conjunction with *ad hoc* records of observations by FMU staff. The HCV assessment clearly shows that the MTCS area is not fundamental to meeting the basic needs of the nearby communities and that there is little to monitor in this regard.
(ii) Social: There are no communities within the MTCS area and the direct social impact of the harvesting and other ITP operations are clearly negligible. The SIA assessment clearly shows that the MTCS area is not fundamental to meeting the basic needs of the more distant communities and that there is little to monitor in this regard. Furthermore, any use that might be made of the MTCS area for NTFP will surely lessen as the rural population decreases and continues to change its consumption patterns to those of a more modern way of life. These assessments also showed that the impact of operating, and of harvesting in particular, in the MTCS area has no or negligible

social impact other than a positive one in providing employment for those with the relevant skills - or for those who wish to obtain such skill – and the required levels of discipline and energy required for regular employment. The LPF's road network is of significant social importance as it provides small holders access to the Lana Oil Palm mill and, of greater significance, access to Bintulu Town.

(iii) Social: Employment is monitored by analysing the payroll at the more or less the same time each year.

d) Costs are monitored by budgetary controls in which productivity and the efficiency of forest management will of necessity also feature.
e) Growth rates are monitored through a network of PSPs.
f) The risk of invasion by exotic species is monitored during the regular patrols.

17. Climate Change - Adaption, Mitigation and Monitoring

17.1 Introduction

Forests have a significant function in climate change mitigation by acting as "sinks", i.e. absorbing carbon from the atmosphere and storing it in biomass and soils.

Sustainable Forest Management (SFM) can help reduce the negative effects of climate change on forests and forest-dependent people.

In 2010, the **Conference of the Parties** (**COP**) to the United Nations Framework Convention on Climate Change (**UNFCCC**) adopted a decision on reducing emissions from deforestation and on the conversion of forests, sustainable management of forests, and enhancement of forest carbon stocks, usually known as ***REDD+***. The accessibility of benefits from ***REDD+*** activities to individual forest managers would depend on the arrangements in place in the country for ***REDD+*** benefit-sharing.

17.2 Policies on Climate Change

Forest management is affected by climate change policies made at the national and global levels. Under the **Malaysian Timber Certification Scheme (MC&I SFM 1/2020)**, forest management shall comply with the **National Policy on Climate Change, 2002** and the **UN Framework Convention on Climate Change, 1992.**

18. Adaptation and Mitigation in Forestry

Adaption and mitigation are the two main responses to climate change. The mitigation addresses the causes of climate change whereas the adaptation on its impacts.

In the forest sector, adaptation encompasses changes in management practices design to decrease the vulnerability of forests to climate change and interventions intended to reduce the vulnerability to climate change.

19. Adaption Actions

The actions for adaptation to climate change shall address risks or impacts. These actions are drawn mostly from existing forest management practices.

20. Mitigation Actions

Mitigation actions on climate change shall focus reducing **Green House Gases (GHG)** emissions by source and increasing GHG removals by sinks. These actions can be grouped into four general categories.

21. Monitoring and Evaluation

Monitoring of the climate change adaption and mitigation actions shall be additional and significant burden. Nevertheless, the existing databases, criteria and indicator processes and forest certification schemes shall form the framework for monitoring.

Regardless of the scale of monitoring required, forest management shall use precautionary approach and involve participation by local people on the social and environmental impacts.

Monitoring will require the collection of data on indicators of climate-induced impacts (e.g., forest productivity, forest health and forest pests). Many of these data will normally be collected in standard forest inventory.

22.Conclusion

Forests provide a wide range of goods and ecosystem services to the stakeholders and climate change, combined with deforestation, forest degradation and population pressure, threaten the continuity of such provision.

Measures to ensure forest adaption are compatible and identical with established SFM practices to meet the economic, social, and environmental needs of stakeholders. SFM practices can help reduce the economic, social, and environmental vulnerability of forests and forest-dependent people to climate change.

Climate change mitigation programs (e.g., REDD+) are emerging that can increase the stock of carbon in forests; and that can help the costs of actions (from Carbon Credits) to reduce GHG emissions due to deforestation and forest degradation.

23. Forest Plantation Management Plan – Review and Revision

To take into account new knowledge, Samling R&D findings, developments within the ITP sector and to ensure that as far as is possible LANA meets downstream's evolving requirements it might be necessary to interpret parts of this FPMP with a degree of flexibility. Any such changes will be incorporated at the mid-term review or the end-term revision of this FPMP.

Mid-term Review: A mid-term review of the LANA Forest Plantation Management Plan will take place and a revision may follow if deemed necessary.

Revision: In the last year of the ten-year term the FPMP will be revised as necessary.

24.Internal Audit and Management Review

24.1 Introduction

Forest management activities are subject to internal audit and management review at planned intervals as required under Malaysian Criteria & Indicator (MC&I) 8.1.3 of Malaysian Timber Certification Scheme (MTCS ST 1002:2021) for sustainable forest management. Both internal audit and management review will ensure that there is continual improvement in the management system.

24.2Internal Audit

The internal audit shall be planned and conducted once a year. The objectives of the audit plan shall ensure that the FMU:

(a). meets the requirements of its management system; and
(b). its management system conforms to the requirements of MC&I SFM.

24.3Management Review

The Management Review shall be conducted annually and shall include at least the following:

(a). The status of actions from previous management reviews.
(b). Changes in external and internal issues that are relevant to the management system.
(c). Information on the FMU's performance, including trends.
(d). Opportunities for continual improvement.

24.4 Non-conformity and Corrective Action

When any non-conformity is encountered, applicable action shall be taken to control and correct it.

24.5 Continual Improvement

By undertaking the annual internal audit and management review, the sustainable management of the forest shall be continuously improved by addressing the suitability, adequacy and the effectiveness of the sustainable management system.

24.6 Internal Audit and Management Review Procedure

The Internal Audit and Management Review Procedure is used as the basis to the annual internal audit. It outlines the frequency, methods, responsibilities, planning requirements and reporting of the internal audit process.