Proceedings *of the* 17th Malaysian Forestry Conference

A Century of Forest Management: Lessons Learnt & the Way Forward

PERSIDANGAN PERHUTANAN MALAYSIA
XVII
11 – 12 November 2014, Sabah

SARAWAK FORESTRY

Magellan Sutera Harbour Resort,
Kota Kinabalu
11th – 12th November, 2014

Proceedings

of the

17th Malaysian Forestry Conference

"A Century of Forest Management: Lessons Learnt & the Way Forward"

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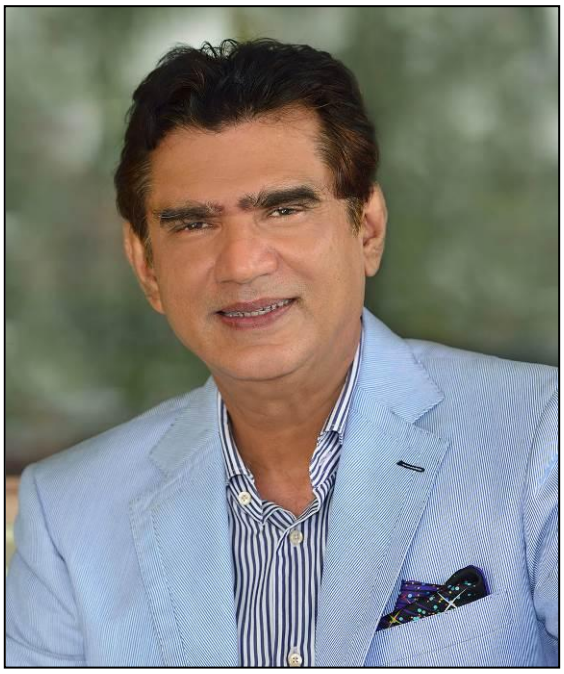
FOREWORD



The theme for the 17th Malaysian Forestry Conference, "A Century of Forest Management: Lessons Learnt & the Way Forward" was timely and appropriate as the department was celebrating its 100th anniversary, and forest management has been practised for about a century in other parts of Malaysia.

Forestry had been the main source of revenue contribution to the state, and today, it is still one of the important sectors contributing to socio-economic development. Throughout a century of forest management in Sabah, indeed we have learnt a lot from the past, from exploitative timber harvesting to sustainable forest management. Realizing the importance of utilizing the natural resources in a sustainable manner, we have embarked on sustainable forest management (SFM) implemented first in Deramakot Forest Reserve, which has been certified by the internationally-recognized Forest Stewardship Council. A similar path of evolution of forest management has been trodden in Peninsular Malaysia and Sarawak. It is timely to take stock and share our experiences in this conference.

A total of 74 papers are included in the Proceedings, comprising 3 keynotes, 37 working papers, 13 information papers and 21 posters (abstracts). The working papers were presented at the conference based on six concurrent sessions, namely: Forest Management, Forest Governance, Forest Biodiversity, Plantation Forestry, Forest Ecosystem Services and Social Forestry. At the end of the conference, resolutions were adopted, primarily based on the presentation of papers and thorough discussions.

I would like to accord my appreciation to the authors for their contribution. I thank the Conference Paper Sub-Committee headed by Dr Lee Ying Fah and the Conference Secretary, Mr Frederick Kugan for expediting the publication of the Proceedings. Owing to the large number of papers received and time constraint, they have not been thoroughly edited. Moreover, it is not the intention of the Conference Committee to do so. Nevertheless, Dr Arthur Y. C. Chung, Dr Joan Pereira, Maria Ajik, Samit Abd. Sani, Zamrie Imiyabir, Siti Zubaidah S. Abdullah and Elne Betrece Johnlee had kindly provided some comments on some of the papers. Nurul Aqidah Ibrahim and Petronella Dasim assisted in the compilation. My appreciation also goes to all the staff of the Sabah Forestry Department who have assisted indirectly in preparing the Proceedings.

Thank you.

Datuk Sam Mannan
Director
Sabah Forestry Department

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1.0 INTRODUCTION

The Malaysian Forestry Conference (MFC) is held every three years on a rotational basis amongst the Forestry Departments of Sabah, Sarawak and Peninsular Malaysia. This conference provides a forum for Malaysian foresters to exchange and share information, views and experiences in the administration, management and development of the nation's forest resources. Since the first MFC in 1966, a total of 17 conferences have been held. The 17th MFC was hosted by the Sabah Forestry Department.

The conference objectives are as follows:

- to provide a platform for discussing and resolving problems collectively, pertaining to the aspects of forest development;
- to co-ordinate the planned management of the forest resources and their utilization, seeking means and methods leading to the development and diversification of the forest industries with the aim of maximizing their contribution to the socio-economic development of the nation;
- to co-ordinate lines of research and the use of improved techniques in all aspects of forestry operations and utilization;
- to establish a closer working relationship and understanding among foresters from all over Malaysia; and
- to generate public awareness in the importance of forestry as an integral element in nation building.

2.0 CONFERENCE PROGRAMME

11th NOV., 2014

OPENING CEREMONY	
7:00 am	Registration of Participants
8:30 am	Arrival of VVIPs and Invited Guests
9:00 am	Arrival of the Right Honourable Chief Minister of Sabah
9:05 am	National Anthem 'Negaraku' and State Anthem 'Sabah Tanah Airku'
9:10 am	Recital of Doa
9:15 am	• Welcoming Address by YBhg Datuk Sam Mannan, Director of Sabah Forestry Department • Opening Speech by the Right Honourable Datuk Seri Panglima Musa Hj. Aman, Chief Minister of Sabah • Launching of the Conference
9:40 am	Tour of the Conference Exhibition
9:50 am	Photo Session (Ballroom 1)
10:00 am	Refreshments / Press Conference
CLOSED SESSION	
10:30 am	Agenda: • Appointment of Conference Chairman • Appointment of Conference Officials • Appointment of Chairpersons of Plenary Sessions • Report on Actions Taken on Resolutions Adopted at the 16th Malaysian Forestry Conference Amendments to Standing Orders of Malaysian Forestry Conference
11:30 am	Presentation by Institute of Foresters Malaysia (IRIM)
12:00 noon	Lunch (Five Sails & Rose Garden)
PLENARY SESSION I	
1:30 pm	Keynote Address by Datuk Sam Mannan, Director of Sabah Forestry Department
1:50 pm	Keynote Address by Dato' Sri Prof. Dr. Hj. Abd. Rahman bin Hj. Abd. Rahim, Director General of Forestry Department Peninsular Malaysia
2:10 pm	Keynote Address by Tuan Haji Sapuan Ahmad,

	Director of Forest Department Sarawak
2:30 pm	Coffee Break
WORKSHOP SESSION (6 CONCURRENT SESSIONS)	
3:00 – 4:40 pm	Session I: Forest Management: Technology, Innovation and Practices Session II: Forest Governance: Policy, Legislation and Enforcement Session III: Forest Biodiversity: Restoration, Conservation and Protection Session IV: Plantation Forestry: Sustainable Wood Production and Wood Based Industry Session V: Forest Ecosystem Services: Food, Water, Energy, Climate and Recreation Session VI: Social Forestry: Stakeholders, Participatory and Awareness
5:00 pm	Q & A
5:30 pm	End of Day 1 Programme

12th NOV., 2014

WORKSHOP SESSION (CONT.)	
9:00 am	Discussion on Conference Resolutions
10:30 am	Coffee Break
PLENARY SESSION II	
11:00 am	Presentation of Groups' Recommendations on Conference Resolutions
12:00 noon	Q & A
12:30 pm	Lunch
CLOSED SESSION	
2:30 pm	Consideration and Adoption of Conference Resolutions
3:15 pm	Coffee Break
CLOSING SESSION	
3:30 pm	• Remarks by the Director General of Forestry Department Peninsular Malaysia • Remarks by the Director of Forest Department Sarawak • Remarks by the Director of Sabah Forestry Department cum Chairman of the 17th Malaysian Forestry Conference Closing Remarks by the Deputy Secretary General of the Ministry of Natural Resources & Environment, Malaysia
4:30 pm	End of Conference Session

CLOSING DINNER	
7:00 – 10:30 pm	MFC Dinner at Padang Merdeka, Kota Kinabalu

13th NOV., 2014

FIELD EXCURSION	
7:00 am – 9:30 pm	Klias Peat Swamp Field Centre, Rumbia Information Centre & Padas Damit Forest Reserve

Sport activities of the 17th Malaysian Forestry Conference

SPORTS (GOLF, BOWLING & FUTSAL)	
8th Nov.	Golf – Dalit Bay Golf and Country Club, Tuaran
8th Nov.	Bowling – CPS Bowl, Level 8, Centre Point, Kota Kinabalu
9th Nov.	Futsal – Suria Futsal, Jesselton Point, Kota Kinabalu

3.1 WELCOME ADDRESS BY THE DIRECTOR OF SABAH FORESTRY DEPARTMENT, YBHG. DATUK SAM MANNAN

Bismillah nirahman nirahim.

Selamat pagi, Asalamualaikum dan Salam Sejahtera.

Yang Amat Berhormat, Datuk Seri Panglima Musa Haji Aman, Ketua Menteri Sabah dan juga menteri yang bertanggungjawab terhadap perhutanan dan tanah, saya bagi pihak warga perhutanan dan mereka yang mempunyai kepentingan dalam isu-isu konservasi dan "*good forest governance*," di Malaysia, merakamkan ribuan terima kasih atas penghormatan yang telah diberi kepada kami, dengan kehadiran YAB Datuk Seri pada pagi ini.

Untuk makluman semua, secara kebetulannya, Dewan Undangan Negeri Sabah dan Pembentangan Budget 2015, sedang bersidang pada ketika ini di Dewan Undangan Negeri.

Despite of this ongoing important event in the state, the Chief Minister has made it his priority also, to address this forum of eminent people in the world of forestry and conservation in this country. For that, he deserves the greatest applause from us all. Kami sangat bertuah dengan adanya sokongan sedemikian at the highest level of authority, di negeri Sabah.

YBhg. Dato' Hj. Nor Akhirrudin bin Mahmud, representing the Director-General, Jabatan Perhutanan, Semenanjung Malaysia, YBhg. Tuan Haji Sapuan Ahmad, Director of Jabatan Hutan, Sarawak, YBhg Datu Hj Ali Yusop, CEO, Sarawak Forest Corportion, dif-dif jemputan, warga perhutanan, pihak media, tuan-tuan dan puan-puan sekalian.

Bagi pihak Kerajaan Negeri Sabah dan jawatankuasa penganjur, selamat datang ke Persidangan Perhutanan Malaysia yang Ke-17, iaitu, satu program "meeting of the minds" yang telah berterusan selama 48 tahun dan belum pernah gagal, diadakan semenjak tahun 1966. Negeri Sabah menganjurkan persidangan ini pada tahun 1968 pada pertama kali, dan Persidangan Ke-17 ini adalah kali ke-6, Sabah menjadi tuan rumah persidangan.

YAB Ketua Menteri, tuan-tuan dan puan-puan yang dihormati sekalian,

Over the last two days, since our event at the Padang Merdeka, you have heard me make many speeches. The last thing you want to hear this morning, is more verbal diarrhoea from me. Adoi, dia lagi? Tidak pandai habis-habis! So, I have had my say. No doubt, you will hear more from me, when I address you once more, later on today, in one of the keynote addresses, on how we are moving forward here in Sabah. Until then, Finetto!

Sebelum saya mengakhiri ucapan saya ini, izinkan saya untuk memberi sedikit kesimpulan tentang halatuju Negeri Sabah berkenaan perhutanan dan konservasi melalui "my parting words,"

(i) Sabah is dead serious in attaining good forest governance, sustainable living and conservation;

(ii) Being No. 2 is not good enough. If we cannot have twin towers, super highways, amusement parks etc., never mind, so be it!! But, we want to preserve our natural heritage and attain world class tropical forest management – the benchmark;

(iii) We promise what we can deliver and deliver on our promises. Otherwise, we lose credibility and worst still, we lose Face!! And I lose my head!!;

(iv) One indicator of sustainability is the survival of endangered species, the Orang Utan being the most iconic species for Borneo. So I say to you, it is our promise that if the Orang Utan is to survive as a species in this world, it has the greatest chance here in Sabah. (Ya, Temberang Sikit!! Banyak!!). On the reasons why, I will elaborate later today; and

(v) We acknowledge we are too small to compete on the basis of size. So, we prefer to compete on the basis of governance.

And lastly, ladies and gentlemen, one of the greatest assets we have here in Sabah, which Einstein once described as, "***What really counts, cannot be counted,***" is political support at the highest level and an informed and knowledgeable leadership. Bukan calang- calang. There is the man himself, Datuk Seri Panglima Musa Hj Aman, who provides the motivation and support, to make things happen. Thank you Sir.

Dengan itu, YAB Ketua Menteri, Datuk-Datuk, tuan-tuan dan puan-puan yang saya hormati sekalian, sekali lagi, saya ucapkan ribuan terima kasih atas kehadiran dan sokongan yang telah diberikan.

Tidak saya lupa juga, adalah peranan semua ahli jawatankuasa daripada tiga Wilayah, yang diketuai oleh Deputy Director, Dr Frederick Kugan, yang telah berkhidmat dengan cemerlang untuk memastikan persidangan ini berjalan dengan baik dan teratur. The degree of difficulty for Fred and team, this time is not one event but three events. I torture him three times this year. But what does not kill you, will make you stronger.

Dengan itu sekian dan terima kasih.

3.2 OPENING SPEECH BY CHIEF MINISTER OF SABAH, YAB DATUK SERI PANGLIMA MUSA HJ AMAN

I am pleased to be here with you this morning to open the 17th Malaysian Forestry Conference 2014. The Sabah State Government is honoured that this important conference is being held in this state, and I thank the organizers for this invitation to launch this gathering of experts. I also wish to congratúlate the Sabah Forestry Department Director, Datuk Sam Mannan, and his able team on their hard work in organizing and hosting this conference. To guests from abroad, I warmly welcome you to Sabah, the Land Below the Wind.

I was informed that the Malaysian Forestry Conference has since 1966 been held every three years on a rotational basis amongst the Forestry Departments of Sabah, Sarawak and Peninsular Malaysia. This Conference provides a forum for Malaysian foresters to exchange and share information, views and experiences in the administration, management and development of the nation's forest resources. The presence of delegates from other government agencies, non-governmental organizations, civil society and industry will enable more in-depth deliberations and hopefully will produce beneficial outcomes.

The conference theme "A Century of Forest Management: Lessons Learnt and the Way Forward" is timely as the Sabah Forestry Department is celebrating its 100th anniversary. Indeed, forestry has contributed significantly to the socio-economic development and well-being of the people in Sabah over the years. There is a lot that we have learnt from the past to move forward. Similarly, a path of evolution of forest management has been trodden in Peninsular Malaysia and Sarawak.

I trust that all ideas, thoughts and discussions adopted as resolutions will contribute towards the formulation of policies and new approaches that will place the forestry sector on stronger footing. I also wish to take this opportunity to thank the Natural Resources and Environment Ministry of Malaysia for its assistance and cooperation in further developing the forestry sector in Sabah.

Please allow me to continue with the rest of the speech in Bahasa Malaysia.

Hutan hujan tropika memainkan peranan yang penting dan amat bernilai kepada kehidupan manusia. Sebagai sumber semulajadi yang boleh diperbaharui, hutan seharusnya tidak dihadkan pengertiannya kepada pengeluaran balak dan kayu semata-mata, tetapi peranan hutan jauh lebih signifikan dari segi perkhidmatan ekosistem, seperti pembekalan air, sistem peredaran udara, keseimbangan persekitaran dan kepentingan biodiversiti.

Dalam konteks Negeri Sabah, sementara pelbagai cara dan usaha telah dan sedang dilakukan untuk mempelbagaikan asas-asas ekonomi, industri perhutanan masih memainkan peranan yang penting. Selaras dengan visi dan misi Jabatan Perhutanan Sabah, tumpuan utama adalah ke arah merealisasikan pengurusan hutan secara mampan.

Daripada 3.6 juta hektar jumlah keluasan kawasan Hutan Simpan Kekal Negeri pelbagai kategori dan fungsi, seperti Hutan Bakau, Perlindungan, Domestik, Rekreasi dan Hidupan Liar, seluas lebih kurang 2.2 juta hektar adalah Hutan Simpan Kekal Kelas II (komersial). Kini, Hutan Simpan Kekal Komersial ini ditadbir-selia di bawah *Sustainable Forest Management Licence Agreement*, diurus tadbir berasaskan *Forest Management Plan* dengan menggunakan Hutan Simpan Deramakot sebagai model pengurusan.

Keputusan kerajaan negeri Sabah memperluaskan Model Pengurusan Hutan Deramakot, ke seluruh Hutan Simpan Kekal Komersial membuktikan satu keazaman politik yang tinggi. Pelaksanaan dan tindakan Dasar Perhutanan Negeri yang berteraskan prinsip pengurusan hutan mampan dalam

membangunkan dan memperbaharui sumber-sumber hutan, kini telah pun dipraktikkan. Sehingga kini, sejumlah 860,000 hektar hutan di Sabah telah pun mendapat pensijilan.

Di samping itu, Kerajaan Negeri amat menyedari mengenai kepentingan hutan dari segi konservasi biodiversiti, dan kawasan seluas 39,000 km persegi, terutamanya kawasan pendalaman Sabah telah dikhaskan untuk program-program Inisiatif 'Heart of Borneo'. Initiasif ini merupakan satu pendekatan untuk implementasi konservasi biodiversiti yang melibatkan tiga negara di Borneo, iaitu Malaysia, Brunei Darussalam dan Indonesia. Sehingga kini, banyak aktiviti telah pun dilaksanakan dalam memperkukuhkan konservasi biodiversiti di Borneo, khususnya di Sabah, di bawah penyeliaan Jabatan Perhutanan Sabah.

Saya juga amat mengalu-alukan langkah Jabatan Perhutanan Sabah menjalinkan kolaborasi dengan pelbagai agensi dalam dan luar negara bagi melaksanakan program-program konservasi. Antaranya adalah kerjasama dengan *International Society of Mangrove Ecosystems* (ISME), yang menjalankan aktiviti-aktiviti rehabilitasi hutan bakau, dengan *European Union* (EU) dalam menangani masalah-masalah perubahan cuaca dan *Reducing Emissions from Deforestation and Forest Degradation* (REDD+), dan juga dengan *Kyoto University, Japan*, dalam pengurusan biodiversiti serta pemantauan REDD+.

Dengan harapan yang tinggi, penuh yakin dan optimis, disusuli dengan semangat dan kesungguhan semua pihak, serta hasrat murni yang mendokong usaha untuk mencapai matlamat persidangan ini, saya mengucapkan selamat maju jaya kepada tuan-tuan dan puan-puan sekalian.

Akhir kata, saya juga merakamkan ucapan syabas dan terima kasih kepada Jabatan Perhutanan Sabah di atas penganjuran persidangan ini.

Dengan ini, saya dengan lafaz *Bismillahir Rahmanir Rahim,* merasmikan Persidangan Perhutanan Malaysia ke-17. Sekian, terima kasih.

4.0 PROCEEDINGS OF CONFERENCE

4.1 CONFERENCE OFFICIALS

Conference Chairman:	YBhg. Datuk Sam Mannan, Director of Forestry, Sabah Forestry Department
Vice Chairmen:	Tuan Haji Sapuan Ahmad, Director of Forests, Forest Department Sarawak
	YBhg. Dato' Sri Prof. Dr. Hj. Abd. Rahman bin Hj. Abd. Rahim, Director General, Forestry Department Peninsular Malaysia
Conference Secretary:	Mr. Frederick Kugan, Deputy Director (Forest Sector Planning), Sabah Forestry Department
Session Chairperson:	
Workshop Session (i)	Tuan Haji Abang Mohamad Mohtar Abang Pawozan, (Penolong Pengarah Hutan-Bahagian Penyelidikan, Pembangunan & Inovasi), Forest Department Sarawak
Workshop Session (ii)	Mr. Fidelis Edwin Bajau, Deputy Director (Development), Sabah Forestry Department
Workshop Session (iii)	Mr. Rahim Sulaiman, Deputy Director (Management), Sabah Forestry Department
Workshop Session (iv)	YBhg. Dato' Nik Mohd Shah bin Nik Mustafa, Deputy Director General (Operations & Technical), Forestry Department Peninsular Malaysia
Workshop Session (v)	Mr. Francis Gombek, Manager, Sarawak Forestry Corporation
Workshop Session (vi)	Mr. Koh Hock Lye, Senior Director of Forest Management Division, Forestry Department Peninsular Malaysia

Resolution Committee	
Chairman:	Dr. Lee Ying Fah, Deputy Director (Research & Development), Sabah Forestry Department
Vice Chairman:	Mr. Wong Ting Chung, Deputy General Manager, Sarawak Forestry Corporation
Members:	1) Dr. Robert C. Ong (SFD) 2) Mr. Samit Hj. Abd. Sani (SFD) 3) Dr. Arthur Y.C. Chung (SFD) 4) YBhg. Dato' Hj. Nor Akhirrudin bin Mahmud (FDPM) 5) Mr. Yap Yee Hwai (FDPM) 6) Mr. Jeffri bin Abd. Rasid (FDPM) 7) Mr. Abg Ahmad Arabi (SFC) 8) Mr. Jack Liam (FDS) 9) Mr. Wong Siong Kuan (FDS)

Rapporteurs:	**Chief Rapporteur**: Dr. Chey Vun Khen Senior Research Officer, Sabah Forestry Department
Workshop Session (i)	• Mr. Ricky Jonathan Alek**,** FDS ***(Head)*** • Ms. Kuina Kimjus, SFD • Tn. Hj. Roslan bin Rani, FDPM
Workshop Session (ii)	• Mr. Mohd Ridza bin Awang, FDPM ***(Head)*** • Ms. Rosila Anthony, SFD • Ms. Syafiani Osman, FDS
Workshop Session (iii)	• Dr. Chey Vun Khen, SFD ***(Head)*** • Mr. Taha Wahab, SFC • Mr. Lim Kee Leng, FDPM
Workshop Session (iv)	• Mr. Julaihi Abdullah, SFC ***(Head)*** • Ms. Michelle Yap Sue Sem, SFD • Mr. Hamdan bin Napiah, FDPM
Workshop Session (v)	• Tn. Hj. Zahari bin Ibrahim, FDPM ***(Head)*** • Dr. Reuben Nilus, SFD • Mr. Rambli Ahmad, SFC
Workshop Session (vi)	• Tn. Hj. Anuar Mohamad, SFD ***(Head)*** • Mr. Baher@ Biha Razali, FDS • Ms. Poh Lye Yong, FDPM

4.2 STANDING ORDERS OF THE MALAYSIAN FORESTRY CONFERENCE

(as amended in the 15th Malaysian Forestry Conference)

Preamble

The Forest Department of Sabah, Sarawak and Peninsular Malaysia, and Sarawak Forestry Corporation having a common interest in the planned development of Forestry and proper utilisation of the forest resources of Malaysia and desiring to further the attainment of these ends through common cooperation have agreed to hold regular conference as a platform for the exchange of information, ideas and experiences.

Definitions

1. The Conference shall be known as the MALAYSIAN FORESTRY CONFERENCE (PERSIDANGAN PERHUTANAN MALAYSIA) and shall hereinafter be referred as the conference.
2. For purpose of these standing orders, Sabah, Sarawak and Peninsular Malaysia, and the Sarawak Forestry Corporation shall hereinafter be individually referred to as the State and Corporation respectively.
3. A conference Session is one when the Conference sits for purpose other than a Plenary Session, under the chairmanship of the Conference Chairman.
4. Plenary Session is one when working papers are being presented and discussed, under the chairmanship of the Plenary Sessions Chairman.
5. A Workshop Session is one when a group participants elected by the Conference, sits for a specific purpose as decided by a Plenary or Conference Session.

Rule 1: Participation

The participants to the Conference shall be:

(a) all officers of the Forest Services of Sabah, Sarawak, and Peninsular Malaysia, and the Corporation.
(b) all volunteers, associate experts and consultants being employed by, seconded to or posted to the respective Forest Services of the State and the corporation.

Observers

Anyone with interests in forestry may be invited to attend the conference as observers, and shall be required to pay a registration fee, the amount of which shall be determined at the discretion of the host state.

Rule 2: Objectives

2.1 To discuss and resolve common problems pertaining to all aspects of forestry development.
2.2 To coordinate the planned management of the forest resource and its utilization, and to seek means and methods leading to the development and diversification of forest industries with the aim of maximising its contribution to the socio-economic benefits of the nation.
2.3 To coordinate lines research and use improved techniques in all aspects of forestry operations and timber utilisation.
2.4 To establish closer working relationship and understanding between the officers from the three States.
2.5 To generate public consciousness through publicity and education on the importance of forestry as an integral element in the national economy.

Rule 3: Frequency

3.1 The venue and dates of the Conference shall be determined by the State to host the Conference.

Rule 4: Venue, Date and Duration

4.1 The venue and dates of the Conference shall be determined by the State to host the Conference.
4.2 The duration of the Conference shall not exceed 14 days inclusive of tours.

Rule 5: Theme

5.1 The theme of the Conference shall be decided upon by the host State, after due consultation with the other States. The Conference may also propose the theme for the next Conference.

Rule 6: Emblem

6.1 The Conference shall have as its official emblem the design of a cross-section of a log of wood, the centre of which will be fourteen pointed star adopted form the national flag. On the left of the star, within the log cross section will be a microscope depicting forest resources. In place of bark on the lower half of the log cross-section, will be part of a toothed wheel representing industry. Below of the log cross-section will be a map, arranged on the left and right side of the log cross-section, showing the component regions of Malaysia. Around the top half circumstance of the log cross-section will be written the following words, "PERSIDANGAN PERHUTANAN MALAYSIA". Below the lower circumstance of the log cross-section and between the two halves of the map will be the Conference Session number and the year.

Rule 7: Papers and Posters

7.1 Papers presented at the Conference shall be classified into two categories, viz, working and information papers. Only working papers shall be tabled at the Conference.
7.2 The guidelines to authors as in **Appendix I** should be adhered to in the preparation of papers.
7.3 The guidelines to authors as in **Appendix II** should be adhered to in the preparation of posters.
7.4 Working papers must be distributed to participants at least one week before the Conference Session.
7.5 The host State may for specific interest invite papers from outside the Forest Department of Sabah, Sarawak and Peninsular Malaysia to be presented as Working Papers.

Rule 8: Registration

8.1 All participants and observers to each Conference Session shall register themselves for the conference.

Rule 9: Opening Ceremony

9.1 The conference shall be opened by a distinguished personage, from the Ministry responsible for forestry or by any other personage of similar or higher status from the Government.
9.2 There shall be a welcoming speech by the Head of the Forest Services of the host State.

Rule 10: Conference Officials

10.1 The Conference shall, during each Conference Session, elect a Chairman, two Vice-Chairmen and a Secretary whose terms of office shall continue until the next session of the Conference.
10.2 Nominees shall be duly proposed and seconded from the floor and election shall be by open majority vote.
10.3 There shall be one or more Plenary Session Chairman, and one or more Rapporteurs for each Plenary Session Chairman and Rapporteurs shall terminate at the end of the Conference.

Rule 11: Duties of Conference Officials

11.1 Conference Chairman

The Conference Chairman shall:

(a) Call the Conference to order.
(b) Ensure due observance of these Standing Orders.
(c) Maintain order and proper conduct of the Conference.
(d) Have the right to give the floor to any speaker and determine the time limit for a speaker to speak.
(e) Call for votes should there be occasion requiring such action.
(f) Have a casting vote.
(g) Declare the closing of the Conference session.
(h) Cause the proceedings to be prepared, published, and subsequently distributed.
(i) Effect follow-up actions on resolutions for implementation by all concerned.
(j) Cause to notify the host State to organise the subsequent Conference.

11.2 Conference Vice-Chairman

The Conference Vice-Chairman shall exercise all the functions of the Chairman in the absence or at the request of the Chairman.

11.3 Conference Secretary

The conference Secretary shall:

(a) Form a Conference Secretariat whose function will be to organise and coordinate the smooth running of the conference.
(b) Maintain order and conduct of the particular Plenary Session.
(c) Receive, collate and circulate documents, reports and resolutions of the Conference as and when necessary.

11.4 Plenary Session Chairman

The Plenary Session Chairman shall:

(a) Chair the Plenary Sessions for which he is elected.
(b Maintain order and conduct of the particular Plenary Session.
(c) During the Plenary Session, reserve the right to give the floor to any speaker, determine the time limit for a speaker to speak, call for votes should there be a necessity and have a casting vote.

11.5 Rapporteurs

Rapporteurs shall:

(a) Record all proceeding during the Plenary Session for which he is elected.
(b) Collate, summarise and submit the record of Plenary Sessions proceedings to the Conference Secretariat.

Rule 12: Conference Procedure

12.1 As soon as appropriate after the official opening ceremony, the last Conference Chairman shall call the Conference Session to order.
12.2 The first function shall be the election of the Conference Chairman, who shall then take over the Chair, and thenceforth continue the election of other Conference officials.
12.3 The respective heads of the three State Forest Services shall give a resume on actions taken to implement the resolutions of the last Conference.
12.4 The Plenary Session shall be chaired by the appointed Plenary Sessions Chairman or in his absence the Conference Chairman.
12.5 Presentation of Working Papers should be limited to a maximum of 20 minutes. About 30 minutes shall be allotted for discussions but the period shall be left to the discretion of the Chairman.
12.6 Resolutions may be initiated at a Plenary Session, and a Workshop Session shall be elected to draft the resolutions.

12.7 The Conference shall have a Closing Conference Session in which the resolution proposals or/and findings of the Workshop Session shall be discussed.

Rule 13: Workshop Sessions

13.1 Workshop Sessions or Working Groups may be formed by the Plenary Sessions to look into any specific topic or draft resolution.
13.2 Workshop Sessions shall meet at times other than when the Plenary or Conference Session, unless by special sanction of the Conference Chairman.

Rule 14: Resolutions

14.1 Resolutions can be initiated at a Plenary Session, but shall be drafted by a Workshop Session elected for this purpose.
14.2 All Resolutions must be precise, brief, and as concise as possible.
14.3 All Resolutions put forward shall be decided by a show of hands.

Rule 15: Tours

15.1 The Conference shall also include tours to place related to the theme and/or deemed necessary by the host State.
15.2 Post-conference tours may also be arranged at the discretion of the host State.
15.3 Conference tours shall be held within the period of the Conference, with sessions before and after the tours.

Rule 16: Amendments

16.1 The power to cause any amendment to any part, these Standing Orders shall vest upon the Conference Session and any decision for such amendment shall be decided by an open majority vote.
16.2 Any proposals for amendments shall be submitted to the State to host Conference, not less than one month before the due date of the Conference.
16.3 The State to host the Conference, on receipt of such proposals, shall cause copies of the proposals to be distributed to all participants not less than one week before the date of the Conference.
16.4 Any proposals for amendments shall be presented to the Conference Session before the Plenary Sessions commence.

4.3 RESOLUTIONS OF THE 16TH MALAYSIAN FORESTRY CONFERENCE

The 16th Malaysian Forestry Conference was Held on 5-9 December 2011 in Malacca with the theme "Forests for Community Livelihood". The Conference was officiated by the Right Honourable Chief Minister of Malacca and was attended by a total of 277 participants and observers.

The Conference was conducted in six (6) Plenary Sessions, namely:

Session 1: Forest Certification and Sustainable Forest Management
Session 2: Ecotourism and Forest Economics
Session 3: Forests and Climate Change
Session 4: Forest Biodiversity and Conservation
Session 5: R&D and Innovation in Forestry
Session 6: Forest Law and Enforcement

A total of 36 working papers and 18 posters were presented during the Conference. Based on the discussions held and issues raised, the Conference adopted the following:

1. Recognizing that forest management certification is a meaningful yardstick for affective implementation of sustainable forest management, the Conference adopted the following:
   1.1. All Forest Management Units be encouraged to fully undertake forest management certification under Malaysian Timber Certification Scheme (MTCS) or other credible internationally recognized schemes;
   1.2. Frequent consultant amongst the forestry agencies in Sabah, Sarawak and Peninsular Malaysia be undertaken to facilitate the sharing of experiences gained in implementing forest management certification;
   1.3. Adequate funding and technical support be made available to various components that contribute towards effective implementation of sustainable forest management;
   1.4. Wider participation of, and consultation with, relevant stakeholder in forest management and conservation be further encouraged;
   1.5. Community forestry in improving livelihood be accorded greater emphasis in sustainable forest management; and
   1.6. Leadership at the highest level be constantly updated on the importance and the state of implementation of forest management certification to enhance their continued commitment and support.

2. Recognizing the increasing demand on forest for recreation and ecotourism activities, the Conference resolved that;
   2.1. Consolidated efforts be intensified to enhance capacity building, promotions and marketing of forest recreation and ecotourism areas;
   2.2. Economic opportunities be further developed for revenue generation and employment;
   2.3. Greater participation of local community be encouraged; and
   2.4. Potential ecotourism areas be explored and further developed.

3. Recognizing the adverse effects of climate change, the Conference resolved that:
   3.1. Concepts, policies, initiatives and research activities related to climate change and forests be explored and/or intensified;
   3.2. Road map at national-level & sub-national level and/or other climate change mitigation and adaptation measures be formulated and implemented; and
   3.3. Adequate funding and technical support be made available to mitigate adverse effect of climate change, including those of renewable energy.

4. Recognizing the significance of forest Biodiversity and conservation, the Conference resolved that;
   4.1. Actions be taken to further document forest Biodiversity and enhance the protection of areas with high conservation values;
   4.2. Efforts be intensified to harness forest biological resources for sustainable economic purposes;
   4.3. Formulation of mechanism for Access and Benefit Sharing (ABS) of biological resources, notably for the local & indigenous communities, be fully supported;
   4.4. Ex-situ conservation of rare, endangered and threatened species in suitable locations be accorded greater emphasis; and

4.5. Conservation Education and Public Awareness (CEPA) initiatives be further enhanced to promote forest biodiversity and conservation.

5. Recognizing that R & D and innovations are crucial towards realizing sustainable forest management, the Conference resolved that:
   5.1. State-of-the-art technologies and innovative approaches be further explored and utilized as tools to enhance forest management and conservation as well as forest industry;
   5.2. The utilization of the rich biological diversity be further optimizer for the development of herbal, ornamental, cosmetic and pharmaceutical products through the application of appropriate biotechnology;
   5.3. Capacity building to enhance professionalism and expertise be further intensified; and
   5.4. Cooperation and collaboration among researchers, forest managers and practitioners be enhanced and synergized.

6. Recognizing the importance of fostering greater integrity, professionalism and dedication of forest personnel, as well as in enhancing forest law enforcement towards sustainable forest management, the conference resolved that:
   6.1. The existing forestry legislations be kept up-to-date and relevant in line with the changing forestry environment and societal needs;
   6.2. Capacity building for forestry personnel in preparing investigation papers and tendering of evidences for forestry offences be enhanced;
   6.3. Information exchange on law enforcement be enhanced amongst the forestry agencies in Sabah, Sarawak and Peninsular Malaysia; and
   6.4. Innovative technologies and integrated approaches be employed to enhance the effectiveness of forest law enforcement.

4.4.1 REPORT ON ACTIONS TAKEN ON THE 16TH MALAYSIAN FORESTRY CONFERENCE - SABAH FORESTRY DEPARTMENT

RESOLUTION 1: Recognizing that forest management certification is a meaningful yardstick for effective implementation of sustainable forest management, the Conference resolved that:-

1.1 All Forest Management Units be encouraged to fully undertake forest management certification under Malaysian Timber Certification Scheme (MTCS) or other credible internationally recognized scheme;

- In the case of Sabah, forest certification is government driven; the state government has played a strong loading role in the drive for certification whereby certification is made compulsory for the long term licensees. They should attain full certification by 2014, either under the Malaysian Timber Certification Scheme (MTCS) or any credible scheme which is recognized internationally.
- Currently, Sabah has 446,570 ha of fully certified forests and 417,192 ha of partially certified forests, totalling approximately 863,762 ha. These certified forest areas and other forested areas are shown in **Table 1** and **Table 2** respectively:

Table 1: Certified Forest Reserves in Sabah as of December 2013.

No.	Name	FMU / Locality	Total Area (Ha)	Certification Scheme	Assessor	Validity
1.	Deramakot Forest Reserve	FMU 19A	**55, 139**	FSC (Natural Forest Management)	SGS	April 2008 – April 2013
2.	Tangkulap-Pinangah Forest Reserves	FMU 17A	**50,070**	FSC (Natural Forest Management)	SCS	1 June 2011 – 31 May 2016
3.	Ulu Segama-Malua Forest Reserves	FMU 20, 21 and 22	**241,098**	FSC (Natural Forest Management)	SCS	13 June 2011 – 12 June 2016
5.	Benta Wawasan Sdn Bhd	Kalabakan Forest Reserve	**16,000**	FSC Controlled Wood	SGS	February 2011 – February 2016
6.	Sabah Forest Industries Sdn Bhd	FMU 7	**224,199**	Verification of Legal Compliance (VLC)	The Smartwood Program of Rainforest Alliance	10 Sept 2012 – 9 Sept 2015
				FSC Controlled Wood		October 2010 – October 2015
7.	Sabah Foundation Concession Area-Sg. Pinangah Forest Reserve	FMU 15 & 16	**176,993**	Verification of Legal Compliance (VLC)	The Smartwood Program of Rainforest Alliance	26 May 2010 – 25 May 2016
8.	KTS Plantation Sdn Bhd	FMU 19B / Segaliud Lokan FR	**57,247**	MTCS/PEFC (Natural Forest Management)	SIRIM QAS International Sdn Bhd	28 May 2013 – 02 December 2015

Table 2: Certified forested lands (outside forest reserve) in Sabah as of Dec 2013.

No.	Name	FMU / Locality	Total Area (Ha)	Certification Scheme	Assessor	Validity
1.	Sabah Softwoods Sdn Bhd	Brumas	**27,374**	FSC (Forest Plantations)	SCS	25 February 2011 – 25 February 2016
				FSC Chain of Custody	SGS	15 February 2011 – 14 February 2016
2.	Hijauan Bengkoka Plantations Sdn Bhd	Bengkoka Peninsular, Pitas District	**15,642**	FSC (Forest Plantations)	SCS	20 June 2011 – 19 June 2016

- The 5 FMUs, involving 213,913 ha, are on the way to be certified by 2014 for full forest management certification under the WWF/GFTN Certification Support Programme. The FMUs are listed as follows:

No.	FMUs	FMU/Locality	Total Area (Ha)
1.	Trusmadi & Sg. Kiluyu Forest Reserves	FMU 10	**74, 736**
2.	Timimbang-Botitian Forest Reserves	FMU 4	**13, 610**
3.	Pin Supu Forest Reserve	FMU 19	**4, 696**
4.	Northern Gunung Rara Forest Reserve	FMU 23 & 24	**55, 942**
5.	Ulu Kalumpang & Mt. Wullersdorf Forest Reserves	FMU 27	**64, 929**
TOTAL			**213,913**

1.2 Frequent consultation amongst the forestry agencies in Sabah, Sarawak and Peninsular Malaysia be undertaken to facilitate the sharing of experiences gained in implementing forest management certification;

- Sabah Forestry Department officials attended meetings and conferences related to the subject matter, amongst others, are listed below;
-

No.	Seminar/ Conference/ Visit	Date & Venue	SFD's Representative(s)	Paper presented
1.	Seminar on Forest Management Certification (Natural Forest)	20 – 21 August 2014, Four Points by Sheraton Hotel, Kuching, Sarawak.	1. Musa Salleh. 2. Hj. Hussin Tukiman. 3. Petin Kilau. 4. Azman Said 5. Adrian Rawlenes 6. Amelia C. Bosi; and 7. Sitti Khadizah Abd Kadir	Experiences and Lessons Learnt on Forest Management Certification in Sabah by Mashor Mohd Jaini and Musa Salleh

2.	Regional Conference on Planted Forests in Sarawak	13-15 Oct, 2014	Dr. Robert C. Ong	Forest Plantation Development in Sabah
3.	Study Tour to the Sarawak Planted Forests near Bintulu, together with SFMLA representatives.	16-18 June, 2014	Dr. Robert C. Ong	-

- Other meetings participated by the department are as follows:
  i) Standard Review Committee (SRC) meeting for the review of the Malaysian Criteria and Indicators for Forest Management Certification (Forest Plantations) [MC&I (Forest Plantations)];
  ii) PEFC (*the Programme for the Endorsement of Forest Certification*) Forest Certification Stakeholder Dialogue on 14-15 November 2013 in Hotel Istana, Kuala Lumpur;
  iii) Regional Consultation on the Review of the MC&I (Forest Plantations) on 10 April 2014 in Tang Dynasty Hotel Kota Kinabalu;

- The department also jointly organised with the MTCC (Malaysian Timber Certification Council) the Seminar on the MTCS on 21 October 2014 at Klagan Hotel, Kota Kinabalu. The objective of the seminar was to familiarize the long term licensees on the MTCS and the requirements of the standards for forest management certification, for both natural forest and plantation forest.

- The department also hosted several visits by officials from Forestry Department Peninsular Malaysia, Forest Department Sarawak and Permanent Secretary of Ministry of Resource Planning and Environment and Sarawak Timber Industry Development Corporation (STIDC), to learn forest management in Sabah, particularly on forest certification, as follows:
  i) Lawatan Kerja oleh Pegawai-pegawai "Bahagian Silvikultur & Pemeliharaan Biologi Hutan, Jabatan Perhutanan Semenanjung Malaysia, ke Hutan Simpan Deramakot, 2 Oktober 2012.
  ii) Sarawak Forest Department Senior officer visit to Deramakot Forest Reserve, 2-4 December 2013; and
  iii) Official Visit by the Permanent Secretary of Ministry of Resource Planning and Environment and Sarawak Timber Industry Development Corporation (STIDC) to Deramakot Forest Reserve and KTS Plantation Sdn. Bhd., 16-19 February 2014.

1.3 Adequate funding and technical support be made available to various components that contribute towards effective implementation of sustainable forest management;

- The Sabah Forestry Department received an Annual Recurrent Budget of about RM100 million every year, for the department's operational expenses.
- In 2012-2014, a total of about RM100 million Development Budget was allocated to the department, as follows:

YEAR	STATE (RM)	FEDERAL (RM)
2012	23,328,820.00	6,795,000.00
2013	31,979,170.00	5,692,280.00
2014	24,286,555.00	7,507,300.00
TOTAL	**79,594,545.00**	**19,994,580.00**

- Since 2006, the Sabah Forestry Department has been utilizing Forest Rehabilitation and Social Forestry Projects funds to restore badly degraded Forest Reserves due to encroachments, forest fires and poor logging practices. The approved budget under these funds in year 2014 is RM5.9 million.
- The department also received funding from the 10th Malaysian Plan for various SFM activities as follows:

NO.	PROJECT	SOURCE	ALLOCATION (RM)
1.	Community Forestry Management Project at Mangkuwagu FR, Tongod	Federal Funded Development Projects	289,780
2.	Sustainable Forest Management at Deramakot FR	Sabah State Government RMK10 fund (2013-2014)	8,000,000
3.	Sustainable Development and Management Planning of Tangkulap / Pinangah FR	Sabah State Government RMK10 fund (2013-2014)	4,000,000
4.	Forest Fire Protection and Control	Sabah State Government RMK10 fund (2012-2014)	900,000
5.	Reinforcement of the Forest Fire Prevention System	Federal Government Development Projects (2013-2014	2,300,000

- In terms of technical support, research in Sabah Forestry Department has been providing support in procuring information for Forest Management Plans (FMP), Environmental Impact Assessments (EIS) and High Conservation Value Forests (HCVF).

1.4 Wider participation of, and consultation with relevant stakeholders in forest management and conservation be further encouraged;

- Stakeholders consultation is included in the Forest Management Plan of each FMU, and is also a part of forest certification requirements.
- Several projects / initiatives implemented by the department also included stakeholders consultations to increase their participation and awareness in forest management and conservation, such as the following:
  i) Sabah FLEGT /TLAS implementation process;
  ii) Appointment of a Technical Working Group (TWG) under the Government of Malaysia-UNDP-GEF Project entitled "Biodiversity Conservation in Multiple-Use Forest Landscapes Management in Sabah".

iii) State Level Heart of Borneo (HoB) Meeting to monitor the implementation of the Strategic Plan of the Heart of Borneo Project Initiative in Sabah;
iv) Consultation with various parties in the implementation of the Forever Sabah Initiative; and
v) Various stakeholders' consultation and workshops for the planning of the EU-REDD+ project in Sabah entitled "Tackling Climate Change through Sustainable Forest Management and Community Development".

- The department has also carried out training involving communities for activities as follows:
  i) In 2012, Forest Fire Prevention and Suppression Training was conducted for one forest plantation company and three FMUs i.e. Acacia Forest Industry (AFI) in Bengkoka, Pitas, Bornion Timber Bhd. in Sook, Keningau, Sabah Forest Industries (SFI) in Sipitang and Sapulut Forest Development (SFD) Sdn. Bhd. in Sapulut. In July 2014, the same training was held at Pitas Nursery.
  ii) Training on the concept of Sustainable Forest Management was held in April 2013 for target groups in the nearby oil palm plantations, teachers, JKKKs and Ketua Kampungs of the Timimbang-Botitian SFM Project. They are directly or indirectly involved in the project area and are mostly residing adjacent to the project area.

1.5 Community forestry in improving livelihoods be accorded greater emphasis in sustainable forest management;

- The department has implemented various social/ community related forestry projects, such as the following:

a. Gana Social Forestry Project – Started in 2006, the SFD had facilitated access to financing and provided better infrastructure such as, better road access and housing for those who needed them most at the Gana Resettlement and Integrated Development (GRID) Project located in Kg. Gana (adjacent to Lingkabau Forest Reserve). Funding for this project came from the 9th Malaysian Plan and the Community Forestry Cess Fund. The department will continue its presence in Kg. Gana and Lingkabau Forest Reserve through the EU-REDD+ Project (2013-2016).

b. Social Forestry Project in Kelawat Forest Reserve, Kota Belud - In 1992, the department introduced a "win-win" solution to the local communities living adjacent to Kelawat Forest Reserve, whereby the local communities were invited to be partners in the management of KFR through a "Joint Forest Management" (JFM) initiative. This is a collaborative approach by adopting the agroforestry system, which is the planting of multiple crops and trees on the same piece of land in order to address the basic subsistence needs of the local communities, while at the same time, restoring and conserving biodiversity. The project reveals that there is a commitment from the participants to continue their attempts to make the project sustainable. On 24th May 2014, twenty-one families of traditional farmers were granted permission to occupy part of the Kelawat Forest Reserve for 20 years. The permit was granted over 130ha of the 229 ha that make up the reserve, on condition that the families abide with traditional farming and in return they participate in the forest rehabilitation process and maintain the forest.

c. Establishment of KOPEL Bhd. at Mukim Batu Puteh Kinabatangan – The villagers of Batu Puteh, Kinabatangan initiated the MESCOT Initiative in 1996, in response to the establishment of a protected area – the Lower Kinabatangan Wildlife Sanctuary – which stretches more than 160 km along the Lower Kinabatangan. In 1996, tourism was seen as a potential source of income and employment, particularly for the many unemployed youths within the village. The MESCOT initiative was developed with support from the Sabah Ministry of Tourism and Environment Development (as it was known at the time), in close cooperation with the Sabah Forestry Department and WWF. The initiative was given the mandate to assist the local community to plan ecotourism activities, and build local human capacity to manage these activities. MESCOT was the name decided by the villagers involved, mostly unemployed youths from the Mukim Batu Buteh, which make up the Batu Puteh Community. In 2002, after two years of operation, the village tourism associations (established by the MESCOT Initiative), decided to amalgamate and establish a community-based cooperative. The cooperative was registered in July 2003 and is known as KOPEL Bhd. (short for "*Koperasi Pelancongan Mukim Batu Puteh Kinabatangan Bhd.*"). The community group involved in the establishment of the MESCOT Initiative was absorbed by KOPEL Bhd. to continue their role in coordination, training, administration, and communication. The original conservation agenda of the MESCOT Initiative was also maintained by KOPEL Bhd. In this respect KOPEL Bhd. has continued to develop the community forestry and forest habitat restoration activities. Today, through continuous effort, KOPEL Bhd has emerged as one of the key players in ecotourism and environmental conservation in Kinabatangan. This reputation has gained the recognition by the Sabah Forestry Department that the cooperative is a reliable partner in conserving and in the wise use of Pin Supu Forest Reserve.

d. Mangkuwagu Forest Reserve – This forest restoration project involves the direct engagement of the local community in the field work i.e. line preparation, holing and planting etc. As of 2012, a total of 134,220 rubber seedlings were planted by the village participants, covering an area of 298 ha.

e. Tamparuli Forest Reserve – The Joint Forest Management Project (JFMP) aims to rehabilitate the degraded part of the forest reserve involving two villages through the Village Agroforestry Committee. On degraded lands, fast growing tree species were inter-planted with high quality cash crops. In addition, farming activities such as rearing of marketable and good quality chicken, fish, mushrooms and bee-keeping were also introduced.

f. Deramakot, Tangkulap & Sg. Pinangah Forest Reserve:

- ✓ The three (3) forest reserves are managed by the Deramakot District Forestry Office. Since there are villages located adjacent to these forest reserves, a Social Forestry Committee (SFC) was formed in each village. The main role of the SFC is to act as a vehicle to communicate between the villagers and the forest managers pertaining matters related to local forest administration. During the year 2012-2013, there were 3 meetings involving SFC in each village, NGO, the relevant government agencies and the Deramakot District Forestry Office. Issues discussed were mostly confined to

the aspect of social forestry. Common issues raised and discussed were employment in Deramakot FR, gravity piped water, human-animal conflicts, forest protection, human resource development and road access.

- ✓ The Tangkulap /Pinangah FR FMU17A Social Forestry Committee which was formed in 2007 comprises community members from four villages located adjacent to the forest reserve. The main objective of the committee is to instill awareness on the importance of forest restoration and conservation as well as to garner support of the villagers in matters relevant to the management of FMU 17A. The Social Forestry Committee convened 5 times from the year 2012-2014. Capacity building courses, handicraft course, were organized during the year 2014 for selected representatives from the four villages.
- ✓ Handicraft and Swiftlet Farming Training courses were also conducted for the members of Social Forestry Committee of the Deramakot Forest Reserve. The participants were from 4 villages namely Kg. Balat, Kg. Desa Permai, Kg. Tulang-tulang and Kg. Kuamut.

1.6 Leadership at the highest level be constantly updated on the importance and the state of implementation of forest management certification to enhance their continued commitment and support.

- There are various platforms used to update the highest level leadership on the importance and the state of implementation of forest management certification e.g. State Legislative Assembly and weekly Post-Cabinet Meetings, which are attended by the Director of Sabah Forestry Department, and various other meetings, seminars etc.
- The department also periodically reports to the Chief Minister of Sabah on the statistics of compliance by the SFM License Agreement (SFMLA) holders. Annual 'Compliance Certificate Awards' were presented to the SFMLA holders who had complied with the SFM principles and SFMLA conditions. In 2011, 2012 and 2013, a total of 15, 26, and 30 SFMLA holders, respectively, were awarded the Compliance Certificate by the department.
- Awards for the licensees were presented in the presence of the Chief Minister.

RESOLUTION 2: Recognizing the increasing demand on forests for recreation and ecotourism activities, the Conference resolved that:

2.1 Consolidated efforts be intensified to enhance capacity building, promotion and marketing of forest recreation and ecotourism areas;

- Sabah Forestry Department has been working together with the relevant authorities, such as Ministry of Tourism, Culture and Environment, Sabah Tourism Board, local councils and local communities in capacity building, promotion and marketing of forest recreation and ecotourism areas.
- The department has also intensified efforts to promote forest recreation and ecotourism areas, i.e. (i) products development within forest reserves under the 10th Malaysia Plan; (ii)

monitoring the revenue generated from visitors; and (iii) active participation in meetings related to eco-tourism issues and development.

- Nature centres in the forest reserves have been developed for ecotourism activities since the Ninth Malaysia Plan. About RM60.58 million has been invested thus far for the development of 22 sites throughout the state since 2008, to promote forest recreation and ecotourism activities. These sites are listed below:

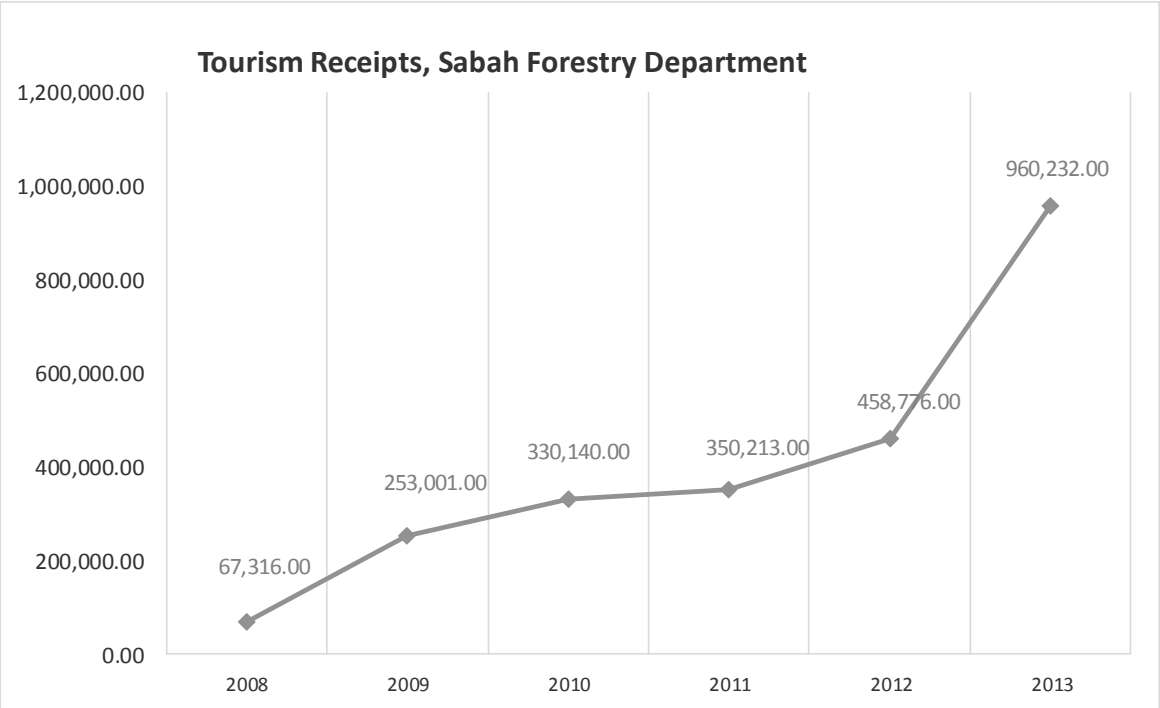
Nature Centre/ Ecotourism Sites within Forest Reserve	Forestry District
1) Padas Damit Forest Reserve, known as Klias Peninsula	Beaufort
2) Rainforest Discovery Centre (RDC)	Sandakan
3) Tower of Heaven, Mount Silam	Lahad Datu
4) Kawang Information Centre	Kota Kinabalu
5) Rafflesia Information Centre	Tambunan
6) Pin Supu FR – KOPEL	Kinabatangan
7) Sapagaya Waterfall	Lahad Datu
8) Mt. Trus Madi • Tambunan • Keningau	 Tambunan Keningau
9) Tabin Wildlife Reserve	Lahad Datu
10) Madai Nature Centre	Kunak
11) Deramakot Field Centre	Deramakot
12) Klias Peat Swamp Field Centre	Beaufort
13) Ulu Kukut Stop-By Centre	Kota Belud
14) Kota Marudu Recreation Site	Kota Marudu
15) Mangrove Discovery Centre	Sandakan
16) Rumbia Information Centre	Beaufort
17) Bukit Gemok Information Centre	Tawau
18) Membalua Recreation Site	Tawau
19) Lok Kawi Botanical Garden	Kota Kinabalu
20) Lungmanis Information Centre	Sandakan
21) Sandakan Rainforest Park	Sandakan
22) Gunung Tingkar, Sg. Pinangah FR	Tongod

2.2 Economic opportunities be further developed for revenue generation and employment;

- The department has developed nature centers within the Forest Reserve, for the purpose of public awareness and also to collect revenue through the collection of entrance fees.
- As part of the efforts to diversify forest revenue, entrance fees and other administrative charges or services in the forest reserves were collected since 2008, under the Fees Enactment 1981(2nd Revision). Since 2008, the annual collection of revenue has been on a steady increase. As of 2013, about RM 2.42 million had been collected from twenty (20) forest nature centres in Sabah. The collection in 2013 recorded a 109.70% increase compared to

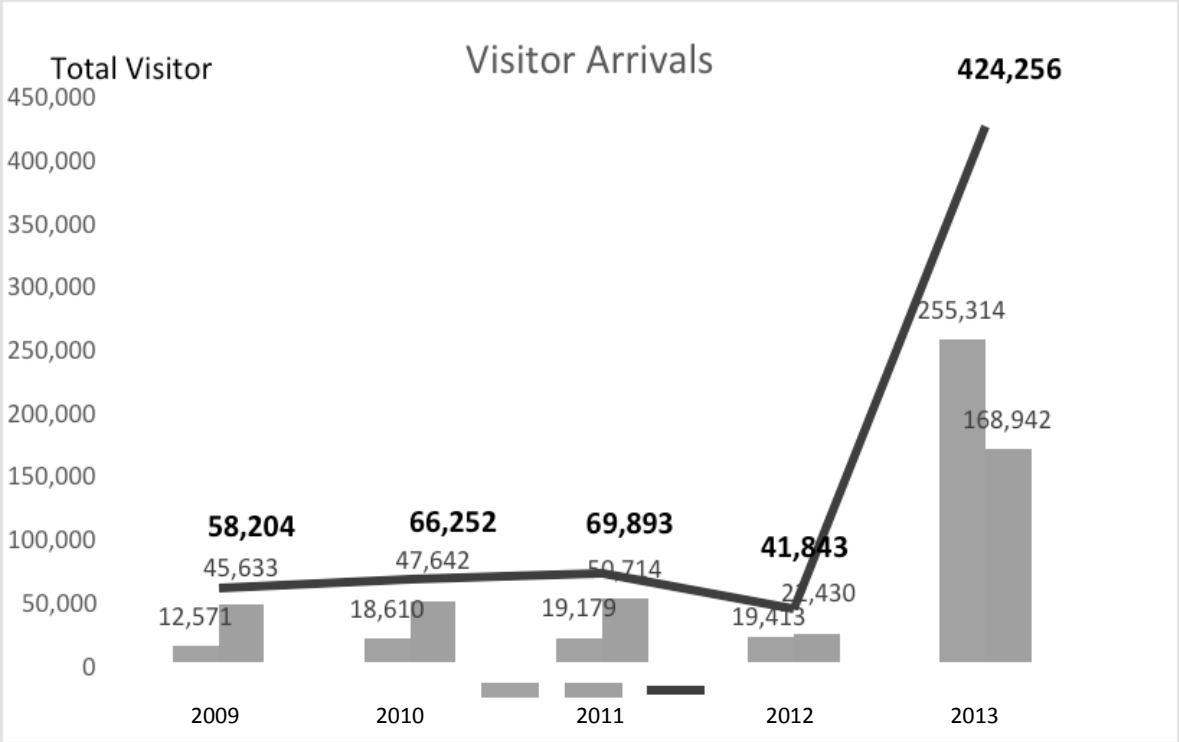
2012 (as per Table). This trend shows a positive outlook for generating direct revenue for the State.

Year	Revenue (RM)
2008	67,316.00
2009	253,001.00
2010	330,140.00
2011	350,213.00
2012	458,776.00
2013	960,232.00
TOTAL	**2,419,678.00**



Throughout the year 2013, the department has received 334.7 per cent increase in tourist arrivals or 424,256 visitors compared to year 2012, the highest growth ever recorded since 2009.

Year	Visitor Arrivals		
	International	Local	Total
2009	12,571	45,633	58,204
2010	18,610	47,642	66,252
2011	19,179	50,714	69,893
2012	19,413	22,430	41,843
2013	255,314	168,942	424,256
TOTAL	**325,087**	**335,361**	**660,448**



2.3 Greater participation of local communities be encouraged;

- In Tambunan, local folks from Kg. Sinua were hired as guides to climb Mt. Trus Madi.
- At the Klias Peat Swamp Field Centre, Beaufort, the department promotes conservation and awareness initiatives to the general public. The centre also accommodates eco-tourism activities and has hosted several functions organized by various parties related to the preservation of the peat swamp ecosystem.
- In Kinabatangan, the Community Ecotourism Co-operative (KOPEL BHD) is established as a community Ecotourism Cooperative of the Batu Puteh Community located at the villages of Batu Puteh, Lower Kinabatangan and comprises 4 villages namely Batu Puteh Village, Mengaris Village, Perpaduan Village and Singgah Mata Village. KOPEL was formed to amalgamate a number of separate village ecotourism associations such as Mescot, Mayo do Talud Boat Services, Wayon Tokou Nature Guide Service, Mescot Culture Group and Tulun Tokou Handicrafts Association as well as Miso Walai Village Homestay which is based at the KOPEL Office at Mengaris Village comprising more than 35 families homestay.
- Local communities and students around the Kelawat Forest Reserve are encouraged to come and learn about the collaboration between the department and the communities residing within the forest reserve in undertaking agro-forestry project within the allocated area of Kelawat Forest Reserve.
- Villagers with an interest in forest related work are recruited as staff on a case by case basis.
- Promising rural entrepreneurs are given contracts to carry out forestry operations under the concept of “Kampong Taukehs”.

2.4 Potential ecotourism areas be explored and further developed.

- More facilities have been provided at the Sandakan Rainforest Park, Tower of Heaven (Mount Silam) Lahad Datu, and Rainforest Discovery Centre (RDC).
- The department continues to explore with interested parties especially those in the tourism industry to develop new tourism sites.

RESOLUTION 3: Recognizing the important roles of forests in mitigating the adverse effects of climate change, the Conference resolved that:

3.1 Concepts, policies, initiatives and research activities related to climate change and the roles of forests be revisited, explored and/or intensified;

- The Sabah Forestry Department has been actively involved in the greenhouse gases inventory under the Land Use, Land-Use Change and Forestry (LULUCF) sector.
- In research, a study on carbon stock assessment in forest plantation was undertaken.
- In pursuance to the formation of the Sabah REDD+ Operational Taskforce and four sub-groups under the Technical Committee in late 2012, a meeting with the relevant agencies was held in early 2013, where the members agreed to adopt the National institutional arrangement for REDD+ implementation.
- The department had also attended several REDD+ related meetings and workshops organized by the Federal Government, in efforts to streamline the sub-national and national REDD+ development.
- The department has also initiated a project on REDD+, funded by the European Union (EU), on "Tackling Climate Change through Sustainable Forest Management and Community Development". The project took of in December 2013. This 4-year programme aims to contribute to the sustainable and low-carbon development of the State of Sabah. The programme is community-oriented and focuses on three demonstration sites, i.e. Kampung Gana in Kota Marudu, Kinabatangan and Ecolinc Kinabalu Zone. EU experts will work closely with the Sabah Forestry Department, and implementing lead partners, i.e. Sabah Wildlife Department and Sabah Parks, as well as with other government agencies, including several community-based organisations such as PACOS and village based cooperative KOPEL to develop the REDD+ policy, environmental & social safeguards (ESS), and monitoring, reporting and verification (MRV) system based on the experiences drawn from the demonstration sites.

3.2 Roadmap at national and sub-national level for REDD+ and/or other climate change mitigation and adaptation measures be formulated and implemented;

- The department has been working closely with the Federal Government and WWF-Malaysia to formulate the Sabah REDD+ Readiness Roadmap, since 2011. The project is still on-going.

3.3 Adequate funding and technical support be made available to mitigate adverse effect of climate change, including the use of renewable energy.

- In 2013, the department signed the Contract with the European Union (EU) on the "Tackling Climate Change through Sustainable Forest Management and Community Development" programme. The 4-year programme aims to contribute to the sustainable and low-carbon development of the State of Sabah, with total funding of EURO 4 million from the EU.
- The department has also started using green energy, such as solar power. The Rainforest Discovery Centre, some street lights at the Forest Research Centre, Sepilok and Sandakan Rainforest Park are some examples of facilities powered by solar energy which is environmentally friendly. More of these will be implemented in the future by the department.
- Experts are being identified to assist the department to mitigate the adverse effect of climatic change, which includes innovation approaches on forestry and communities living at the fringes of the Forest Reserves (Community Forestry).

RESOLUTION 4: Recognizing the significance of forest biodiversity and conservation, the Conference resolved that:

4.1 Actions be taken to further document forest biodiversity and enhance the protection of areas with high conservation values;

- Under the Heart of Borneo (HoB) Initiative (from 2012 onwards), scientific expeditions have been conducted in 7 forest reserves in Sabah, for the formulation of forest management plans. Some of the findings of the expedition have been published and presented in international conferences.
- HCVF assessments in various forest reserves were undertaken as requirements under Forest Certification.
- The State has thus far declared about 1.35 million ha or about 20% of the State's land area under TPAs, which surpasses the IUCN's requirement of 10%. The State Government has set a target of 30% of TPAs within the next 10 years.
- Sabah may have an additional area of 200,000ha of TPAs before the end of 2014.

4.2 Efforts be intensified to harness forest biological resources for sustainable economic purposes;

- Given the growing importance of the conservation of biological resources, a project entitled "Biodiversity Conservation in Multiple-Use Forest Landscapes Management in Sabah, Malaysia" was commisioned in 2012. This project is funded by the Global Environment Facility (GEF) through the UNDP with the objective to institutionalize a multiple-use forest landscape planning and management model which brings the management of critical protected areas and connecting landscapes under a common management umbrella that is sustainably funded by revenues generated within the area.
- The project will meet this objective by achieving three interconnected outcomes: (1) provisioning of an enabling environment for optimized multiple use planning, financing, management and protection of forest landscape; (2) demonstration of multiple-use forest landscape planning and management system, and (3) demonstration of innovative sustainable financing methods for multiple-use forest landscape management.
- The project is a six-year project, commencing June 2012 and is expected to be completed in 2018. The total project cost is about US$23.9 million, with GEF contribution of US$ 4.4 million.
- In addition to the above, research has been carried out on native ornamental plants and improving genetic materials in forest plantations for sustainable economic purposes; and exploration of plant and insect diversity in support of ecotourism.

4.3 Formulation of mechanisms for Access and Benefit Sharing (ABS) of biological resources, notably for the local and indigenous communities, be fully supported;

- Relevant initiatives carried out by the department with regard to ABS are as follows:
  - ✓ Standard Operation Procedure (SOP) for ABS with villagers, especially Kg. Desa Permai, Deramakot was formulated by Deramakot Forestry Office.
  - ✓ An MoU was signed between Sabah Forestry Department and KOPEL Bhd, a community based organization (CBO), for the implementation of the community eco-tourism project at Kg. Batu Puteh, Kinabatangan.
  - ✓ EU-REDD+ programme, which started in 2013, aims at the defining role of local communities in REDD+ implementation and to identify means to reward the communities for doing so under international funding. This project involves 3 pilot areas i.e. Kampung Gana in Kota Marudu, Kinabatangan and Ecolinc Kinabalu Zone.

4.4 *Ex-situ* conservation of rare, endangered and threatened species in suitable locations be accorded greater emphasis;

- Research is being conducted on Bornean endemic dipterocarps and native ornamental plants, including propagation of selected species for conservation purposes.
- Danum Valley Borneo Rhino Sanctuary (DVBRS) was completed in 2014 to provide a natural environment for rhinos, facilitate breeding programs to increase the number of rhino births, and promote environmental education programmes towards rhino conservation in

Sabah. This sanctuary was funded by the forestry companies through the Sabah Forestry Department, Yayasan Sime Darby, Yayasan Sabah and BORA.

- A collaborative research project between Danau Girang Field Centre (DGFC), Sabah Wildlife Department, and Oxford University on wild sun bears in Kinabatangan started in May 2013.
- The department, in collaboration with the Sabah Wildlife Department and LEAP, established the Borneo Sun Bear Centre at Sepilok, Sandakan in 2008. The centre acts as a two-stage effort to provide the care, rehabilitation and release of orphaned and captive sun bears, as well as to address the lack of knowledge and awareness of this little-known bear both in Malaysia and internationally. There are currently 33 rescued bears living at the BSBCC which has 2 bear houses, a quarantine building and a number of forest enclosures.

4.5 Conservation Education and Public Awareness (CEPA) initiatives be further enhanced to promote forest biodiversity and conservation.

- Many programmes on environmental education promoting forest biodiversity, involving many schools in Sabah have been organized, e.g. 3rd Malaysian EE Conference & EE Race. Besides students, teachers and university students, local communities are also involved.
- The list of Environment Education (EE) programmes conducted by the department in 2012-2014 is as follows:

Environment Education Programme in 2012			
Month	**Date**	**Activities**	**Number of participants**
Jan	12	New trainees intake of Forestry Training School, Telupid	27 trainees
March	16th	Bird Race in conjunction with school break	25 Junior Rangers, 5 staff & 6 interns
	22-24th	EE Exchange Program Between KEEP of Japan-RDC of Malaysia-Taiwan through Video Conferencing at Kiyosato, Japan.	1 Junior Ranger: Marshall Neo Petol & 8 students from Sandakan.
May	20th	Ist meeting for World Environment Day (WED) preparation	Not available
	26th	Final meeting for World Environment Day preparation	Not available
June	4-8th	WED Camp on HoB at Klias Peat Swamp Forest Field Centre	38 Junior Rangers & 8 staff
	21st – 22nd	Environmental Education Programme for Tadika Kemas Kg Tinusa & Little Play School with Montessori Guide Education	191 students
July	5th	Environmental Education Programme for Tadika Kemas Fajar	32 students
August	6th	Environmental Education Programme for SMK Perempuan Sandakan	18 students

Sept	24-29th	Jr Rangers lead the Children's forum on " Why students are not interested in the environment" during the 3rd Malaysian Environmental Education Conference at RDC	7 Junior Rangers led 25 other students.
Nov	17th	Seed propagating activity at RDC nursery	21 Junior Rangers & 10 staff
Environment Education Programme in 2013			
Jan	19th	Janakalynakasa Welfare Trust	24 students and 13 accompanying officials
	19th	Talk on Forest Conservation for LaVerne University	14 students and 4 lecturers
	27th	University Malaya (OKU)	8 students and 4 lecturers
February	28th	Taman Didikan OKU Sandakan Syaidatul	6 students and 4 teachers
March	2nd	Tree Planting activity by Wanita UMNO (Together with OKU Kids)	40
April	20th	SMK Merpati	27 students and 3 teachers
	26th	SK Batu Puteh, Kinabatangan	32 students and 10 teachers
May	11th	Tabika Taman Samudera	32 students and 4 teachers
	18th – 19th	Teacher's Environmental Education Exchange Programme with Sampoerna School of Education of Indonesia	10 teachers (Sandakan) & 20 teachers (Indonesian)
	22nd	SMK Sandakan	48 students and 6 teachers
June	6th-8th	Children's Bird Camp in conjunction with the Borneo Bird Festival 2013	26 children
	12th	SMK Batu Sapi	98 students and 8 teachers
	15th	Exotic tour group	4 students and 19 lecturers
	19th	Education Department (Kinabatangan Branch)	16 students and 5 officials
	20th	Taski Abim	120 students and 4 teachers
	27th:	Heart of Borneo Roadshow - Sipitang	200 participants
August	24th	Students from China	5 students and 2 teachers
Sept	21st	Semarak Tari group, Sabah	47 students and 11 teachers
	23rd	SK Lidong, Beluran	9 students and 6 teachers
Oct	4th	Tabika Kemas Sg. Tiram and Tabika Kemas Bt. 18	26 students and 10 teachers
	5th	SJKC Pai Sheng, Kunak	42 students and 12 teachers
	9th	Heart of Borneo Roadshow – Lahad Datu	200 participants
	10t	SK Sg. Anib III (OKU)	13 students and 7 teachers
	19th	PLKN Treasure Hunt activity	75 students and 6 trainers
	22nd	SK Muhibbah (OKU)	5 students and 4 teachers
Nov	7th	Kolej Vokasional, Sandakan	30 students and 7 teachers
	9th	SK Paris, Kinabatangan	47 students and 3 teachers
	14th	SK Pamol, Sandakan	31 students and 4 teachers

Dec	5th	MS undergraduate (A talk on RDC)	120
	11th	Sabah Association for Buddhist Mission, Sandakan	25 students and 10 officials
	17th	MRSM Sandakan	6 students and 41 teachers
	21st	Anak Yatim Islam Tawau	43 students and 19 officials
Environment Education Programme in 2014			
Feb	17th – 22nd	Training Course on Interpretation Basics and Birding' for Yayasan Sabah Field Centre Environmental Education Staff.	25 participants
March	8th	EEP for IPG, Kota Kinabalu	20 students and 1 official
	10th-14th	Training on 'Mereka Bentuk Program dan Aktiviti Pendidikan Alam Sekitar' for KOPEL – Batu Puteh, Kinabatangan	6 participants
April	12th	EEP for SM Sung Siew	120 students and 15 teachers
	12th	Briefing for International School KL	20 students
	15th	EEP for Tabika Kemas Sepilok	10 students and 2 officials
	16th	EEP for Pusat Pendidikan Islam Integrasi Al-Fateh Sabah	11 students and 5 officials
	19th	EEP from MRSM Tawau	31 students and 6 teachers
Mei	10th:	EEP for SMK Elopura II	29 students and 3 teachers
	15-18th	Conducted EE activities during the Hari Belia Peringkat Negeri, organised by SEEN, Ranau.	100
	24th:	EEP for SM St. Cecilia	39 students and 11 teachers
	24th:	EEP for SK Fajar Harapan	47 students and 6 teachers
	27th:	EEP for Tadika Pelangi Methodist Sandakan	70 students and 5 teachers
June	18th	Forest Conservation talk for the University Miami 1st group	19 students and 2 lecturers
	30th	Forest Conservation talk for University Miami 2nd group	20 students and 2 lecturers
July	19th	Interpretation course for tourism students of SMK Sandakan	14 participants
August	19th – 21st	Ramsar CEPA Kit Training for community	23 participants
	30th	EEP for SK St. Monica	117 students and 27 teachers
Sept	6th	EEP for Cheshire Home	29 students and 3 officials
	11th	EEP for Tabika Istimewa	42 students and 4 officials

RESOLUTION 5: Recognizing that R&D and innovations are crucial towards realizing sustainable forest management, the Conference resolved that:

5.1 State-of-the-art technologies and innovative approaches be further explored and utilized as tools to enhance forest management and conservation as well as the forest industry;

- In research, the Ecological Niche Modelling was developed to study the endemic dipterocarp distribution as well as other endemic plants.
- Renewable energy is used in some of the research equipment.
- Application of LiDAR technology for carbon stock assessment is being conducted.
- The department has also piloted the use of Unmanned Aerial Vehicles (UAVs) for monitoring.

5.2 The utilization of the rich biological diversity be further optimized for the development of herbal, ornamental, cosmetic and pharmaceutical products through the application of appropriate biotechnology;

- The phytochemistry laboratory has been set up for herbal and as other related studies.
- Propagation of ornamental plants, such as orchids, pitcher plants and begonias has been conducted.
- Research on improvement of tree planting materials, such as Laran and Binuang was carried out.

5.3 Capacity building to enhance professionalism and expertise be further intensified;

- Many researchers, officers and staff have attended both international and local conferences, seminars, training workshops and courses to enhance their skills in R&D and innovations in SFM.
- The no. of conferences, seminars, workshops and training courses attended by SFD officials in 2012 and 2013 are as per listed below:

Year	No. of Conferences / Seminars / Workshops / Courses attended	No. of SFD officials participated in Conferences / Seminars / Workshops / Courses
2012	119	220
2013	111	241

5.4 Cooperation and collaboration among researchers, forest managers, practitioners and other stakeholders be enhanced and synergized.

- Sabah Forestry Department has been proactive in establishing collaboration with various institutions, individual experts and other forestry stakeholders in realizing SFM. Among them are Center for Ecological Research, Kyoto University (CERKU), International Society for

Mangrove Ecosystems (ISME), Royal Society, Stability of Altered Forest Ecosystems (SAFE) Project, University Malaysia Sabah (UMS) and all the FMU holders.

- Since 2007, the department has entered into 33 Memorandum of Understanding (MoUs) with several partners, to implement various conservation related projects involving an accumulated investment of about RM 91 million. The list of the MoUs entered is as follows:

	Local / Foreign Organization	Duration / Objectives	Status	Funding (RM)
		2007		
1.	Global Eco-Rescue Foundation LTD	*Duration: 6 months* To explore the possibility of creating tradable carbon offset credits in support of forestry conservation and reforestation efforts in Sabah	Completed	
2.	WWF-Malaysia Forest and Trade Network (MFTN)	*Duration: 2 years* To obtain credible certification for Tangkulap-Pinangah Forest Reserves (FMU 17A)	Completed	
3.	The Hongkong and Shanghai Banking Corporation (HSBC) Bank Malaysia Berhad	*Duration: 2 years* Giving Orang Utans Permanent Home in Deramakot Forest Reserve	Completed	200,000
4.	Malaysian Palm Oil Council (MPOC)	*Duration: 3 years* 1) To establish a mobile unit for wildlife enforcement & monitoring team in FMU 17A, 2) Research on the diversity of ground vegetation in a given oil palm plantation in Sabah, and 3) Producing Tabin Wildlife Reserve & Publication Guide Book, Promotional Video and Educational Posters.	Completed	456,810
		2008		
5.	Center for Ecological Research, Kyoto University, Japan	*Duration: 5 years* Research on the disturbance and recovery of tropical forests	In progress	1,352,076
6.	Lands Empowerment Animals Planet (LEAP)	*Duration: 5 years* Establish Bornean Sun Bear Conservation Centre (BSBCC) at Sepilok, Sandakan.	Extended for another year to November 2014	
7.	The Nature Conservancy – TNC	*Duration: 4 months* Develop HCVF report for FMU17A	Completed	74,000 **USD 20,000*
8.	Global Forest and Trade Network (GFTN-Malaysia)	*Duration: 2 years* Obtain credible certification for Ulu-Segama Malua Forest Reserves	Completed	

9.	WWF-Malaysia (Marks & Spencer, United Kingdom)	*Duration: 1 year* Forest restoration in Northern Ulu Segama	Completed	170,000
10.	EU Member States, i.e. Germany & Netherlands via Malaysian Timber Council (MTC)	*Duration: 3 years* Development & implementation of an Independent Auditing System for Sustainable Forest Management License Agreement in Sabah / Malaysia with reference to Malaysian Legality Criteria set for the VPA/FLEGT process "*Sabah Independent Auditing of SFMLA*"	Completed	305,250
11.	Sime Darby Plantation Berhad	*Duration: 10 years* Forest rehabilitation & protection project in the Northern Ulu Segama Forest Reserve	In progress	25,000,000
12.	New Forests Asia	*Duration: 6 years* Support the conservation of Malua Forest Reserve through the creation of the Wildlife Habitat Conservation Bank as a commercial business.	In progress	33,000,000.00 USD$ 10 mill
2009				
13.	WWF-Malaysia	*Duration: 3 years* Forest restoration project in Northern Ulu Segama through the funds made available by Adessium Foundation of the Kingdom of Netherlands	Completed	2,024,000
14.	WWF-Malaysia	*Duration: 5 years* Forest restoration project in Northern Ulu Segama through the funds made available by ItoChu-Japan	In progress	4,254,800
15.	PPB Oil Palms Berhad	*Duration: 5 years* To restore riparian reserves at Segama Wetlands	In progress	
2010				
16.	The Royal Society, South East Asia Rainforest Research Programme (SEARRP)	*Duration: 5 years* Renewal and extension of SEARRP's research work in Danum Valley	In progress	
17.	Hap Seng Building Materials Sdn Bhd	*Duration: 30 months* To (1) recruit field workers for forest rehabilitation and protection works, forest management activities and tree planting, and (2) to undertake the experimental "no net loss" voluntary endeavor of the department, by restoring at least 40	Completed	2,000,000

		hectares of degraded lands and forests		
18.	Rhino and Forest Fund E.V. (RFF)	*Duration: 5 years* To reforest Tabin Wildlife Reserve and establishment of forest and wildlife corridors between Tabin Wildlife Reserve and neighboring forest land	In progress	
19.	Sabah Wetlands Conservation Society	To restore and rehabilitate 7 hectares of mangroves in Sulaman Lake Forest Reserve with 24,000 mangrove seedlings.	Completed	
20.	Girl Guides Association Malaysia, Sabah Branch, Sandakan District	To develop Wilderness Park for Girl Guides Association Malaysia	Completed	
21.	WWF-GFTN	To obtain credible certification for FMU 23, FMU 24 & FMU 26, better known as the Kalabakan-Gunung Rara Forest Reserve, based on the FSC principles and criteria	In progress	
22.	International Society for Mangrove Ecosystems (ISME)	ISME will raise and provide the funds for mangrove rehabilitation activities in Sabah to be implemented by Sabah Forestry Department. First phase	Entering the 2nd phase (2014-2019)	*Phase I:* RM599,365.00 *Phase II:* ~ RM 846,175.00 (*Based on yearly allocation of 5.5 million Yen)*
2011				
23.	Leibniz Institute for Zoo and Wildlife Research (IZW)	*Duration: 4 years* Establish a wildlife monitoring program (short term wildlife inventories and long-term wildlife trend monitoring in different Forest Management Units (FMUs), managed by the SFD.	In progress	
24.	AEON (M) Sdn Bhd	*Duration: 5 years* Restore 80 hectares of degraded areas within Northern Ulu Segama	In progress	
25.	Agency Remote Sensing Malaysia (ARSM)	*Duration: 5 years* Map out Sabah's forest cover for REDD+ implementation	In progress	
26.	Sen Heng	*Duration: 3 years* To restore degraded compartment 111-15, 111-16A (46.15ha) and carry out maintenance works and restoration success assessment in Northern Ulu Segama	In progress	

27.	AEON Jusco	*Duration: 5 years* To restore degraded compartment 111-10, 111-18 (77.00ha) and carry out maintenance works and restoration success assessment in Northern Ulu Segama	In progress	
2012				
28.	State Government of Acre, Brazil, through WWF-Brazil	*Duration: 2 years* Jointly work on seven (7) areas of works such as (i) Sustainable Forest Management and Independent Certification, (ii) Innovative Incentives for Nature Conservation, (iii) Reforestation of Degraded Areas, (iv) Responsible Forest Plantation Development including Rubber and its production, (v) Protected Areas Development and Expansion, (vi) Research and Development in the Forestry Science, and (vii) Eco-Tourism.	In progress	
29.	Tropical Rainforest Conservation & Research Centre Bhd (TRCRC), wholly owned by Lanskap Malaysia	*Duration: 99 years* Establish a Living Collection Centre (LCC) for all tropical rainforest species in Malaysia and neighboring countries, including the set up of plant nurseries on the project site, as well as to further support the development and expansion of the department's existing facilities at the Forest Research Centre (FRC) for the purpose of this project.	In progress	
30.	Tropical Biosphere Research Centre, University of Ryukyus, Japan	*Duration: 5 years* Promote the following exchange activities based on their respective and educational needs: (1) exchange of staff members, (2) exchange of academic materials, publications and information, (3) joint hosting of seminars, conferences, and symposia, (4) joint research, and (5) other scientific exchanges, with a view to advance scientific research, education, cultural understanding, and to contribute to the mutual benefit and development of both parties.	In progress	
31.	IOI Corporation Bhd, Kwantas Corporation Bhd, Perbadanan Kemajuan Pertanian Selangor (PKPS) and Tung Hup Enterprise	*Duration: 5 years* Preventing illegal hunting activities, manage human-wildlife conflicts and improve environmental awareness in the oil palm plantations that are in proximity with the eastern and northern boundaries of Malua Forest	In progress	

		Reserve.		
2013				
32.	Permian Global Research Limited	*Duration: 6 months* To explore the feasibility of REDD+ implementation in the State. Under this MOU, a feasibility study will be carried out on selected forest reserves, i.e. Klias Wetlands, Ulu Kalumpang Forest Reserve and Kuamut Forest Reserve. Permian Global Research Limited, with the assistance from the Wetlands International and Royal Society, will recommend a business plan based on the feasibility study for the State Government's consideration when the MOU comes to its terms by mid 2014.	Completed	
33.	European Union (EU)	*Duration: 4 years* Under this contract, both parties will work together on "Tackling Climate Change through Sustainable Forest Management and Community Development" programme The 4-year programme aims to contribute to the sustainable and low-carbon development of the State of Sabah. The programme will specifically focus on communities in the areas of Kampung Gana in Kota Marudu, Kinabatangan and Ecolinc Kinabalu Zone. EU experts will work closely with the Sabah Forestry Department, and implementing lead partners, i.e. Sabah Wildlife Department and Sabah Parks, as well as with other government agencies, including several community-based organisations such as PACOS and village based cooperative KOPEL.	Progressing	EU 4 million

RESOLUTION 6: Recognizing the importance of fostering greater integrity, professionalism and dedication of forestry personnel, as well as in enhancing forest law enforcement towards sustainable forest management, the Conference resolved that:

6.1 The existing forestry legislations be kept up-to-date and relevant in line with the changing forestry environment and societal needs:

- Amendment of Forest Enactment 1968 and Forest Rules 1969 is on going to cater for the needs of good forest law and governance.
- Recent changes/ amendments made on the Forest Enactment 1968 are as follows:

Gazette Notification No.	***Sections amended***	***Dated***
1,211/2012	Section 3A of the Forest Enactment 1968: Appointment of Honorary Forest Rangers (23 persons of Malaysian National) for a period of three years, with effect from 1st July 2012 to 30th June 2015.	08.11.2012
4/2014	**Short title and commencement** 1. (1) This Enactment may be cited as the Forest (Amendment) Enactment 2013. (2) This Enactment comes into operation on 15 December 2013. Section 2 (definitions of "export ", "forest produce", "import", "permit") "export" means to take or cause to be taken out of Sabah, by land, sea or air to any place, any forest produce in a vessel, scow, conveyance or aircraft for the purpose of forest produce being taken out of Sabah by land, sea or air; "forest produce" means – *(a)* timber, firewood, charcoal, getah, wood oil, bark, extracts of bark, copal, damar and atap found in or brought from a Forest Reserve, State land or alienated land; *(b)* the following when found in or brought from a Forest Reserve or State land – (i) trees and any produce thereof, silk, cocoons, honey and wax; or (ii) carbon stored in trees or plants; *(c)* all vegetables and animal matters and products other than animals and animal products which are subject to the provisions of the Wildlife Conservation Enactment 1997 [*Enactment No. 6/1997*], and all minerals and mineral substances other than mineral oil and minerals	12.12.2013

Gazette Notification No.	*Sections amended*	*Dated*
	substances which are subject to the provisions of the Mining Ordinance 1960 [*Ordinance No. 20/1960*] found in or brought from a Forest Reserve or State land; *(d)* imported timber; "import" means to bring or cause to be brought any forest produce into Sabah, by land, sea or air but does not include *bona fide* transit of forest produce and transshipment of forest produce; "permit" in relation to the export and import of forest produce, means a certificate of approval issued by the Director; <u>Section 5(e)</u> Class V – Mangrove Forest – For supply of mangrove timber or other produce to meet the general demands of trade and for eco-tourism activities; <u>Section 42(1)(*b*)</u> (i) prohibiting or regulating, by means of permit, licence, registration or otherwise, the possession of, or any dealings in, specified types of forest produce; (iii) regulating or prohibiting the export and import of any forest produce and prescribing any fees and payments payable in respect thereof;	
S4/2012	In the exercise of the powers conferred by section 42 of the Forest Enactment 1968, the Chief Minister makes the following rules: **Citation and commencement** 2. (1) These rules may be cited as the Forest (Danum Valley Conservation Area)(Amendment) Rules 2012. (3) These Rules are deemed to have come into operation on 1 April 2012. **Amendment of rule 1** (2) The privileges and conditions declared in these rules shall apply to the area of the Danum Valley Forest Reserve as delineated on F.D. Plan No. 91/88C, Mount Louisa Forest Reserve as delineated on F.D. Plan No. 91/100, Bukit Piton Forest Reserve as delineated on F.D. Plan No. 77/123 and Sungai Taliwas Forest Reserve as delineated on F.D. Plan No. 78/171 (hereinafter called "the Reserve").	22.11.2012

Gazette Notification No.	*Sections amended*	*Dated*
S5/2012	In the exercise of the powers conferred by section 42 of the Forest Enactment 1968, the Chief Minister makes the following rules: **Citation and commencement** 3. (1) These rules may be cited as the Forest (Maliau Basin Conservation Area)(Amendment) Rules 2012. (4) These Rules are deemed to have come into operation on 1 April 2012. **Amendment of rule 1** (2) The privileges and conditions declared in these rules shall apply to the area of the Maliau Basin Forest Reserve as delineated on F.D. Plan No. 91/88C and Maliau Buffer Zone Forest Reserve as delineated on F.D. Plan No. 102/94 (hereinafter called "the Reserve"). **Amendment of rule 2** *(j)* a representative of the Agriculture University of Malaysia; *(k)* a representative of the University of Malaysia Sarawak; and *(l)* a representative of the Sapulut Forest Development Corporation Sdn Bhd.	22.11.2012

6.2 Capacity building for forestry personnel in preparing investigation papers and tendering of evidences for forestry offences be enhanced

- In 2012-2014, the Sabah Forestry Department conducted six (6) training courses related to forest law enforcement for its personnel. The list of the training courses held and number of people trained are as follows:

No.	Year	Course Type	Title	No. of trainee
1	2012	Honorary Forest Ranger	Kursus Ranjer Hutan Kehormat di Institut Perhutanan Sabah, Telupid, 22-24 Okt 2012	35
2		Investigation and Prosecution	Kursus Penyiasatan dan Pendakwaan (Lanjutan & Ulangkaji) Bagi Pegawai dan Kakitangan Lapangan Wilayah Kota Kinabalu dan Kudat di (i) Hotel Sabah Oriental, Kota Kinabalu, 21-24 Mei 2012 dan (ii) Dewan Serbaguna Pusat Kraftangan Sabah, Keningau, 26-29 Mac 2012	118
3		Investigation and Prosecution	Kursus Pemantapan Siasatan & Pendakwaan Serta Kursus Pengumpulan Bukti dan	67

			Pengambilan Gambar (Exsibit) Di Tempat Kejadian Untuk Pegawai dan Kakitangan Lapangan Wilayah Tawau dan Sandakan di MB Hotel, Tawau, 11-13 Jun 2012	
4	2013	Honorary Forest Ranger	Kursus Renjer Hutan Kehormat di Sento Hotel, Keningau pada 6-8 Nov 2013	46
5		Investigation and Prosecution	Kursus Penyiasatan dan Pendakwaan (Lanjutan & Ulangkaji) Bagi Pegawai dan Kakitangan Lapangan (i) Wilayah Sandakan & Tawau di Institut Perhutanan Sabah, Telupid pada 11-12 Jun 2013 dan (ii) Wilayah Keningau, Kota Kinabalu dan Kudat di Tang Dynasty Hotel, Kota Kinabalu, 20-22 Ogos 2013	134
6	2014	Prosecution	Kursus "Hand on Training" Pemantapan Pendakwaan bagi Pegawai-Pegawai MCEE dan Pegawai-Pegawai Perhutanan Daerah Serta Pegawai-Pegawai Memegang Surat Kuasa Mendakwa di Hotel Tang Dynasty, Kota Kinabalu pada 21 Mac 2014.	33

- In addition to the above, the department has also allocated more funds for further training on forensic investigation and prosecution, which includes wildlife offences.

6.3 Information exchange on law enforcement be enhanced amongst the forestry agencies in Sabah, Sarawak and Peninsular Malaysia

- Several meetings and workshops were held amongst the forestry agencies to enhance information exchanges on experiences, lessons learnt and technical issues, for instance on the MAL-EU-FLEGT VPA Agreement and Timber Legality Assurance System (TLAS) related issues.

6.4 Innovative technologies and integrated approaches be employed to enhance the effectiveness of forest law enforcement.

- The department has adopted remote sensing technologies to enhance the effectiveness of forest law enforcement and piloted the use of Unmanned Aerial Vehicle (UAV) for monitoring.

4.4.2 REPORT ON ACTIONS TAKEN ON THE 16TH MALAYSIAN FORESTRY CONFERENCE - FORESTRY DEPARTMENT PENINSULAR MALAYSIA

NO	RESOLUTIONS	ACTIONS TAKEN
RESOLUTION 1: Recognizing that forest management certification is a meaningful yardstick for effective implementation of sustainable forest management, the Conference resolved that:-		
1.1	**All Forest Management Units be encouraged to fully undertake forest management certification under Malaysian Timber Certification Scheme (MTCS) or other credible internationally recognized scheme;**	In 2013, eight (8) FMUs in Peninsular Malaysia consisting of the state of Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu covering an area of 4.51 million hectares have undergone MC&I Re-certification Audit and MC&I Surveillance Audit as planned and had successfully retained the Forest Management Certificate.
1.2	**Frequent consultation amongst the forestry agencies in Sabah, Sarawak and Peninsular Malaysia be undertaken to facilitate the sharing of experiences gained in implementing forest management certification;**	Consultations had been undertaken through regular meetings to review the certification standard used in the MC&I (2002) document amongst the three forestry agencies in the Standards Review Committee (SRC) under the purview of Malaysian Timber Certification Council (MTCC). Experiences are shared through seminars and workshops.
1.3	**Adequate funding and technical support be made available to various components that contribute towards effective implementation of sustainable forest management;**	This has been done through budget allocations to FDPM and the State Forestry Departments from both Federal and State Treasuries. In 2013, a total of RM75.32 million comprising state and federal budgets had been allocated for Development Expenditure (DE) budget. Technical inputs with regard to improvement of MC&I standards are provided through the existing mechanism of the SRC of which FDPM is actively involved.
1.4	**Wider participation of, and consultation with relevant stakeholders in forest management and conservation be further encouraged;**	The MC&I is reviewed and updated every five (5) years based on feedbacks, research findings and experiences gained through its implementation in the field. Parties involved in this multi-stakeholder forum include the indigenous peoples and workers' union representing the social, environmental and economic interest groups, and the relevant government agencies.
1.5	**Community forestry in improving livelihood be accorded greater emphasis in sustainable forest management; and**	The communities living within or adjacent to the FMUs are given priority and opportunities for employment and contract works. Any issues related to the livelihood of the communities are discussed and resolved through meetings and consultations.
1.6	**Leadership at the highest level be constantly updated on the importance and the state of implementation of forest management certification to enhance their continued commitment and support.**	The National Land Council (NLC) chaired by the Deputy Prime Minister serves as a forum, among others to solve problems and issues regarding forestry policies, administration and management.

NO	RESOLUTIONS	ACTIONS TAKEN
		A paper entitled "Pemantapan Pelaksanaan Pengurusan Hutan Secara Berkekalan Melalui Pewartaan Cadangan Hutan Simpanan Kekal Di Semenanjung Malaysia" was tabled during the 68th National Land Council Meeting on 9 August 2012 to increase and maintain the PRF by the state authority in line with certification principle and criteria. At the departmental level, quarterly meetings are held to discuss and monitor the progress of MC&I implementation. These meetings are chaired by the Director-General of Forestry Department Peninsular Malaysia (FDPM) and attended by all State Forestry Directors as well as Division Directors of FDPM HQ. Apart from the above meeting, meeting among the state forestry MC&I officers has also been held to discuss the preparation of MC&I auditing during the first quarter of each year.
RESOLUTION 2: Recognizing the increasing demand on forests for recreation and ecotourism activities, the Conference resolved that:		
2.1	**Consolidated efforts be intensified to enhance capacity building, promotions and marketing of forest recreation and ecotourism areas;**	Several efforts undertaken by FDPM to consolidate and enhance capacity building, promotion and marketing of amenity forest and ecotourism are: i. Establishment of the Management and Development Committee on Amenity Forest and State Park Forest that focuses on the aspects of management and development of amenity forest and state park forest in Peninsular Malaysia; ii. Conduct courses on Hazard Tree Management; Interpretative Trail Management; Carrying Capacity, Limit Acceptance of Change (LAC) and Training on Management Plan of Amenity Forest and State Park Forest; iii. Distribute brochures, compendium/directory of amenity forest and state park forest for public reference and promotion; iv. Collaborate with Tourism Malaysia in distributing brochures on amenity forest and state park forest to hotels, resorts and shopping complexes; v. Collaborate with local broadcasting stations such as RTM, TV3, ASTRO in promoting the natural beauty of amenity forest and state park forest in Peninsular Malaysia;

NO	RESOLUTIONS	ACTIONS TAKEN
		vi. Disseminate up-to-date information on amenity forest and state park forest through FDPM's portal; vii. Conduct study tours to amenity forest and state park forest located locally and overseas to share information as well as to gain experience and knowledge on tourism management aspects; and viii. Upgrade infrastructure and development of amenity forest and state park forest through allocations received from Ministry of Tourism and Culture Malaysia (MOTAC).
2.2	**Economic opportunities be further developed for revenue generation and employment;**	Two newly identified potential amenity forests for privatization includes Ulu Bendol Amenity Forest in Negeri Sembilan and the Mata Ayer Amenity Forest in Perlis. These will enhance the economic opportunities of the local communities.
2.3	**Greater participation of local community be encouraged; and**	FDPM through the State Forestry Departments : i. Encourages the local communities to generate income by selling food, beverages and souvenirs to the public in kiosks built within the amenity forest and state park forest. ii. Privatizes the management of some existing facilities in the amenity forest and state park forest to the local communities.
2.4	**Potential ecotourism areas be explored and further developed.**	One amenity forest from each state has been identified as potential area to be developed as an ecotourism destination under the Tenth Malaysia Plan (2011-2015). In 2013, an allocation of RM12.75 million was received for the development of amenity forest and state park forest. In 2014, the total allocation was RM 18.2 million (Development Fund: RM 6.7 million; Cess Fund: RM 5.7 million and MOTAC Fund: RM 5.8 million).
RESOLUTION 3: Recognizing the important roles of forests in mitigating the adverse effects of climate change, the Conference resolved that:		
3.1	**Concepts, policies, initiatives and research activities related to climate change and the roles of forests be revisited, explored and/or intensified;**	The National Policy on Climate Change had been approved by the Government on 20th November 2009. The National Focal Point for climate change is the Ministry of Natural Resources and Environment Malaysia (NRE). Under the 26 Million Trees Planting Campaign, this campaign in Peninsular Malaysia from 2010 to 30 June 2014 achieved 21.09 million trees covering an area of 22,602 hectares. This achievement is also complemented by the Programme for the Planting of Mangroves and other

NO	RESOLUTIONS	ACTIONS TAKEN
		Suitable Tree Species Along the National Coastline since 2005 with the planting of 4,489,869 trees covering an area of 1,418 hectares. These two initiatives have contributed to mitigating the adverse effects of climate change.
3.2	**Road map at national and sub-national level for REDD+ and/or other climate change mitigation and adaptation measures be formulated and implemented; and**	The Draft National REDD+ Strategy has been developed by NRE with input from a series of workshops being conducted as follows: i. National Inception Workshop on REDD+: Building Capacity for Decision Makers and The Way Forward; ii. Workshop on Malaysia's REDD+ Readiness Project: Institutional Framework for Peninsular Malaysia; and iii. Workshop on Malaysia's REDD+ Readiness Project: Private Sector Engagement and National Stakeholder Consultation in which FDPM is actively involved.
3.3	**Adequate funding and technical support be made available to mitigate adverse effect of climate change including the use of renewable energy.**	FDPM is working with NRE in identifying potential sources of funding and technical support for forestry activities in climate change mitigation under the REDD+ initiative. Among the potential sources of funding are bilateral and multilateral funding and direct private investment. In addition, FDPM has also submitted project proposal entitled: "Avoided Emissions from Peat Swamp Forests and Ecological Connectivity in the Central Forest Spine, South-East Pahang, Malaysia" through NRE for funding under the Nationally Appropriate Mitigation Actions (NAMA) facility.
RESOLUTION 4: Recognizing the significance of forest biodiversity and conservation, the Conference resolved that:		
4.1	**Actions be taken to further document forest biodiversity and enhance the protection of areas with high conservation values;**	A total of 7 Proceedings on scientific expedition which document forest biodiversity had been published and disseminated since 2011. A total of 21 High Conservation Value Forest (HCVF) areas had also been established in Kedah, Perak, Selangor, Negeri Sembilan, Johor, Kelantan, Terengganu And Pahang for the protection of their high conservation values.
4.2	**Efforts be intensified to harness forest biological resources for sustainable economic purposes;**	FDPM ensures that harnessing of forest resources are economically sustainable by adhering to the existing rules and regulations.
4.3	**Formulation of mechanism for Access and Benefit Sharing (ABS) of biological resources, notably for the local and indigenous communities, be fully supported;**	FDPM is actively involved in the draft bill of Malaysia Access of Benefit Sharing, an act to implement the Convention on Biological Diversity (CBD) and related international agreements on access to biological resources and the sharing of benefits arising from their utilisation and for matters connected therewith.
4.4	**Ex-situ conservation of rare, endangered and threatened species in suitable locations be accorded greater emphasis;**	FDPM is fully committed to the ex-situ conservation of significant species with the establishment of arboretum, botanical garden, herb garden and genetic resource area.

NO	RESOLUTIONS	ACTIONS TAKEN
	and	
4.5	**Conservation Education and Public Awareness (CEPA) initiatives be further enhanced to promote forest biodiversity and conservation.**	Two seminars on the findings of forest biodiversity scientific expeditions have been conducted to promote forest biodiversity and conservation since 2011. Besides that, FDPM is also actively conducting exhibitions, forestry camps and conservation activities to enhance public awareness.
RESOLUTION 5: Recognizing that R&D and innovations are crucial towards realizing sustainable forest management, the Conference resolved that:		
5.1	**State-of-the-art technologies and innovative approaches be further explored and utilized as tools to enhance forest management and conservation as well as forest industry;**	FDPM will continue to seek cooperation with FRIM in this aspect. FRIM has conducted research in various fields of forestry ranging from natural forest, plantation forest, forest products and industries. Various innovations in the forms of techniques, technology and products have been developed and presented in seminars and published. FRIM was involved and engaged in various projects and meetings to discuss research needs related to forestry activities towards achieving SFM.
5.2	**The utilization of the rich biological diversity be further optimized for the development of herbal, ornamental, cosmetic and pharmaceutical products through the application of appropriate biotechnology;**	FDPM shall continue to collaborate with FRIM and other research institutions in this aspect.
5.3	**Capacity building to enhance professionalism and expertise be further intensified; and**	The "FDPM Training Policy" is formulated and adopted by the State Forestry Departments (SFDs) to address this issue. FDPM officers have been urged to go for their post graduate studies. Annually, six (6) officers are selected for further studies locally and abroad in various forestry fields. A short period attachment program of FDPM officers to FRIM and other research institutions is also under consideration.
5.4	**Cooperation and collaboration among researchers, forest managers, practitioners and other stakeholders be enhanced and synergized.**	This aspect is addressed at various meetings, dialogues and forum involving related parties such as *Jawatankuasa Pengurusan Bersama Jabatan Perhutanan Semenanjung Malaysia dan Institut Penyelidikan Perhutanan Malaysia, Jawatankuasa Penyelarasan Penyelidikan Perhutanan* (JPPP) and *Majlis Urusan Hutan Silvikultur* (MAJURUS).
RESOLUTION 6: Recognizing the importance of fostering greater integrity, professionalism and dedication of forestry personnel, as well as in enhancing forest law enforcement towards sustainable forest management, the Conference resolved that:		
6.1	**The existing forestry legislations be kept up-to-date and relevant in line with the**	FDPM is in the final stage to amend the National Forestry Act 1984 (amendment 1993). The amendment of the Wood-

<table>
<tr><th>NO</th><th>RESOLUTIONS</th><th>ACTIONS TAKEN</th></tr>
<tr><td></td><td>changing forestry environment and societal needs;</td><td>Based Industry Enactment 1986 (amendment 2009) has been submitted to the State Forestry Departments.

In addition, FDPM together with other relevant agencies and NGOs has taken the initiative to review the National Forestry Policy 1978 (amendment 1993). The draft of the amended policy will be discussed and reviewed by relevant parties at the ministerial level.</td></tr>
<tr><td>6.2</td><td>Capacity building for forestry personnel in preparing investigation papers and tendering of evidences for forestry offences be enhanced;</td><td>Investigation officers attached to the State Forestry Departments have been trained and given guidance by the Department to ensure proper investigation papers (IP) are prepared and tendering of evidence is executed as per the requirement of the prosecutors. These officers are constantly updated with the necessary tools/equipment as well as the Standard Operating Procedures (SOPs) to ensure complete IP’s are prepared.

Courses conducted are as follows:
<table>
<tr><th>Year</th><th>Courses</th><th>Date</th><th>Venue</th><th>No. of Participants</th></tr>
<tr><td>2012</td><td>Lab Penyelarasan Akta Perhutanan Negara 1984 dan Kaedah-Kaedah Hutan Negeri</td><td>21 - 23 Feb.</td><td>Kedah</td><td>25</td></tr>
<tr><td></td><td>Bengkel Penguasaan Akta Perhutanan Negara 1984 & Enakmen Industri Berasas Kayu Siri Pertama Tahun 2012;</td><td>4 – 7 Jun</td><td>Melaka</td><td>43</td></tr>
<tr><td></td><td>Bengkel Penguasaan Akta Perhutanan Negara 1984 & Enakmen Industri Berasas Kayu Siri Kedua Tahun 2012;</td><td>18 – 21 Sept.</td><td>Melaka</td><td>50</td></tr>
<tr><td>2013</td><td>Bengkel Penyediaan Kertas Siasatan Untuk Pegawai Penyiasat JPSM</td><td>12 – 17 Mei</td><td>Pahang</td><td>44</td></tr>
<tr><td></td><td>Bengkel Pengurusan dan Pengendalian Kes Kesalahan Hutan di Mahkamah Tahun 2013</td><td>29 Okt.–1 Nov.</td><td>Melaka</td><td>40</td></tr>
<tr><td></td><td>Bengkel Penguasaan Akta Perhutanan Negara 1984 & Enakmen Industri Berasas Kayu Tahun 2013</td><td>19 – 22 Nov.</td><td>Terengganu</td><td>45</td></tr>
<tr><td>2014</td><td>Bengkel Penguasaan Akta Perhutanan Negara 1984 dan Enakmen Industri Berasas Kayu Tahun 2014</td><td>7 – 10 April</td><td>Kedah</td><td>40</td></tr>
<tr><td></td><td>Bengkel Teknik Merakam Percakapan Saksi Untuk Pegawai Penyiasat JPSM</td><td>9 – 12 Jun</td><td>Kedah</td><td>40</td></tr>
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<tr><th>NO</th><th>RESOLUTIONS</th><th>ACTIONS TAKEN</th></tr>
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<table>
<tr><td></td><td>Bengkel Penguasaan Akta Perhutanan Negara 1984 dan Enakmen Industri Berasas Kayu tahun 2014</td><td>13 – 16 Okt.</td><td>Perak</td><td>50</td></tr>
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</td></tr>
<tr><td>6.3</td><td>Information exchange on law enforcement be enhanced amongst the forestry agencies in Sabah, Sarawak and Peninsular Malaysia; and</td><td>Information exchange between the forestry agencies is carried out through courses, workshops and meetings coordinated by NRE and MPIC, for instance, in finalizing the Country Specific Guideline for the Australian Illegal Logging Prohibition Act 2012 which involved the three regions.</td></tr>
<tr><td>6.4</td><td>Innovative technologies and integrated approaches be employed to enhance the effectiveness of forest law enforcement.</td><td>FDPM with selected state forestry departments are exploring and testing the effectiveness of various tools such as Unmanned Aerial Vehicles (UAV) and Radio Frequency Identification (RFID) for detecting illegal logging and encroachment in forest law enforcement. In addition, FDPM has implemented Forest Monitoring Using Remote Sensing (FMRS) which employed remote sensing and geographical information system (GIS) technology in mapping, licensing and detecting forest changes with the collaboration of Agensi Remote Sensing Malaysia (ARSM).</td></tr>
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4.4.3 REPORT ON ACTIONS TAKEN ON THE 16TH MALAYSIAN FORESTRY CONFERENCE - FOREST DEPARTMENT SARAWAK & SARAWAK FORESTRY CORPORATION

RESOLUTION 1: Recognizing that forest management certification is a meaningful yardstick for effective implementation of sustainable forest management, the Conference resolved that:-

1.1 All Forest Management Units be encouraged to fully undertake forest management certification under Malaysian Timber Certification Scheme (MTCS) or other credible internationally recognized scheme;

a) The Chief Minister of Sarawak on 2nd October 2013 endorsed the Project Implementation Framework for HoB Sarawak, which emphasized promotion of forest certification for sustainable forest management within Heart of Borneo (HoB) area.

b) Malaysian Timber Certification Council (MTCC) had discussion on forest certification with Sarawak Timber Industry Development Corporation (STIDC), FDS and SFC on 10th September 2013 as an initiative to embark on forest management certification in STIDC concession area.

c) Ministry of Resource Planning & Environment (MRPE) hosted a dialogue session on Forest Management Certification Initiative with Sarawak Timber Association (STA) on 13th September 2013. The event was also attended by FDS, SFC and STIDC.

d) Certification of 7 Forest Management Unit (FMU) in Sarawak has been included in SFC's Corporate Business Plan 2014-2018 as a strategic objective.

1.2 Frequent consultation amongst the forestry agencies in Sabah, Sarawak and Peninsular Malaysia be undertaken to facilitate the sharing of experiences gained in implementing forest management certification;

a) Working visit was made to FMU and Mangrove Forest in Perak on 3rd – 7th December 2012. This involved 22 officers from FDS, SFC and STIDC.

b) SFC participated in the Malaysian Protect Areas Consultation Forum in Kota Kinabalu in 2013.

c) SFC attended a seminar on sharing experiences and challenges of managing protected areas with Sabah Park in August 2013 in Kota Kinabalu.

1.3 Adequate funding and technical support be made available to various components that contribute towards effective implementation of sustainable forest management;

a) Allocation received by FDS in 2011 – 2013 is shown in Appendix 1.

b) Technical support is provided in the form of operational guidelines being developed in several relevant disciplines, including High Conservation Value Forest (HCVF), Local Community Engagement, Annual Allowable Cut (AAC) computation, and PSP Establishment & Assessment.

c) A Forest Certification Unit has been set up in SFC's new organization structure.

1.4 Wider participation of, and consultation with relevant stakeholders in forest management and conservation be further encouraged;

a) Capacity Building Workshop on National Forest Inventory was conducted on 18th – 19th June 2013. It was organised by Ministry of Natural Resources & Environment (NRE) in collaboration with FDS. Participants consisted of officers from FDS and SFC.

b) FDS in collaboration with the NRE and MRPE organised a CITES Stakeholders' Consultation and Capacity Building Seminar in Kuching on 27th September 2012.

c) Sarawak CITES Committee meeting was held on 2nd September 2013. It was attended by senior officers from MRPE, FDS, SFC, STIDC and other government agencies.

d) Honorary Wildlife Ranger Program is well promoted as part of the CEPA in Sarawak, in particular for the communities living adjacent to Totally Protected Areas (TPA), Bakun, crocodile conflict areas and certified FMU (Anap Muput).

e) Dialogues session conducted by FDS:

1. A total of 9 dialogues were held by Regional Forest Offices with local people in Kuching, Sibu, Bintulu and Miri for the year 2012 and 2013.

2. Dialogues with the Licence for Planted Forests (LPF) holders were held on 22nd and 29th March 2012 in Sibu and Bintulu respectively.

3. Dialogues with communities were as follows:

    a. Gaharu and fruit planting was held on August 2012.
    b. Maintenance of Ba' Medamot housing was held on April 2013.
    c. Development of valley pond at Rh. Anthony Bau was held on March 2013.
    d. Development of basic amenities such as shelter and maintenance of wooden bridge was held on August 2013.

1.5 Community forestry in improving livelihoods be accorded greater emphasis in sustainable forest management;

a) FDS had organised many activities for the communities who are living in the vicinity of Permanent Forest Estate (PFE) and TPA. The purposes of the activities are to enhance

facilities for eco-tourism and to improve community livelihood. Activities that have been organised for the communities are as follows:

1. Tagang System: The Tagang System has been developed since 2009 in Ulu Engkari. Up to date, the Tagang System still continues and FDS is continuously monitoring the progress of Tagang System. To enhance eco-tourism, basic amenities have been built at Tagang area such as shelter and maintenance of wooden bridge at Rh. Bada.
2. Pilot project for gaharu and fruit trees planting in Ba' Kelalan: More than 110 households were involved in the planting program and 3,000 of gaharu seedlings were distributed.
3. Pilot project on apiculture was still in progress with involvement of FDS staff within the community area in Ba' Kelalan.
4. Maintenance of suspension bridge at Sg. Kubaan, Long Semirang and Sg. Adang, Ulu Limbang and construction of housing in Ba Medamot were carried out.
5. Construction of 3 km forest trail crossing Tama Abu Range, 3 shelters, 8 trails, 5 bridges, 8 meter of fences (*lalau*), stools and stairs was carried out to enhance eco-tourism activities.
6. Valley pond was constructed at Rh. Anthony Bau.
7. Basic amenities were provided at Botanical Garden Long Langai, Ba' Kelalan, Lawas.
8. Capacity building and training for communities:
   a. Study tour at Danau Santarum with involvement of 10 communities. This program has been conducted by FDS in collaboration with NTFP-EP (implementation partners of AFSN). The objective of the program is to expose the community to apiculture and craft manufacturing and marketing.
   b. Handicraft training was conducted in collaboration with Handicrafts Malaysia for people in Ba' kelalan.

b) SFC is directly involved in a number of community-based projects, including Forest Landscape Restoration and Community Enterprises Development in Tatau, Bintulu.

1.6 Leadership at the highest level be constantly updated on the importance and the state of implementation of forest management certification to enhance their continued commitment and support.

a) The Chief Minister of Sarawak has been briefed on the important of the sustainable development and conservation of Heart of Borneo area in Sarawak. On 2nd October 2013, YAB Chief Minister agreed on the proposal to promote forest certification for sustainable forest management within HoB area in Sarawak.
b) Datuk Amar Tan Sri Adenan bin Satem, Minister in the Chief Minister's Office and Minister of Special Functions, Sarawak has urged all forest licensed holder to certify their concession area before 2017 during the opening ceremony of Sarawak's HoB Seminar 2013 on 26th June 2013.

RESOLUTION 2: Recognizing the increasing demand on forests for recreation and ecotourism activities, the Conference resolved that:

2.1 Consolidated efforts be intensified to enhance capacity building, promotions and marketing of forest recreation and ecotourism areas;

a) FDS has conducted various types of technical courses such as Botany Course, Environmental Awareness Programme, Global Position System (GPS) Training and sent staff to attend seminars and conferences that are related to forestry.

b) SFC has set up an Eco-tourism Development unit and various efforts are being made towards capacity building, product development, marketing and other development objectives.

c) An ecotourism master plan is being developed for western Sarawak based on the 5 National Parks in the vicinity of Kuching.

d) 80 Park Guides have been trained and licensed to provide guiding services. To date 268 Park Guides have been licensed.

2.2 Economic opportunities be further developed for revenue generation and employment;

a) SFC assisted in development of community based eco-tourism initiatives in Kampung Temurang in collaboration with the Majlis Perbandaran Padawan in January 2013.

2.3 Greater participation of local communities be encouraged;

a) The ITTO-supported projects in Lanjak Entimau Wildlife Sanctuary and Pulong Tau National Park involved local communities as co-partners in conservation management. These projects were "Development of Lanjak Entimau Wildlife Sanctuary As A Totally Protected Area - Phase I" (1992-2006) and "Transboundary Biodiversity Conservation Area (TBCA) - Pulong Tau National Park, State of Sarawak, Malaysia – Phase I (2005-2012).

b) Another new FDS-ITTO project entitled "Buffer zone management for Pulong Tau National Park and involvement of local communities in management, Sarawak, Malaysia" (2013-2016) will be further promoted and will strengthen the local participation in the management and conservation of the forest.

c) A noteworthy programme of FDS that is jointly conducted with SFC is the appointment of Honorary Wildlife Rangers throughout Sarawak to be the "eyes and ears' of the Government. They comprise representatives from the local communities, logging companies and civil societies. Since 2003, 682 Rangers have been appointed.

d) SFC is promoting crocodile as an attraction for community-based ecotourism in Kampung Bako and Seduku.

e) 30 and 12 locals from Mulu and Kg Bako respectively have been trained as Park Guides.

2.4 Potential ecotourism areas be explored and further developed.

a) Existing TPAs as at September 2013: 803,987.70 ha (land area and territorial water)

b) Proposed TPAs :357, 553.4 ha (land area and territorial water)

c) Number of National Parks : 31 (595, 760 ha)

d) Number of Nature Reserves : 8 (1, 767.30 ha)

e) SFC collaborates with various agencies such as Ministry of Tourism, Sarawak Tourism Board, Majlis Perbandaran Padawan and Majlis Perbandaran Serian to identify and develop ecotourism sites (e.g. rafflesia and caves at Temurang, caves of Selabur and Sireh, Alfred Russel Wallace's sites at Peninjau and Santubong and Becarri's site at Vallumbrosa).

RESOLUTION 3: Recognizing the important roles of forests in mitigating the adverse effects of climate change, the Conference resolved that:

3.1 Concepts, policies, initiatives and research activities related to climate change and the roles of forests be revisited, explored and/or intensified;

a) The State Government has set aside about 2.1 million hectares for Heart of Borneo Initiative program in Sarawak. With the rich river system in HoB area, it has great potential for hydroelectric power generation. This renewable source of energy is virtually carbon-free.

b) Sarawak's contributions to the HoB initiative will be its policy on SFM, nature conservation through the TPAs and Trans-Boundary Conservation Areas (TBCAs), and planning and development of new socio-economic projects to benefit the rural populations, all of which will contribute to conservation and sustainable development. HoB Sarawak's project Implementation framework was endorsed by the State cabinet on 24th October 2013.

c) Activities conducted by FDS were as follows:

1. Research project has been conducted on the development of field model for estimation of biomass and carbon stock for juvenile mangrove (*R. mucronata*) planting.
2. Field trials conducted using Finnish hyper spectral tool for MRV – REDD+.
3. Workshop on Malaysia's REDD+ Readiness Project: Component 1 Institutional Framework for Sarawak was held on 2nd – 3rd August 2012, it was organised by NRE. Participants involved various government agencies, private sectors and NGOs.
4. Negotiation session on REDD+ at State level was organised by NRE in collaboration with FDS on 30th September – 1st October 2013.

5. The State Government has decided to set aside about 2.1 million hectares that will enable Sarawak to contribute to the Heart of Borneo's long term objectives as given under the Bali Declaration. These objectives are conservation vision and with a view to promoting the people's welfare, and cooperation to ensure effective management of forest resources and conservation of a network of protected areas, productive forests and other sustainable land uses.

3.2 Roadmap at national and sub-national level for REDD+ and/or other climate change mitigation and adaptation measures be formulated and implemented;

Road map on REDD+ has been formulated at national level. Capacity building on REDD+ was conducted among relevant stakeholders on 2nd – 3rd August 2012 and 30th September – 1st October 2013.

3.3 Adequate funding and technical support be made available to mitigate adverse effect of climate change including the use of renewable energy.

a) The Federal Government has funded RM 5.8 million during the mid-term review of Ninth Malaysia Plan and RM 10 million in the current Tenth Malaysia Plan for the HoB Sarawak.

b) Allocation which amounted to RM200, 000 has been approved by NRE for REDD+ pilot project in 2014.

c) Sarawak's highland areas are mostly located within the HoB area. These are the headwaters of the major rivers in the State that are ideal for sustainable hydropower development. Sustainable hydropower development is one of the best options for clean and renewable energy.

d) The Sarawak Government promotes the coordinated development and management of water, land and related resources through integrated watershed management in order to maximize economic and social welfare and equity without compromising the sustainability of vital ecosystems and environment.

RESOLUTION 4: Recognizing the significance of forest biodiversity and conservation, the Conference resolved that:

4.1 Actions be taken to further document forest biodiversity and enhance the protection of areas with high conservation values;

a) SFC is documenting and promoting the conservation of rafflesia at Naha Jahey, Begu and Gedong.

b) SFC is involved in the conservation of orangutan habitat at Ulu Menyang and sea grass habitat at Pulau Sampadi.

c) SFC has taken the technical lead for HCVF Assessment in Sarawak, having already worked on Anap Muput and Kubaan Puak over the past years.

d) Projects carried out by FDS were as follows:

1. Integrated Conservation of Mulu endemic slipper orchid (*Paphiopedilum sanderianum*) through asymbiotic and symbiotic seed propagation and species restoration

2. Non-Detriment Finding Survey (NDF) on estuarine crocodile (*Crocodylus porosus*) in Sarawak

3. Conservation of Ramin and Gaharu in Ulu Mentawai and Conservation of Limestone Orchids. The projects were initiated last year under the HoB Initiative. Sarawak Government supported the projects by injecting fund to do more intensive research for both projects in 2014-2015.

4. Mentawai Scientific Expedition in Ulu Mentawai. The expedition carried out in September 2012 attracted 100 scientists and researchers from FDS, SFC, Sarawak Biodiversity Centre (SBC), Forestry Department Peninsular Malaysia (JPSM), Mineral Geoscience Department Malaysia, Universiti Kebangsaan Malaysia (UKM), Swinburne University and Universiti Malaysia Sarawak (UNIMAS). Two-week expedition - the fifth in the State under the HoB, saw researchers collecting data that included, among others, aspects of microbiology, insect, reptiles, amphibians, tropical pitchers plants, water quality, and soil characteristics.

4.2 Efforts be intensified to harness forest biological resources for sustainable economic purposes;

a) SFC promotes and assists community-based ecotourism in Padawan and Serian.

4.3 Formulation of mechanisms for Access and Benefit Sharing (ABS) of biological resources, notably for the local and indigenous communities, be fully supported;

a) ABS has been enacted at the national level but the State Government has not made any decision to adopt ABS. However, the State Government has agreed to make amendments to the existing law to regulate access to biological resources and partnership benefits.

b) The Sarawak Biodiversity Centre has been selected as the Focal Agency for the State in ABS, while the FDS has been listed as a Competent Authority, and the Department of Agriculture will carry out enforcement work.

4.4 Ex-situ conservation of rare, endangered and threatened species in suitable locations be accorded greater emphasis;

a) *Ex-situ* conservation effort by FDS focuses on Orchidaceae, Musaceae, Zingiberaceae and ornamental plants.

b) SFC has carried out *ex-situ* conservation in connection with the Bakun WIMOR project and Murum project.

c) Guidelines on identification and protection of endangered, rare and threatened species and features of special biological interest are being developed.

4.5 Conservation Education and Public Awareness (CEPA) initiatives be further enhanced to promote forest biodiversity and conservation.

a) CEPA's activities carried out by FDS were as follows:

1. World Wetlands Day was celebrated at Kuching Wetland National Park on 16th February 2012 and 25th February 2013 at Kuala Sungai Lemidin. These events were attended by at least 300 people from government agencies, NGOs, private sector, community folks and students. The main activity was the planting of mangrove trees by all the participants to mark the World Wetlands Day. Other activities included talks, games, boat cruising, colouring contest and dialogue competition for primary school children and essay competition for secondary school student.
2. Wetland Tour for local newspaper writers and photographers was held on 24th February 2012 and 15th February 2013. The programme aimed to promote public awareness among the writers as well as the public.
3. Bakau Planting programme was a joint programme between FDS and Petronas under their CSR programme. The programme was attended by 70 participants from PETRONAS and FDS. A total of 500 seedlings were planted in Kuching Wetland National Park (KWNP).
4. Eco-Bako programme was attended by at least 200 students from various schools. The programme was held on 4th May 2013 at KWNP and jointly organised by FDS and PETRONAS.
5. Documentary entitled "*Kehidupan Paya"* was filmed in KWNP on 15th-19th April 2013 by the local producer with the collaboration of FDS and was aired on RTM 2 (Simfoni Alam) on 22nd October 2013.
6. Environmental Education workshop was held in Riverside Majestic Hotel on 21st-23rd August 2013 and attended by 50 trainee teachers and 10 lecturers from Institute Perguruan Batu Lintang, Kuching, and Institute Perguruan Tun Abdul Razak, Samarahan.
7. Talk on Conservation of Flora and Fauna for the International Islamic University was held in Bako village. The talk was attended by 53 students and lecturers.
8. A total of 6 awareness programmes on mangrove were conducted during 2011-2013. These involved local communities, school and university students and private sector. The total number of trees planted was 1,775 covering an area of 2.5 hectares throughout the State.
9. Awareness programme on environmental education was organised for students at Ba' Kelalan – development of nature trails and shelter for awareness and environmental education equipped with tree and trail signages.
10. Educational Environment Workshop was held at Lambir NP on 21st – 25th May 2012.
11. Workshop on Preparation of Environmental Education Module in Lambir NP on 27th – 29th August 2013.

b) SFC routinely carries out a number of activities (Nature n U, Friends of Nature, Adventure with Wildlife, Honorary Wildlife Ranger and Junior Honorary Wildlife Ranger programmes,

Bako Buntal Bay and 3M Buaya (Mengenali, Memahami, Memulihara Buaya) to promote conservation education and awareness.

RESOLUTION 5: Recognizing that R&D and innovations are crucial towards realizing sustainable forest management, the Conference resolved that:

5.1 State-of-the-art technologies and innovative approaches be further explored and utilized as tools to enhance forest management and conservation as well as the forest industry;

a) Hyperspectral and Compact Airborne Tactical System (CATs) applications have been operationalized for enforcement and monitoring purposes since 2012.

b) R&D in collaboration with local and foreign institutions on development of hyperspectral technology application has been initiated.

c) SFC has implemented Information Management System (MIST) and Protected Areas Information Management System (PAMIST) in Sarawak.

5.2 The utilization of the rich biological diversity be further optimized for the development of herbal, ornamental, cosmetic and pharmaceutical products through the application of appropriate biotechnology;

a) Sarawak Biodiversity Centre is the authority on this matter.

5.3 Capacity building to enhance professionalism and expertise be further intensified;

a) FDS has organised a number of programmes including Ulu Mentawai Scientific Expedition, Paya Maga and Mentawai Scientific Expedition Seminar and post-graduate programme to promote capacity building.

b) FDS in collaboration with the NRE organised a Seminar on Sarawak's Heart of Borneo 2013 on 26th – 27th June 2013 at Hilton Hotel, Kuching.

c) A few officers in FDS have been sent for further study in overseas (Master and PhD) to enhance their professionalism and knowledge.

d) SFC is collaborating with Biodiversity Conservation Society of Sarawak (BCSS) in Statistical Package training for SFC staff, NGO, universities and other agencies.

5.4 Cooperation and collaboration among researchers, forest managers, practitioners and other stakeholders be enhanced and synergized.

a) Signing of Memorandum of Understanding (MoU) between the State Government Sarawak and the Japan Research Consortium for Tropical Forests in Sarawak (JRCT) was held at Yokohama, Japan on 5th November 2012.

b) FDS is collaborating with Universiti Putra Malaysia and UNIMAS on research projects as follows:
   1. Forest Resource Inventory
   2. Development of spectral database (MDF & Coastal Forest)
   3. Mangrove monitoring (mortality & health)
   4. Coral & benthic habitat assessment

c) SFC has built and expanded an extensive network of R&D collaboration with the industry, other research institutions and NGOs.

RESOLUTION 6: Recognizing the importance of fostering greater integrity, professionalism and dedication of forestry personnel, as well as in enhancing forest law enforcement towards sustainable forest management, the Conference resolved that:

6.1 The existing forestry legislations be kept up-to-date and relevant in line with the changing forestry environment and societal needs:

a) FDS conducted workshops on 16th–20th April 2012 and 11th–13th July 2012 to review the Forest Ordinance, Forest Rules and The Forests (Planted Forest) Rules.

b) A workshop was also held on 4th–6th September 2013 to formulate new forest rules, namely the Forests (Trained Workmen) Rules, the Forests (Registration) Rules and the Forests (Nursery) Rules in Sarawak.

6.2 Capacity building for forestry personnel in preparing investigation papers and tendering of evidences for forestry offences be enhanced

a) SFC routinely provides training to impart knowledge and skills related to Sarawak's Log Tracking System and revenue assessment procedures.

b) Three Investigating Officer courses were conducted by FDS in 2012 and 2013.

c) Two workshops on Investigation Paper Enhancement (IPE) were conducted in Miri and Sibu in 2013

d) Seminars and short courses that were attended by FDS (enforcement staff) in 2012-2013 were as follows:-

   1. Wildlife Forensic Seminar 4th–5th July 2012, Thailand.
   2. Asean Wilflife Enforcement Network 28th–31st May 2012

3. Protected-area Operation and Tactical Enforcement Conservation Training 19th–30th March 2012, Thailand.
4. Enforcement Ranger Course 11th–24th September 2012, Kalimantan, Indonesia.

6.3 Information exchange on law enforcement be enhanced amongst the forestry agencies in Sabah, Sarawak and Peninsular Malaysia

a) Malaysian Anti-Corruption Commission, Royal Malaysia Police, JPSM, PERHILITAN, Royal Malaysian Customs Department, Sabah Forestry Department were invited to give a talk/briefing/discussion during the Investigation Officer courses held in 2012 and 2013.

6.4 Innovative technologies and integrated approaches be employed to enhance the effectiveness of forest law enforcement.

a) The airborne surveillance & enforcement system (CATS) utilizing hyperspectral technology was operationalised.

b) The customized tool developed by Finland (Forest Clearing Tool) for illegal felling was tested.

c) Investigation Paper Tracking System (IPTS) - a system with which the department can track previous illegal activities by a company or individual was developed. This system can track the status of Investigation Paper.

d) FDS and SFC have embarked on upgrading of LOTS/RBS as well as improvement (on-line application and approval) of the Permit Enter Coupe (PEC) process.

Appendix 1

STATE DEVELOPMENT PROJECTS

2012			2013		
No.	**PROJECT**	**ALLOCATION (RM)**	**No.**	**PROJECT**	**ALLOCATION (RM)**
1	REHABILITATION AND SPECIES ENRICHMENT OF SAMA JAYA FOREST PARK	125,000	1	REHABILITATION AND SPECIES ENRICHMENT OF SAMA JAYA FOREST PARK	125,000
2	PLANTATION SPECIES TRIALS AND PRODUCTION OF PHENONTYPICALLY IMPROVE PLANTATION MATERIALS	250,000	2	PLANTATION SPECIES TRIALS AND PRODUCTION OF PHENONTYPICALLY IMPROVE PLANTATION MATERIALS	250,000
3	DEVELOPMENT OF PULONG TAU NP FOR SUSTAINANBLE BIODIVERSITY AND COMMUNITY DEVELOPMENT	1,000,000	3	DEVELOPMENT OF PULONG TAU NP FOR SUSTAINANBLE BIODIVERSITY AND COMMUNITY DEVELOPMENT	1,000,000
4	TO UPGRADE AND ENHANCE CAPABILITY OF PROTECTION AND ENFORCEMENT AGAINST ILLLEGAL LOGGING, CONTRAVENTION OF FOREST LICENSES AND PERMITS AND WILDLIFE OFFENCES	750,000	4	TO UPGRADE AND ENHANCE CAPABILITY OF PROTECTION AND ENFORCEMENT AGAINST ILLLEGAL LOGGING, CONTRAVENTION OF FOREST LICENSES AND PERMITS AND WILDLIFE OFFENCES	750,000
5	IMPLEMENTATION OF KUCHING WETLAND NATIONAL PARK – RAMSAR SITE MANAGEMENT PLAN	250,000	5	IMPLEMENTATION OF KUCHING WETLAND NATIONAL PARK – RAMSAR SITE MANAGEMENT PLAN	250,000
TOTAL		**2,375,000**	**TOTAL**		**2,375,000**

FEDERAL DEVELOPMENT FUND

2012			2013		
No.	**PROJECT**	**ALLOCATION (RM)**	**No.**	**PROJECT**	**ALLOCATION (RM)**
1	HEART OF BORNEO NEGERI SARAWAK	320,000	1	HEART OF BORNEO NEGERI SARAWAK	780,000
2	APLIKASI TEKNOLOGI HIPERSPEKTRAL OPERASI PERHUTANAN	800,000	2	APLIKASI TEKNOLOGI HIPERSPEKTRAL OPERASI PERHUTANAN	1,100,000
3	PEMBANGUNAN SISTEM PEMANTAUAN TAKTIKAL UDARA	1,300,000	3	PEMBANGUNAN SISTEM PEMANTAUAN TAKTIKAL UDARA	1,400,000
TOTAL		**2,420,000**	**TOTAL**		**3,280,000**

4.5 PRESENTATION BY INSTITUTE OF FORESTERS MALAYSIA (IRIM)

THE FORESTRY PROFESSION ACT: REGULATION OF THE FORESTRY PROFESSION AND PRACTICES IN MALAYSIA

Tee Choon Hwa | Mohd Jinis bin Abdullah
Institute of Forester Malaysia

ABSTRACT

The forestry sector has been a significant social and economic contributor in nation building since the early years of the country's history. With the growing complexity and multiple roles played by the forest and forestry sector various standards and certification processes had been created and instituted to ensure that the quality of forestry products and services do meet the requirement of the market place. However until today, Malaysia does not have a dedicated legislation to regulate the forestry profession and practices in Malaysia. With globalisation, liberalisation of professional services and international competition, the foresters in Malaysia are in an urgent need to have an Act of Parliament to regulate, govern and protect the forestry profession and to create a level playing field in this borderless competitive world. In this regard, the Forestry Profession Act (FPA) is being drafted by the Institute of Foresters Malaysia (IRIM) and the Ministry of Natural Resources and Environment of Malaysia. It is the intention of this paper to bring to the attention of the foresters on the proposed legislation. This paper highlights the key contents of the FPA and provides the latest updates on the drafting and introduction of the FPA.

1. FOREST AND FORESTRY IN MALAYSIA

The forestry sector has been playing a significant role in the economic and social development of Malaysia ranging from the contribution of the timber economy to the growing potential of various forestry products and services in the areas of bio-energy, bio-technology, biodiversity functions, environmental services and its effects on climate change issues affecting the livelihood and wellbeing of mankind.

1.1 Socio-Economic Contribution

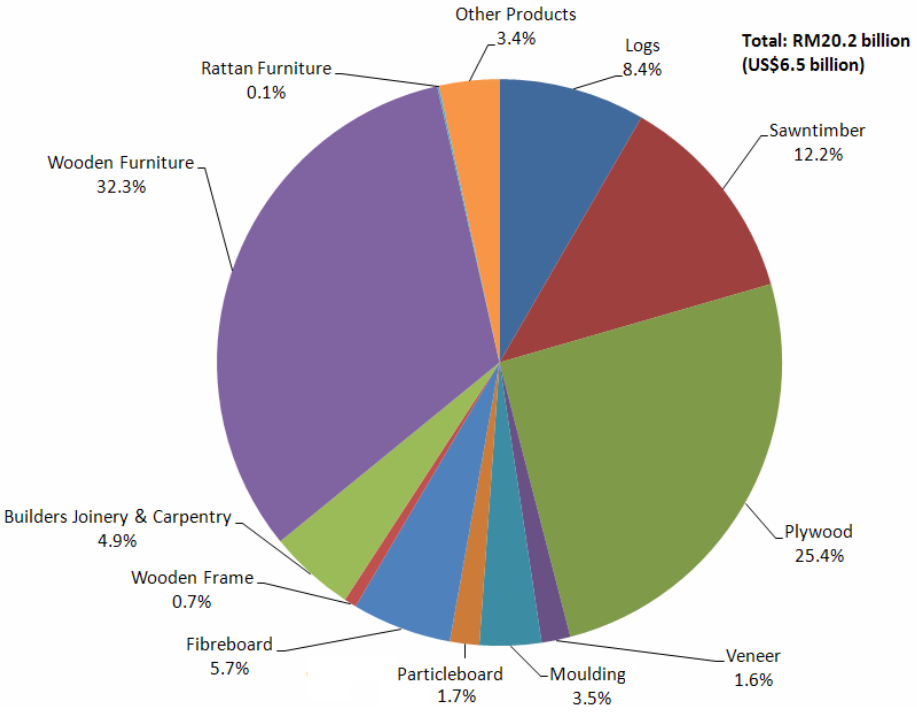
Malaysia has a total land area of approximately 33 million hectares, of which about 74% or 24.43 million hectares is under tree cover in 2013. 18.03 million hectares (54.6% of the total land area) are forested while the balance area of about 6.4 million hectares which constitute approximately 19.4% of total land area is under other tree crops which are actually also trees and plants originated from the forests.

We still have 14.52 million hectares or about 80% of the total forested area gazetted as permanent reserved forests while the rest comprise national parks, wildlife and bird sanctuaries and also the conversion forests where they will be ultimately converted to other land-uses.

Timber products brought in about US$ 6.5 billion of export earnings for Malaysia in 2012. These timber product exports contributed 2.3% of the country's Gross Domestic Product (GDP).

The timber sector provided about 300,000 employment opportunities which amount to about 2.5% of the total employment of Malaysia in 2012.

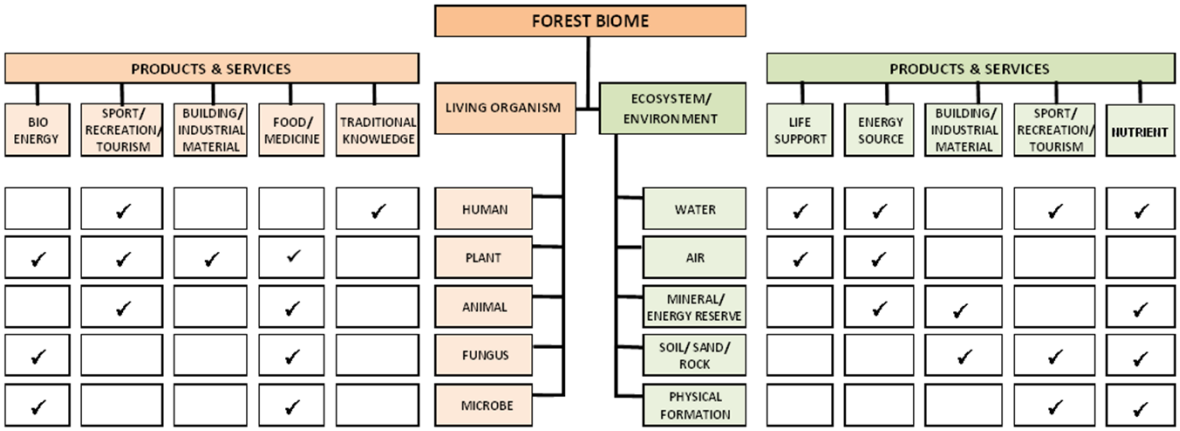
Figure 1: Malaysia's Export of timber and timber product (2012).



1.2 Multiple Roles and Function

The traditional role of the forestry sector which was centred on the production of logs and timber has changed progressively in tandem with the changing economic landscape, dwindling resources and the discerning tastes and demands of the market place.

Figure 2: Products and services of forests**.**



The function and roles played by forests and the forestry sector can be summarised with the chart (Figure 2) above through the grouping of key products and services:

(i) The supply of clean air and water by the forest ecosystem supports human and other life forms on our planet.
(ii) Forest has been a natural source of food in the forms of meat, fruits, vegetables and herbs.
(iii) Timber, rattan, bamboo, fibre, resin and dye are some of the construction and industrial materials we extract from our forests for the construction of shelter and to improve our living condition.
(iv) Traditional knowledge of the forest dwellers and indigenous tribes on medicinal plants and living skills helps to open up and develop the potential of the forest biodiversity.
(v) Energy source and reserves such as firewood, hydroelectricity, wind power, geo-thermal power, mineral and fossil fuels are part of the products available in the forest for energy and power generation.
(vi) The mere beauty of the landscape and natural environment of the forest offers endless options and potential for the development of environmental services, education, tourism and sports activities.
(vii) With more intense research and development efforts in bio-technology, more bio-energy products such as bio-diesel, bio-ethanol, bio-butanol and sugar based enzymatic fuel cell bio-battery can now be produced through bio-synthesis and other bio-chemical processes using feedstock from the forest biomass.
(viii) Herbal extracts, bio-methionine, probiotics, spirulina, etc are bio-medicine and health food supplements which are being cultured or developed involving algae and micro-organisms through some fermentation and organic chemistry processes.

The role and responsibilities of the foresters in the management of the forest resources have grown way beyond the trees, from the higher plants to the lower plants and huge potential lies with the lesser known microorganisms.

2. PREDICAMENTS OF THE FORESTRY PROFESSION

The forestry profession is practiced by is a group of personnel with specialised professional training in the planning, management, operation and development of forests and forest resources. They are engaged directly in various capacities contributing to the day to day operation and development of the forestry sector. Professional foresters pioneered the nation building efforts and remained as the primary contributor and prime mover of the economic development of Malaysia until the recent years when the significance of this sector was overshadowed and overtaken by other more productive and efficient economic activities.

2.1 Professional Quality and Identity

With the growing complexity and multiple roles played by forests and the forestry sector, various standards and certification processes had been created and instituted to ensure that the quality of forestry products and services do meet the requirement of the market place.

There are more emphasis on sustainable management and development, governance, ethics, legality, corporate social responsibility, product quality and quality management systems.

More intensive management of forests and forest resources, more innovative and efficient processing and utilisation of forest produce and effective marketing of forest products and services are required to meet the ever changing needs and tastes of the market. These developments which may have originated from some non-tariff trade barriers and trade discriminations imposed by some importing countries or developed through some genuine market / society driven initiatives are now a reality for our exporters to face. More operational and product standards are established with specific criteria and indicators to demonstrate sustainability, social responsibility, operational transparency, governance, equality, fairness and legality. Independent certification methodology and process are now common requirements before the forest products could be brought into certain specific market. Some of these standards and certification processes involved include the Malaysian Timber Certification Scheme (MTCS), Forest Stewardship Council (FSC) certification scheme, Programme for the Endorsement of Forest Certification (PEFC) certification scheme, Malaysia-European Union Forest Law Enforcement, Governance and Trade Voluntary Partnership Agreement (Malaysia-EU FLEGT VPA), US Lacey Act Timber Legality Declaration and Timber Legality Assurance System (TLAS).

We have now well established standards and certification processes for the forest products and services. However the same cannot be said about the human side of the equation i.e. on the quality and standard

of the forest managers and forestry experts who are managing and operating the standard development and certification processes.

There is currently no formal standard, system or legislation which specify, regulate and certify that the persons managing the certification process are indeed qualified and experienced persons which could be entrusted to carry out the job based on some established standards and procedures. There is no system in place to penalise the unqualified persons or the wrong doers. No remedial action or recourse could be taken if the person involved does not execute or carry out his forestry work or assignment in the professional manner.

The forestry profession in Malaysia is facing a serious predicament on the issue of its professional identity.

We say forestry is a profession. A profession is defined as a job which requires specialised educational qualification, training and skills. A profession usually enjoys a high social status, regards and esteem in society because it is regarded as a valuable and vital vocation to the society as a whole.

A profession in Malaysia usually has an Act of Parliament to register and govern the qualified persons. The professional members are subjected to a set of professional conduct and work ethics under the respective professional act. These professional members are also required under their professional act to attend continuous educational training for regular upgrading and updating of skills.

Without the backing of an Act of Parliament to define, specify, regulate and certify the persons who are tasked to perform the professional duties or to execute skilful work in the forestry sector, where do we derive the comfort or confidence that the end results so produced by the persons will meet the required standards and specifications?

Figure 3: Standards & Certification.

Activity / Player	Laws & Regulations	Executing Body	Certificate / Standard
Forest Resources •Natural Forest •Forest Plantation	MTCS MC&I (Natural Forest) MC&I (Forest Plantation)	MTCC/ SIRIM	FMU FPMU
⇧			
Forest Manager & Forestry Expert	? LEGISLATION GAP ?		?
⇩			
Forest Based Products & Services •Forest Products •Forestry Projects •Forest Valuation	•MTCS / CoC / FLEGT / TLAS •EQA/EIA Order •Guidelines on Asset Valuations / Practice Note 2	•MTCC/SIRIM/MTIB •DOE •SC / IRIM	• certificates • EIA Report/Approval • Forest Assessment Report

The predicament faced by the forestry profession in Malaysia can be easily understood by looking at the following situations encountered by the Securities Commission (SC) of Malaysia and the Forestry Department Peninsular Malaysia (FDPM).

- The problem faced by SC is how to determine and identify the qualified expert whom SC can entrust to carry out a valuation on a forestry asset.

With no existing Act of Parliament to govern and regulate the foresters, the SC was forced to introduce a practice note for the corporate sector known as Practice Note 2: Guidelines on Asset Valuation which was effective since 1st May 2003 which specify and recognise an ordinary member of the Institute of Foresters Malaysia (IRIM) to be a qualified person to prepare a Forest Assessment Report which is required for the valuation of a forest asset.

- The problem faced by FDPM is similar in nature as they have difficulty to identify legally the rightly qualified person to prepare and submit a forest management plan, a forest harvesting plan and a reforestation plan which are plans that require professional inputs for the management and development of the forestry sector.

In the absence of a Professional Act, Rule 13 of the Forest Rules 1988 of Peninsular Malaysia was introduced and enforced.

Rule 13 states:

"A forest management plan, forest harvesting plan or a reforestation plan required under rules 10,11 and 12 respectively shall not be considered by the Director unless it is prepared or endorsed by a professional forester registered as an ordinary member of the Institute of Foresters, Malaysia".

In both the cases quoted above, it is a clear manifestation of the predicament faced by the forestry profession and the forestry sector as a whole where we have to rely on the qualification of an ordinary member of the Institute of Foresters, Malaysia (IRIM) to be used as a yardstick for the recognition of professional qualification although IRIM is in fact just a society registered under the Registration of Society Act 1966 which has absolutely no legal authority to govern or regulate the behaviour and conduct of its members. There is really not much remedial recourse available if any of its members does not behave or conduct himself responsibly and professionally.

2.2 Globalisation and Global Competition

With globalisation, more efficient means of transportation and technology are now easily available; hence every corner of the world is now within reach of everyone. The world is now the market place but the world is also our new competitor.

With globalisation comes the need to have an open and fair competition of trade and services. All countries including Malaysia have jumped into the bandwagon of opening up the local market of goods and services under all sorts of bilateral, regional and global agreements on free trade arrangements and liberalisation. Whether you like it or not, global competition is already at our door step under various bilateral and multi-parties trade arrangements. Liberalisation under bilateral and regional Free Trade Agreement (FTA) arrangements will progress based on schedules mutually agreed between the parties. Under the World Trade Organisation (WTO) arrangement, the schedule of liberalisation of services is agreed upon by the parties based on the General Agreement on Trade in Services (GATS). Full liberalisation of services under the ASEAN free trade market arrangement through the ASEAN Framework Agreement on Services (AFAS) will take place in Malaysia and the whole ASEAN region by the year 2015.

Malaysia has committed to the liberalisation of several services related to the forestry profession which are given in the table below:

Table 1: Liberalisation of Forestry Related Services Committed by Malaysia.

SERVICES IN ECONOMIC SUB-SECTOR	LIBERALISATION COMMITMENTS
Urban planning & landscape architectural services	World Trade Organisation (WTO) - General Agreement on Trade in Services (GATS)
Environmental services in the sub-sector of nature and landscape protection	• ASEAN Framework Agreement on Services (AFAS)

	• bilateral Free Trade Agreements (FTAs) with New Zealand & India
Tourism & travel related services in eco-tourism	Under active development

When the forestry and environmental services are liberalised, foresters from all over the world can now come to Malaysia to carry out forestry assignments and to practise forestry. This will be a real threat to the local foresters if we do not prepare ourselves well.

However with liberalisation of trades and services, we also have now a legitimate opportunity to practise forestry all over the world. The Malaysian foresters have to undergo specialised education in forestry science to prepare themselves for the appropriate on the job experience and exposure before they are qualified and equipped to conquer the world. The forestry experts of Malaysia are widely recognised worldwide especially so in the area of tropical forestry. The number of prominent Malaysian foresters helming renowned and prestigious regional and international organisations, spearheading international projects, is clear testimony to the capability of the local foresters.

However in the process of liberalisation, a level playing field needs to be established before foreign foresters are allowed to practise in Malaysia and the local foresters can venture overseas. There must be at least a legal basis of establishing who are the accredited foresters recognised under the liberalisation arrangement and there are established framework and legislation in place to ensure the proper behaviour and professional conduct of the foresters.
The following table depicts the legislative frameworks used to negotiate the free trade agreements on the liberalisation of various professional services in Malaysia.

Table 2: Legislative Framework of Professional Sectors.

PROFESSIONAL SERVICES:	**LEGISLATIVE FRAMEWORK:**
Accounting & Taxation Services	Accountants Act 1967
Architectural Services	Architects Act 1967
Engineering Services	Registration of Engineers Act 1967
Legal Services	Legal Profession Act 1976
Medical Specialist Services	Medical Act 1971
Dental Specialist Services	Dental Act 1971
Quantity Surveying Services	Quantity Surveyors Act 1967
Land Surveying Services	Licensed Land Surveyors Act 1958
FORESTRY SERVICES	***FORESTRY PROFESSION ACT ?***

It is thus very clear that we need a dedicated Act of Parliament to set the foundation and basis of negotiation in the liberalisation of the forestry sector in Malaysia so that our foresters can be counted in the eyes of the international community and be allowed to compete openly in the world market.

The importance of an institutional and legislative framework in the negotiation process to determine terms and arrangements for the liberalisation of professional services can be better understood by looking at the recommendations made by the Economic Transformation Programme (ETP) lab on the liberalisation of the Landscape Architectural Services which are:

- **Expedite the introduction of a new Landscape Architects Act** with no equity restrictions for golf courses and theme parks subsectors.
- Develop domestic capacity building to enhance capacity of local landscape architects.

Since the Performance Management & Delivery Unit (PEMANDU) of the Prime Minister's Department through the ETP lab realises and recognises the urgent need of the Landscape Architects to have a new act for the Landscape Architectural Profession, we wonder what is the view and opinion of PEMANDU or the Malaysian Government on the wish of the Forestry Profession to have an exclusive Act of Parliament to regulate and protect the local foresters in facing the globalisation process and the intense global competition. The answers will be known and made available with the success or failure in our pursuit to get the draft FPA eventually tabled in the Parliament.

3. DRAFTING INITIATIVES AND PROGRESS

The Institute of Foresters Malaysia (IRIM) had made many attempts in the past, since the 1980s, to initiate the drafting of a dedicated Act for the forestry profession without much success.

IRIM made the latest attempt to prepare a new draft Act at the end of 2013. The initial draft was sent to the stakeholders involved in forest management, research and development, timber industry and education fields for their comments and feedbacks. A preliminary stakeholder consultation meeting was held on 28th November 2013 to obtain a clearer understanding on the response and expectations of the various stakeholders.

The Preliminary Stakeholder Consultation Meeting recognised the importance and urgent need to have a dedicated law for the Forestry Profession;

i) To regulate and safeguard the interest of the Forestry Profession.
ii) To provide a legal framework to organise and empower the Forestry Profession to meet the changing needs of the domestic and international fronts.
iii) To prepare the Forestry Profession to meet the challenges faced in the light of the global drive on the liberalisation of trade and services.
iv) To guarantee and continuously improve the professional standard of the Forestry Profession.

The Consultation Meeting discussed and deliberated on the various feedbacks and comments received and IRIM subsequently made further amendments and corrections to the original draft based on the feedbacks received.

The Consultation Meeting requested IRIM to forward a formal request to the Minister of Natural Resources and Environment to support and to initiate a Bill for the introduction of the Forestry Profession Act.

A revised draft of the proposed Act named the Forestry Profession Act (FPA) was prepared and sent for consideration of the Ministry of Natural Resources and Environment (MNRE) in January 2014. A few meetings and discussions between IRIM and MNRE were held since March 2014.

IRIM further refined the draft FPA taking into account some comments, views and opinions of MNRE and proceeded to prepare the draft Forestry Profession Regulations (FPR) (in English - original version and the Bahasa Malaysia translation) in May 2014.

The contents of the FPA discussed in this paper, are those in the May 2014 version of the draft prepared by IRIM which is the common version being scrutinised by MNRE and other concerned parties and stakeholders.

The draft FPA will be further subjected to various scrutiny and evaluation process and procedures by interested parties and stakeholders. Another formal stakeholder consultation process is expected to be conducted by MNRE before the FPA is sent to the Attorney General's Chambers for their approval and

clearance before presenting for consideration of the Cabinet for the final permission to have the bill tabled in the Parliament.

The continuing process and progress of this initiative to introduce the FPA is now very much in the hands of the MNRE. The forestry community in Malaysia shall give its full support for MNRE and IRIM to expedite this process.

4. KEY CONTENTS OF FPA

The FPA shall be a dedicated Act of Parliament enacted to regulate the forestry profession and forestry practices in Malaysia. The Minister in charge of forestry will oversee the operation and development of the forestry sector through the Board of Foresters of Malaysia which shall be created under the FPA. The primary role of the FPA is to facilitate the registration of foresters and regulate the professional conduct and practice of registered foresters in order to safeguard the safety and interest of the public.

4.1 Board of Foresters of Malaysia (BFM)

The BFM will be the nucleus to the forestry profession under the FPA.

4.1.1 Establishment of BFM

The BFM is an executing body to be established under Section 3 of the FPA which is responsible for the enforcement of the FPA and management of the institutional set up and machinery created under the FPA. BFM is a body corporate with perpetual succession which may sue and be sued.

The Minister may give general directions to BFM in relation to the performance of the functions and powers of BFM under the FPA. BFM may establish committees to assist it in the performance of its functions or powers under the FPA.

4.1.2 Functions and Power of BFM

The functions and power of BFM are provided under Section 4 of FPA. The key functions include the followings:

- to determine and regulate the professional conduct and ethics of the forestry profession.
- to hear and adjudicate disputes relating to professional conduct or ethics of registered foresters directly or through appointment of arbitrators.
- to represent the forestry profession in providing expert opinions and making professional stand on issues and matters affecting the forestry profession.
- to determine the scale of fees and charges for professional services rendered by registered foresters.
- to determine the academic qualifications, training and experience required for registration as a qualified forester through a continuous accreditation mechanism and to conduct the required examination for admission.
- to maintain and constantly update a register of professional foresters through established processes and procedures on admission, renewal, restriction, suspension, cancellation, removal or reinstatement of registration.
- to conduct and promote continuous professional development programmes.
- to have other general power required for its performance of its function, such as purchasing, leasing and disposal of land & properties, procurement of financing, fund raising and others.

4.1.3 Composition of BFM

The BFM shall consist of 13 members who are registered foresters, appointed by the Minister under section 6 of the FPA:

(a) a President.
(b) a Deputy President.
(c) three members from the occupational field of policy and management consisting of one member from the state of Sabah, one member from the state of Sarawak and one member from any state within Peninsular Malaysia.
(d) two members from the occupational field of industry and trade.
(e) two members from the occupational field of research and development.
(f) two members from the occupational field of education and training.
(g) two members nominated by IRIM.

BFM shall appoint a registrar and a secretary from amongst the BFM members to execute the functions stipulated under the FPA.

4.1.4 Tenure of Office

The members of BFM shall each be appointed for a term not exceeding three years. The members shall be eligible for reappointment but no member shall hold office for more than two consecutive terms.

4.1.5 Protection of Board

No member, officer or servant of BFM shall incur personal liability for any loss or damage caused by any act or omission in administering the affairs of BFM unless it is intentional or through recklessness or gross negligence. These people are deemed to be public servants within the meaning of the Penal Code {Act 574]. The Public Authorities Protection Act 1948 [Act 198] shall also apply to any action, suit, prosecution or proceedings against the BFM or the people mentioned above working in such capacity.

No action or prosecution shall be brought, instituted or maintained in any court against the BFM, a member of BFM, the Registrar, an Inspector or any other person authorized to act for or on behalf of BFM for the purpose of enforcing the FPA.

4.2 Qualification & Registration of Professional Foresters

Qualified foresters shall be admitted into the Register of registered foresters after obtaining the approval of their applications from the BFM.

4.2.1 Qualification for Registration

Section 28 of the FPA stipulates the following qualifications for the Registration of professional foresters:

(1) a person who is-
(a) an ordinary member of IRIM who has been an IRIM member for a minimum period of three consecutive years or a fellow of IRIM;

or

(b)(i) a Malaysian citizen;

and

(ii) a graduate with a degree in forestry or a field listed in Table 3 from a university / institution recognised by BFM;

and

(2) who has a minimum 3 years working experience in one or more of the following occupational fields of :
(i) policy and management.
(ii) industry and trade.
(iii) research and development.
(iv) education and training;

and

(3) who has passed the professional examinations which may be imposed by BFM as an additional condition, if applicable.

Table 3: List of forestry fields and sub-disciplines.

1	Management of natural and plantation forests
2	Forest conservation and protection
3	Forest classification, assessment, inventory and valuation
4	Reforestation and afforestation
5	Silviculture
6	Forest harvesting
7	Forest engineering
8	Ecosystem services and impacts of climate change involving forests and forestry activities
9	Environmental study and impact assessments involving forests, forestry operation and activities
10	Forest recreation
11	Forest biodiversity assessment and conservation
12	Forest hydrology
13	Wildlife management
14	Forestry research and development
15	Forest ecology
16	Forest Botany
17	Forestry training and education
18	Community forestry and urban forestry
19	Agro-forestry
20	Nursery practice, landscaping and forest park establishment and management
21	Forestry science on converting, processing and treatment of forest produce
22	Assessment, audit, certification and labelling of forest management, operation and forest produce
23	Forest planning
24	Forestry project planning and evaluation
25	Forest economy, valuation and accounting
26	Forest taxation
27	Forest law and legislation
28	Forest based hazards and disasters
29	Natural resource damage assessment

4.2.2 Register of Registered Foresters

BFM shall keep and maintain a Register which contains the names, business addresses and other particulars of registered professional foresters.

Against the name of each registered forester will be stated his/her qualifications, occupational field(s) and particulars of any restriction or condition, imposed by BFM.

This list will also be published in the Gazette and updated from time to time due to addition, suspension, removal, cancellation or reinstatement.

This gazetted list shall be *prima facie* proof that the persons whose names appear therein are registered professional foresters.

A registered professional forester is entitled to use the abbreviation “Frr” before his name or the abbreviation “P.For.” after his name. He is also allowed to use the prescribed professional stamp with registration reference of the individual forester.

4.2.3 Sole Proprietorship, Partnership and Body Corporate

BFM shall grant its approval to a sole proprietorship, partnership or body corporate to practise as consulting foresters in the prescribed occupational field(s), subject to the following terms and any such other terms, conditions and restrictions as it may deem fit to impose.

(a) sole proprietorship:
the sole proprietor must be a registered forester.
(b) partnership:
all partners must be registered foresters.
(c) body corporate:
(i) the board of directors of the body corporate must consist of -
(aa) entirely of individual persons who are registered foresters;
or
(bb) a majority of individual persons who are registered foresters and other individuals belonging to a profession allied to the practice of forestry or who have been approved by BFM;
and
(ii) all the shares in the body corporate are either held by the persons mentioned in (i)(aa) or (i)(bb), with the registered foresters having a controlling interest in the shares of the body corporate.

4.2.4 Occupational Fields

A qualified forester may, base on his qualifications and experience, apply to BFM to practise forestry under one or a maximum of two of the four occupational fields of:-

(i) policy and management.
(ii) industry and trade.
(iii) research and development.
(iv) education and training.

if he has adequate qualifications and experience to support such application.

A sole proprietorship, partnership or body corporate shall only be approved and registered to practise as consulting foresters in occupational fields in which the registered foresters in their full time employment are registered to practice.

4.2.5 Annual Practising Certificate

The Registrar shall, upon approval of BFM and receipt of the prescribed fee, issue to the registered forester, sole proprietorship, partnership or body corporate a practising certificate in specific occupational field(s) with or without conditions or restrictions. The certificate shall expire on 31st December of the year in which it is issued and shall thereafter be renewable annually.

4.3 Forestry Practices, Consultancy and Professional Services

Under the FPA, only the registered foresters and the entities approved by BFM are allowed to practise forestry or to provide forestry consultancy and professional services to any person or authority in Malaysia in: -

(a) preparation and submission of forestry plans, proposals or reports with contents which may include designs, studies, surveys, inventories, drawings, schemes, illustrations, statistical analysis, financial and economic analysis, forecasts, projections, valuation, assessment, auditing, certification, labelling and others on forestry subjects and matters.
(b) implementation, commissioning, operation, maintenance and management of forestry works or projects.

4.4 Cancellation, Suspension, Removal and Reinstatement

The registration of a registered professional forester and that of a forestry consultant may be cancelled, suspended or removed due to offences committed but they can be reinstated based on the provision of FPA after fulfilling the conditions set and making the relevant payments.

4.4.1 Grounds for cancellation, suspension and removal

Under the FPA, BFM is empowered to suspend, cancel or remove the registration of registered foresters based on the following grounds:

(a) offences involving fraud, dishonesty, moral turpitude, illicit commission or corruption.
(b) failure to disclose directorship, shareholding, agency or financial interest in company or business with dealings done on behalf of client.
(c) registration which was done based on fraud or misrepresentation or by reason of any mistake or error made by BFM in considering the application for registration.
(d) qualification has been withdrawn or cancelled by the awarding authority.
(e) adjudged a bankrupt or of unsound mind or is otherwise incapable of performing his professional duties.
(f) contravening or failure to comply with the FPA.
(g) failure to observe any restriction or condition imposed on the registration or practising approval.
(h) found guilty by BFM of any infamous or disgraceful act or conduct.
(i) using fraud, misrepresentation or concealing facts or circumstances to influence the approval of BFM for a sole proprietorship, partnership or body corporate to practise as consulting forester.
(j) causing, or permitting any partnership or body corporate to practise as consulting forester prior to the approval of BFM being obtained or after BFM has withdrawn its approval.

4.4.2 Procedure and Natural Justice

The cancellation, suspension, and removal order shall only be made by BFM after
(a) a hearing by at least two-thirds of the total number of BFM members; and
(b) an opportunity to be heard either personally or by counsel has been given to the accused person.

Any person whose name has been removed from the Register pursuant to the FPA could be reinstated by BFM if his appeal is allowed and such reinstatement shall be gazetted.

4.5 Offences and Penalties

4.5.1 Appointment and Power of Inspectors

The minister may appoint independent inspectors under section 36 of FPA to:-

(a) ensure that registered foresters comply with FPA.
(b) detect, receive reports and investigate on any act, suspected act, attempts or conspiracy to commit offences under FPA.

A person who obstructs or impedes an Inspector in the exercise of his duty could be liable to a fine not exceeding ten thousand ringgit or to imprisonment for a term not exceeding one year or to both.

4.5.2 Employment of Unregistered Person

Employment of unregistered person to render any forestry services under the FPA is an offence which on conviction is liable to a fine not exceeding twenty thousand ringgit or to imprisonment for a term not exceeding two years or to both.

4.5.3 Registration by False Pretences

The offence committed under FPA for obtaining registration by false pretences shall, on conviction, be liable to a fine of not exceeding one hundred thousand ringgit or to imprisonment for a term not exceeding five years or to both.

4.5.4 Failure to Comply Order on Cancellation or Suspension

Any failure to comply with an order by BFM on cancellation or suspension of registration commits an offence which is liable.

(i) to a fine not exceeding ten thousand ringgit for an individual;
and
(ii) to a fine not exceeding fifty thousand ringgit for a sole proprietorship, partnership or body corporate.

In addition to the penalties mentioned above the registration of the registered forester or the practicing approval of the sole proprietorship, partnership or body corporate concerned, shall be cancelled immediately.

4.5.5 General Penalty

Any person who commits an offence under FPA for which no penalty is expressly provided shall on conviction be liable:-

(a) in the case of an individual, to a fine not exceeding ten thousand ringgit;
and
(b) in the case of a sole proprietorship, partnership or body corporate, to a fine not exceeding fifty thousand ringgit.

4.5.6 Abetments and Attempts Punishable as Offences

A person who abets the commission of or who attempts to commit any offence under FPA shall be guilty of that offence and shall, on conviction, be liable to the punishment provided for the offence.

A person who is any preparatory to or in furtherance of the commission of any offence under FPA shall be guilty of that offence and shall, on conviction, be liable to the punishment provided for the offence.

4.5.7 Offence by Partnership & Body Corporate

Where a partnership or body corporate commits an offence under FPA, the partner, director, manager, secretary or other similar officer of the partnership or body corporate who is responsible for the management or assisting in the management of the partnership or body corporate;

(a) may be charged severally or jointly in the same proceedings with the partnership or body corporate;
and
(b) where the partnership or body corporate is found guilty of the offence, shall be deemed to be guilty of that offence, unless, he can prove that the offence was committed without his knowledge, consent or connivance; and he has taken all reasonable precautions and had exercised due diligence to prevent the commission of the offence.

4.5.8 Conduct of Prosecution

No prosecution for or in relation to any offence under the FPA shall be instituted without the written consent of the Public Prosecutor.

Any officer or agent of the BFM authorized in wiring by the Public Prosecutor may conduct the prosecution for any offence under the FPA.

5. ENFORCEMENT AND APPLICATION OF FPA

The FPA is drafted with the intention to best serve the forestry community. The execution and enforcement of the FPA must be designed to maintain its simplicity and to ensure its functional effectiveness and efficiency without causing undue additional burden to the forestry profession.

5.1 Uniform Act and a Single BFM

Ideally, and it is also the sincere wish of IRIM to have the FPA enforced uniformly in all States and the Federal Territories of Malaysia under one single BFM just like the Registration of Engineers Act 1967 and Quantity Surveyors Act 1967. This will be the best demonstration that the forestry profession of Malaysia from all the three regions can work in unison in the professional aspect amongst the diversity and inherent differences that exist in the forestry sector.

It is undeniable that land and forests are State matters under the ninth Schedule of the Constitution of Malaysia. The interpretation we have on the purpose and function of the FPA is that the FPA deals with the persons undertaking works related to forestry but it does not interfere with or try to influence the manner forestry matter is handled by the respective states and the other government authorities. IRIM advocates that there should be no conflict between the FPA and the other existing laws on forestry both at the Federal as well as the State level.

However the situation may be open to differing interpretation and opinion hence we may be entering into a grey area. It needs to be reiterated that it is never the intention of IRIM to have the proposed FPA to dictate, interfere or influence how the forestry matter is being or to be managed by the State authorities. IRIM does not harbour any ambition to curtail or dilute the authority and power of the States or the Federal Agencies through the application of the FPA. IRIM believes and holds the view that the FPA could also be structured to have a separate Board each in Sabah and Sarawak if all parties concerned decide that that is the best functional arrangement.

Although the land surveyors and the legal profession have separate laws and governing bodies individually for Sabah, Sarawak and Peninsular Malaysia, their situations differ from that of the forestry profession. When the Licensed Land Surveyors Act 1958 was introduced, Malaysia was not formed yet and the land surveyors in Sabah were regulated under Sabah Land Ordinance 1930 and the Surveyors Ordinance 1960. Similarly Sarawak had the Sarawak Land Code 1958 and the Sarawak Land Surveyors Ordinance 2001 which oversee the land surveying profession. As for the legal profession, the Legal Profession Act 1976 was not extended to Sabah and Sarawak because the Sabah Advocates Ordinance 1953 and the Sarawak Advocates Ordinance 1958 were already in place to protect the interest of the legal profession in the two states. However as regards the forestry profession, we are only in the process of drafting the FPA, hence it will be ideal if arrangements could be made to have one uniform law throughout the country for the forestry sector with the individual needs and requirements of the States being properly addressed in the FPA provisions and legal framework.

The decision on which route the FPA shall take is left to be determined by the Attorney General's Chambers and the respective States and Federal authorities.

5.2 Flexibilities and Saving Clauses

On the proposed FPA, flexibility and freedom for adoption and adaptation of the Act by the State governments are provided to address different and variable arrangements and situations which may be encountered by the respective States. Saving clauses and provisions to address possible anomalies are also made available in the Act. Some examples of such provisions are:

- …..the Minister may appoint different dates for coming into operation of this Act, in different parts of Malaysia.
  (Refer: Section 1 subsection (2))

- This Act shall apply throughout Malaysia but shall only be made applicable to Sabah and Sarawak with such modifications as the Yang Dipertuan Agong may by order make..……
  (Refer: Section 1 subsection (3))

- "Minister" means the Minister (or Ministers) charged with the responsibility for matters relating to forestry.
  (Refer: Section 2 on Interpretation)

- The right of a registered forester to practise forestry is subject to any restriction or condition imposed by BFM and the relevant laws of the individual component States of the Federation of Malaysia.
  (Refer: Section 26 subsection (3))

- Nothing in this section shall prohibit any forester in the public service of the Federation or State, or in the service of any local authority or statutory authority, from practising forestry.
  (Refer: Section 26 subsection (4))

- Nothing in this Act shall apply to anything done or omitted to be done by or under the authority of the Federal Government or the Government of any State.
  (Refer: Section 53)

- The Minister may, after consultation with BFM, make such modification to any provisions in any existing laws within 2 years from the appointed date by order published in the Gazette for the purpose of removing difficulties or preventing anomalies in consequence of the enactment of this Act.
  (Refer: Section 54)

5.3 Empowering Employment of Registered Foresters

The FPA through the BFM decides and specifies the qualifications required of a person before he or she is considered for admission to the register of registered professional foresters. However, it is the executing agency which decides under what circumstances is a professional forester required to do a certain job.

This decision to employ a registered forester may appear as an operational routine of a business entity in the forestry sector. However such decision may also be backed by some legislative frameworks empowering the hiring of FPA registered foresters to execute some specific jobs especially those involving public interest.

These arrangements and practice are clearly exemplified in the engineering sector where the Registration of Engineers Act 1967 defines who is a professional engineer and it is the Uniform Building By-Laws 1984 which provides the derivative power that specifies that certain building plans shall only be submitted by a qualified person who is legally defined as a professional engineer registered under the Registration of Engineers Act 1967.

In the context of the forestry sector, it could be the National Forestry Act 1984 which specifies the registered professional foresters to be the qualified persons to executive certain forestry related work or project. Other existing Acts and regulations regulating activities in the forestry sector could also be similarly amended to specify and empower the employment of registered foresters to provide certain professional services.

For a start, to ensure that the forestry sector is effectively managed by qualified foresters, we should seriously consider to specify that the head and the senior positions in the forestry services should only be held by registered foresters under the FPA.

6. CONCLUSIONS

The proposed Forestry Profession Act (FPA) is a dedicated law which regulates and protects the forestry profession in Malaysia. It will provide the legal framework to establish the required qualifications of a person who could be recognised and admitted to the fraternity of the forestry profession.

FPA establishes the professional identity of a qualified forester by way of formal registration and continues to monitor his or her professional conduct. Further upgrading of skill and enhancement of work experience will also be made available through a system and programme of continuing professional development.

FPA represents the most direct governance on the forestry profession. It also helps to project the high esteem and image of the professional foresters in the eyes of the society and the general public by allowing an exclusive use of a special honorific title.

This proposed Act will not only help to safeguard and uphold the integrity of the forestry profession but also protects the interest of the society at large against any irresponsible act or wrong doing.

The enforcement of the proposed FPA has a direct impact on the forestry profession and forestry practices in Malaysia. It provides a clear legal mechanism for the sustainable development of the forestry profession. It is thus the duty of all foresters to participate in the drafting process of the FPA to ensure that all needs and expectations of different sub-disciplines of the forestry community are met.

In the interest of the forestry sector and also the general public, all foresters should make concerted efforts in ensuring the successful introduction of the Act. The local foresters should not let the desire of having a Professional Act remained unfulfilled since the Ministry of Natural Resources and Environment has consented to the drafting of the proposed Act and to forward the same for consideration of the Government and the Parliament.

The forestry profession should continue this momentum and work with support of all parties until the final approval by the Parliament is obtained.

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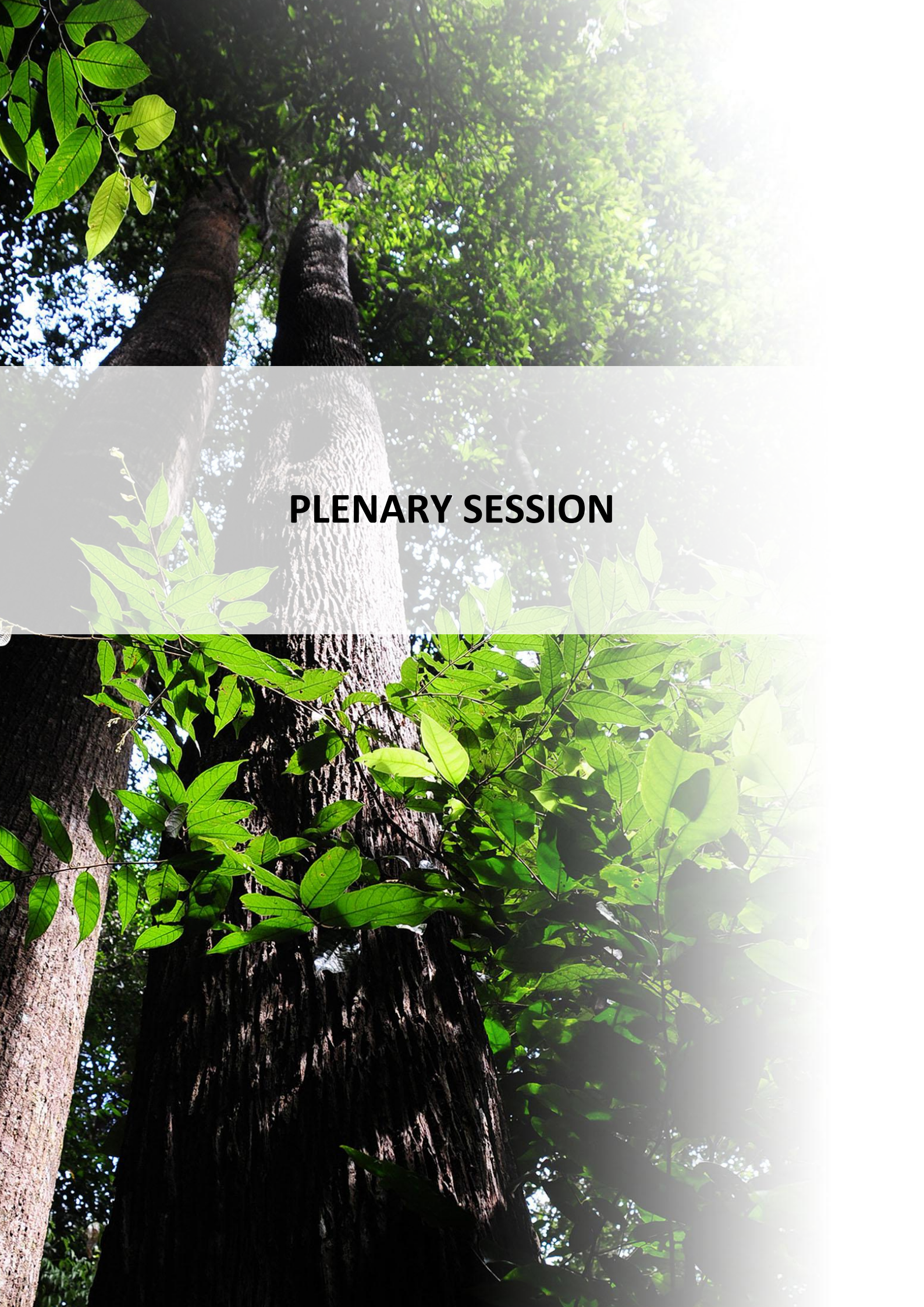

PLENARY SESSION

5.1 KEYNOTE ADDRESS BY YBHG. DATUK SAM MANNAN, DIRECTOR OF SABAH FORESTRY DEPARTMENT

Thank you Madam MC for the introduction.

Ladies and Gentlemen, this time of the day for speaking, is precarious as it is the time to sleep – Manyanah – The Graveyard shift.

Did that wake you up?

In these (20) minutes allocated, let me entice you to listen to our story here, of Sabah, and how we are moving forward.

Firstly, the background.

Prior to policy changes introduced in 1997, Sabah, for all intents and purposes was the Pariah of this country, if not the tropical world, when it came to forest management or the lack of it.

For brevity, these included:

The monkey sees, monkey does syndrome. Our decision makers in the early days thought they had the same all encompassing power of the colonial Governor. So they fought over authority, the right to issue forest concessions being the main competition. Political patronage came about from rewarding supporters through timber land allocations. We became the biggest producer and exporter of tropical timber in the world in the 1970s. Brazil was nothing. Land utilization options blindly followed the recommendations of foreign experts, with bio-diversity being a low priority. In any case, there was so much to throw around. The issuance of short term logging licenses, ignoring good practices, resulted in severe damage to the residual forests, and political instability exacerbated the situation. It was made hay while the sun shines.

The Former Prime Minister said as much in his visit to Deramakot. The opportunity came in 1997 to convince the government of the day that, what we were doing will cause our economic and environmental collapse. ***As a bonus, we were considered Pariahs!!***

The r**eforms** in 1997, briefly were:

The phasing out of short term licenses in forest reserves.

The launching of the SFMLA – FMU 100 – year forest management license agreement system, modeled on Deramakot, with participation from the private sector.

Getting political endorsement at the highest level of power and authority in the country.

After that, as they say, the rest is history.

WHAT ARE WE DOING NOW AND HOW DO WE MOVE FORWARD?

The Sabah papers to be presented today will provide some details and speeches by myself and the Chief Minister, have given you a glimpse of our forte. I shall try not to regurgitate what you already know.

Nevertheless, let me give you our big picture, at least for the next (20) years, meaning from 2010 – 2030 and a little bit of crystal ball gazing. I shall also touch on some organizational issues. I am no prophet or a magician. Therefore, only time will tell the results.

The Big Picture
Listen, Learn, Educate, Influence, Bantai!!

Our most important certificate is political certification – not the FSC, MTCS, RSPO or others. The practitioner will do harm to his organization, ***if he thinks he is the smartest person, every time, he walks into every room***. Compromises have to be made along the way and so long as it is on the basis of 5 steps forward and 2 steps backward, then, you are making progress. From time to time, land use compromises have to be made and this is where your negotiating skills are vital. In the end, be pragmatic with the end in mind as you are not the only one and sole stakeholder. It is more important to have influence rather than power. Power that cannot be carried through, is an illusion.

Increase the Area of TPAs – Totally Protected Areas (TPAs)

Make more from less and less. All pristine forests if identified, as much as possible, are classified as HCVFS – high conservation value forests. The crown jewels of Malua – Imbak – Danum are safe. But do not neglect regenerating forests and secondary forests. They are equally important. We have about 1.35 million ha of TPAs now in Sabah or 20% of the total land area of Sabah as we move to the long term target of 30% or over 2 million ha. of Sabah.

TPAs that need treatment will then be managed on the ground through FMPs (forest management plans) and a dedicated team that do nothing else. As articulated by the IUCN at the HoB conference, regenerating forests are vital for bio-diversity conservation. Take note, 75% of our orang utans are in TPAs or certified forests. That is my point on Sabah being the centre of its survival. It is our opinion that doing more with less, will result in a Sabah of the future with its bio-diversity treasures intact that may bring about multiple benefits that we do not already know. Our inter-generational contract must be honored. Let the future decision makers see some treasures. It is also that much harder to meddle with TPAs due to their highest status for conservation.

Restore, Restore and Restore

A degraded forest with no management input and presence on the ground, is a low hanging fruit that attracts predatory behavior. If you do not care, why would others care ? Our forte in the next (20) years is a massive programme of forest restoration. As of 2013, we have over 500,000 ha of treated, planted or rehabilitated forests. At least another 500,000 ha need treatments of some kind over the next (20) years, in a massive programme of forest restoration. The boring statistics show that, on average, we are doing 20,000 ha of silviculture tending, 3,000 ha of natural species restoration and adding 6,000 ha – 10,000 ha of new planted forests or ITPs each year. This translates to a direct investment of at least RM50m, excluding infrastructure costs – RM1 Billion for argument's sake for the next (20) years. The long term target is: 500,000 m3 of NFM timber, and 5 million m3 of planted timber production. This year, our plantation timber production will be equal to natural forest production or about 2 million m3 or thereabouts for the first time. This is a record on its own.

An NGO is now going through the FMPs of all areas and the data on the restoration programme and I shall thereafter be able to predict with greater confidence, what the picture will look like in the future, once this boring and tedious job is completed.

We do not have a Monopoly over Good Ideas

We strive to ensure that ideas are allowed to float around – no matter how awkward they may appear in the beginning. They can be internally or externally generated. This is where, NGOs, individuals, researches etc., play a vital role.

The World Is Your Oyster – Make Lots of Friends and Lovers

Black man, White man, Brown man, Yellow man etc. etc. Rich man, Poor man, Holy man, etc. Engage with them. There is no harm – keep an open mind. Take the example of the Malua Bio-Bank Project, which was brought to our attention by an NGO. The Royal Society, Britain's premier Academy of Sciences, has been with us for (30) years at Danum. The HoB is also a global initiative in which Malaysia has demonstrated leadership.

Transparency, Reputation and are You Believable?

There must be consistency in your decision making and no deviating from the big picture. One way to address this, is through a transparent system. An example is our third party independent auditing system for the last (5) years that has been extended for another (5) years.

The EU – FLEGT initiative is another such engagement and on a larger scale, the UNDP – GEF project at Kalabakan, that looks at multiple income streams from various land use options. The wide stakeholder participation in all these programmes and information being readily available for public knowledge and engagement, tests your credibility at all times.

It also takes a long time to build up your reputation and once damaged, it is difficult to regain.

Forest Certification
"The preacher must practise what he preaches"

The department has about 400,000 ha of FSC certified forests which it directly manages that will hopefully rise to 600,000 ha by the year end. The benefits do not have to be elaborated. At the same time, our licensees have been given a time line to be certified also. This must be adhered to, and if they fail, each individual case will be assessed on their own merits. The policy on certification must continue as it is an independent assessment of performance. It is not that I do not trust my people. I do trust but keep the option to verify!!

Knowledge Workers and Continuous Improvement of Best Practices

In order to raise standards of performances, you need to set the example and take the lead. Vital skills such as: forest tending, RIL operations, management planning, GIS, HCVFS, Wildlife monitoring, technology, investigations and prosecution, socio-economic surveys etc, are vital to the competence of the Forestry Department.

Deramakot is our experimental hub that has since expanded statewide to places such as: Ulu Segama, Trusmadi, Timimbang and others. Skilled human capital must continually be sharpened on the "hands on" approach – no paper and remote control management. The department strives to have world class practitioners from the humble laborer to the generals.

Money, Money, Money?

Forest revenue is only 4% or less, of the state revenue or some RM100m. It will be in this range in the next (20) years before it picks up again. To me, this **is success by failing**. The spot light is no longer on us.
Despite this trend, we strive to look at other options, such as:

- The Malua Bio-Bank
- Carbon Sales
- Agro-forestry development
- Sales of water
- Land rents
- Eco-tourism concessions
- New products – e.g. cellulose – plastics from trees
- Tourism
- The Mosaic System, etc.

We will try anything at least once. Attempts must be made to diversify revenue from other sources, especially when one controls so much land area.

Forest Research must be Mainstreamed and Part of the Administration and Management
Unlike in the past, research is part and parcel of forest management today and the FRC is not an isolated Ivory Tower for its experts. They are absorbed into forest management and conservation.

Create Native Entrepreneurs through SFM
The "Kampong Tawkehs" is our legacy. We move away from treating the symptoms of poverty and move to create ecological entrepreneurs. In the process, community involvement in SFM becomes mainstream. The benefits are also measurable and market based.

Update Laws to be Relevant
This is a continuous process that must adapt and adopt to changes in the landscape and emerging issues such as carbon, environmental services and forests outside the forest reserve system that are deemed as HCVS.

On enforcement, the platform for effectiveness is a managed forest on the ground: e.g. the SFMLA – FMU system, certified forests and our own managed forests. You must live inside. Expensive but vital.

Articulate, Disseminate, Inform and Convince
A good story not articulated well, will not pass. At the same time, the power of persuasion merits proper recording and interaction. Thus, our proliferation of publications, videos etc. and our engagement with the young and innocent, who matter most. The RDC educational programme remains our best effort on this aspect. At the same time, having yearly programmes of an international scope, such as the HoB conferences, keeps us abreast of developments and ideas floating around the world. It is not mere propaganda but to project the correct, honest and right perception of who we are and what we do.

Empowerment and Delegation of Authority "The best executive is the one who has sense enough to pick good men to do what he wants done and self restrain enough to keep from meddling with them while they do it" (Theodore Roosevelt)
I strive to be surrounded by clever people, preferably more clever than me. A Director cannot keep all important work to himself. In the department, it is our belief that the translation of policies into actions, focused on SFM, has progressed well as every major project is headed by at least a Deputy Director – sometimes more than one major project – be it on SFM , tourism and infrastructure related etc. This empowerment is vital for success, up scaling or else, the Director gets bogged down in micro-management.

Meritocracy and the Succession Plan
We had our fair share of meddling in the past – idiots get jobs they have no competence in. There is no better way to send an organization into the dark ages than ignoring meritocracy. It does so much harm.

From the horse's mouth, it has been stressed to me that, I shall choose competence and character above all else. I hope I have not disappointed the enlightened. At the same time, the succession plan must be designed and executed with care. After all, the dark side of the force is always lurking and ready to pounce at an opportune time. BEWARE.

My Conclusions
Veni, Vidi, Visi
(I came, I saw, I conquered): Julius Caesar

Ladies and Gentlemen, that is our story and thank you for listening to it.

If I can sum up in a few words, it is to ***institutionalize forest management and conservation.***

An institutionalized approach means:

You have a successful story.
You get recognition globally – Sabah is not enough.
You have a wide stakeholder network.
and
You are believable and of good reputation.

In the event of the dark forces returning, you are in a better position to resist them. And in the end process, this video sums it all.

Thank you.

5.2 KEYNOTE ADDRESS BY YBHG. DATO' SRI PROF. DR. HJ. ABD. RAHMAN BIN HJ. ABD. RAHIM, DIRECTOR GENERAL OF FORESTRY DEPARTMENT PENINSULAR MALAYSIA (PRESENTED BY YBHG. DATO' HJ. NOR AKHIRRUDIN BIN MAHMUD)

"THE FUTURE PROSPECT OF FORESTRY IN MALAYSIA: MY DREAM AND ASPIRATION IN 2020"

In the name of ALLAH swt, Most Gracious, Most Merciful.
Salutation to Our Beloved Prophet Muhammad PBUH.

Assalamualaikum WBT;
Salam Sejahtera;
Salam Satu Malaysia;
Salam Satu PPM; and
A very good afternoon.

Thank you very much to Madam MC.

Y.Bhg. Datuk Sam Mannan,
State Director of Forestry Department, Sabah

Y.Brs. Tuan Haji Sapuan bin Ahmad.
State Director of Forest Department, Sarawak

Y.Bhg. Datuk-Datuk, Dato'-Dato', Datu-Datu, distinguished guests, participants, ladies and gentlemen from the State Forestry Department of Sabah, State Forest Department of Sarawak and Forestry Department of Peninsular Malaysia.

At the outset, allow me to extend my prayer to Al-Mighty Allah SWT for providing me this opportunity to participate in this important gathering of the 17th Malaysian Forestry Conference (MFC) in this beautiful city of Kota Kinabalu, Sabah - Land Below the Wind with the theme "**A Century of Forest Management : Lessons Learnt and Way Forward**".

At this juncture, it is also my great honor on behalf of the Forestry Department Peninsular Malaysia (FDPM) to extend our heartfelt congratulations to Y.Bhg. Datuk Sam Mannan, State Director of Sabah Forestry Department on your 100 Years Celebration. Please allow me also to take this opportunity to extend my heartiest congratulation to the State Government of Sabah and the Sabah Forestry Department for their immense effort and hardwork in organizing this MFC Conference as well as other events to mark this historical event in your forestry calendar. As we all are aware that MFC is an important gathering held once in every three years, hence, I would like to share my past experiences as a practising foresters and offer my dream and aspiration on the future prospects of forestry in Malaysia, particularly in the year 2020 when our nation will attain a "High Income and Developed Nation" status. In this context, it is an honor and privilege for me to be here today with you this morning/afternoon to deliver my Keynote Address entitled **"The Future Prospect of Forestry in Malaysia: My Dream and Aspiration in 2020"** in such an important gathering of foresters and experts from various forestry related disciplines throughout the country. It is my humble hope that my deliberation will also attempt to reflect the theme of today MFC - **"A Century of Forest Management: Lessons Learnt and Way Forward"**. I am very sure that every one of us would like to see and hope that our forestry sector will remain important and continue to contribute significantly to the prosperity of Malaysia.

Y.Bhg. Datuk-Datuk, Dato'-Dato', distinguished guests, participants, ladies and gentlemen,

I. INTRODUCTION

We are indeed very fortunate to be endowed with large tract of tropical rainforests, covering three major forest types, namely dry inland forest, peat swamp forest and coastal forest (which is dominated by mangroves). These forest areas have been categorized either as Permanent Reserved Forest (PRF) or Non-PRF area. The PRF has been gazetted under the National Forestry Act, 1984 and managed sustainably. On the other hand, the Non-PRF areas which constitute both the State Land Forest (SLF) and Alienated Land Forest (ALF) are subjected to

the National Land Code. The Forestry Department Peninsular Malaysia (FDPM) which was established as early as 1901 has been entrusted to undertake responsibilities on forest management, development and administration of these forest areas, particularly critical for the implementation of Sustainable Forest Management System in the PRF areas which are under the custodian of FDPM. To date, 44% of the total land areas in Peninsular Malaysia or 4.9 million hectares have been designated as PRF and have been certified for SFM compliance under the Malaysian Timber Certification System (MTCS).

The development of these PRF areas is spearheaded by the key objectives as outlined in the National Forestry Policy (NFP), 1978 (Revised 1992). In accordance with the Article 74(2) of the Federal Constitution of Malaysia, forestry and land matters come under the jurisdiction of the respective State Governments. The National Forestry Council (NFC) which was established in 1972 and currently consolidated into the National Land Council (NLC) comprises members from the Federal and State Governments is overseeing the whole coordinated forest sector management and development in the country. It is through this NLC that the coordination of a common approach to forest management between Federal and State Government was facilitated. The NLC endorses all decisions of the NFC while the responsibility to implement these decisions lies mainly with the respective State Governments. Various forest enactments and ordinances had been formulated and enforced by the respective State authorities since the early 1900's to ensure effective forest management are implemented. In addition, the underlying principle of forest management, development and administration in Peninsular Malaysia continue to be governed and directed by the existing NFP, 1978 (Revised 1992).

Y.Bhg. Datuk-Datuk, Dato'-Dato', distinguished guests, participants, ladies and gentlemen,

II. CURRENT STATUS OF FOREST MANAGEMENT

In the past many years, since the early establishment of the FDPM in 1900, we had successfully sustainably managed our PRF areas for a single unique management objective or "single forest product", namely for timber production only. Perhaps, some other minor forest produces, such as gutta perca latex, keruing oil, petai (*parkia* spp.), rattan and bamboo were also harvested by local indigenous group from our forest at that point in time, but, the volume of these minor forest produces are comparatively small to the volume of timber extracted from our forest areas. The main focus of the "Forest Management Plan (FMP)" is purely managing PRF for timber production. As a result, even the "Harvesting Plan" has therefore been prepared for the purpose of timber harvesting only. In today situation, however, this is no longer true. Our PRF areas are not managed for one single forest product only, but rather for "multiple forest products (or multiple forest values)". These multiple values of forest areas are clearly listed under the Section 10(1) of the NFA, 1984, in which our forest areas could be managed for any of these twelve (12) functional classes. Some of these forest functional classes may also compatible and co-exist to one another. In this context, PRF could be categorized into any of the following functional classes, namely Timber Production Forest under Sustained Yield; Soil Protection Forest; Soil Reclamation Forest; Flood Control Forest; Water Catchment Forest; Forest Sanctuary for Wildlife; Virgin Jungle Reserves; Amenity Forest; Education Forest; Research Forest; Forest for Federal purposes; and Forest State Parks. Principally for the purpose of management, these forest functional classes are grouped into production and protection purposes.

III. CURRENT FORESTRY ISSUES AND CHALLENGES

Currently, there are already many research studies or initiatives undertaken to put some monetary value to these functional classes, especially the protection values provided by these forest. This initiative is widely known as the "Payment Ecosystem Services (PES)". PES has been defined as payment for ecosystem services (PES), also known as payment for environmental services (or benefits), are incentives offered to farmers or landowners in exchange for managing their land to provide some sort of ecological service. They have also been defined as "a transparent system for the additional provision of environmental services through conditional payments to voluntary providers. In other words, forest services can also benefited from this "PES" concept. The existence of PES in forestry, therefore, can provide new opportunity to put monetary value to all our forest services. Unless, we could achieve consensus to these monetary values, we need, therefore, to work hard continuously in order to generate suitable and acceptable price for all forest services generated from our tropical forests.

Despite the presence of "PES" provides good opportunity for us to generate potential future revenue from various forestry services, there are still many issues and great challenges lie ahead of us to make this a reality. It is now, therefore, up to our readiness and preparedness to explore these potentials. While this is still pending, we will continue to meet and indulge in a fruitful discussion for the betterment of future forestry sector development in Malaysia, either at the domestic or international fora. In another development, increasing global

environmental concerns for certified timber have also exerted great pressure for timber certification schemes. Ineffectively, restricting trades in utilization of tropical timber has generated the lack of confidence among consumers that are questioning the source of timber production. We cannot afford to ignore these consumer demands. On the other hand, it is not impossible that timber harvesting would be less of a priority in the near future and trading forest services would be the alternative unless the timber-based industries are always vigilant to increasing consumer demand for certified wood.

Y.Bhg. Datuk-Datuk, Dato'-Dato', distinguished guests, participants, ladies and gentlemen,

As we are aware, forests also play an important role in maintaining environment stability, minimizing damages of riverine ecosystem by erosion, floods and also as a 'carbon reservoir' in regulating the climate and in absorption of carbon dioxide. The world communities have also alerted us that our forests must also continually be managed as a source of biodiversity and contribute towards new finding on medicinal plants that have the potential for pharmaceutical uses. Therefore, the greatest challenge for many forest managers in the coming century will be to strike balance between the need to use the forests for environmental protection, conservation and demand for forest-biodiversity while trying to meet the need for living space as well as maintaining the timber as a source of wealth.

On the other frontier, at the moment, many people in developing countries, such as Malaysia, still depend on natural forest products as their only or main source of livelihood. The rural used forest in many ways including for subsistence, formal and informal employment and other purposes, such as security, cultural and spiritual customs, and recreation. The ecosystem services provided by forests and trees also make important contributions to agricultural production and forest-dependent communities. We must not lose sight that SFM is very important as it also meant for balancing between both forestry and agriculture uses. Land has always been a competing factor between forestry and agriculture uses. In the past, efforts to implement SFM focused heavily on harvesting wood, fiber, fuel and a range of non-wood products. In recent decades, more attention has been directed towards understanding how people use forests, in combination with other natural resources, to achieve food security, alleviate poverty and sustaining community livelihoods. As a result the implementation SFM has also evolved rampantly in tandem with the progress in its three key pillars, namely the economic, environmental and social aspects. In this context, SFM could be regarded as a process to safeguard and deliver a wide range of social, cultural, environmental and economic benefits, increasingly embracing people-centered and pro-poor approaches integrated with other sectors that support food security and livelihoods. This situation needed to be fully resolved particularly critical by the Year 2020 when Malaysia is declared as a "Developed Nation".

Under the Economic Transformation Programme (ETP), Malaysia had also introduced "Malaysia Mega Biodiversity Hub" (MMBH) to enhance ecotourism activities that focuses international attention to Malaysia's outstanding biodiversity, to optimize growth of socially responsible tourism, and to foster ethical sustainable management of practices. This is another opportunity that our PRF areas also can offer, namely eco-tourism within the existing 124 forest recreational areas.

Y.Bhg. Datuk-Datuk, Dato'-Dato', distinguished guests, participants, ladies and gentlemen,

We are fully aware that forestry sector in Malaysia continues to play as an important sector that contributed significantly to the nation's socio-economic development. For example in 2013, the forestry sector contributed RM8.5 billion or 0.9 % of Malaysia's Gross Domestic products of RM 984.45 billion in which RM 19.33 billion contributed from the timber and timber products alone. With the current wave of the changing societal demands, future forest management will also need to cater on the expended roles of forest in livelihoods. Therefore, it is pertinent to develop and strengthen the institutional capacity and expertise in the field of forest management. Greater emphasis should be given in enhancing knowledge and in the development and expansion of skills, such as in the conservation of forest biodiversity in the effective management of watershed and in mitigating climate change. In addition, the number of personnel in forest management should also be increased so as to fully achieve multiple-resource forest management that involves the simultaneous production of forest goods and services which are compatible with the need to conserve the forest ecosystem and at the same time protect the environment.

Deliberation on issues pertaining to climate change and global warming which is now becoming pertinent in both the domestic and international fora. Responding to these demands, FDPM has also embarked on the greening the earth project focusing on the role of forest as "Carbon Reservoir" (Carbon Sequestration) through 26 Million Trees Planting Campaign throughout the country from 2010 to 2014. This tree planting programme has also been expanded in the National Coastal Forest Rehabilitation programme, in which mangrove trees are

vigorously planted along the National coastline. Forests play an important and significant roles in reducing the effect of Green House Gases (CHG), such as carbon dioxide in the climate change effect, in which trees absorb carbon dioxide and release oxygen during the photosynthesis process. I strongly believe that tree planting activities are important for any future greening of the earth programme.

Y.Bhg. Datuk-Datuk, Dato'-Dato', distinguished guests, participants, ladies and gentlemen,

IV. CURRENT NEW FORESTRY DEVELOPMENT AND FUTURE EXPECTATIONS

Looking into the future with high expectation on potential new forest products and services that our forests continue to offer as well as several lessons learnt from past many years of forest management, FDPM is currently pursuing to review several forestry sector priorities in tandem with current new forestry development and future expectations. It is very timely that we need to explore new possibilities in the future national forestry sector development in the country. We need to provide new room for improvement, accept changes and re-align our goals and mission in line with the dynamic forestry scenarios locally and internationally in order to remain competitive and relevant. Indeed the forestry sector development in our country is at a cross-road which warranted us to formulate a new set of forest management strategies, which will fully address the concept of "looking beyond trees".

I believe our meeting today in Kota Kinabalu, Sabah will provide some new thinking and important new guidance in this matter. I strongly believed that the 17th Malaysian Forestry Conference (MFC) in Kota Kinabalu could provide great opportunity and shed more light in achieving our aspiration to ensure that forestry sector continues to remain relevant and contributes significantly to our country socio-economic development. In our last meeting during the 16th MFC, Melaka in 2011, we had successfully outlined a total of 26 action plans under the following 6 key important resolutions areas, namely:

- forest management certification is a meaningful yardstick for effective implementation of sustainable forest management;
- the increasing demand on forest for recreation and ecotourism activities;
- the important roles of forest in mitigating the adverse effects of climate change;
- the significance of forest biodiversity and conservation;
- R&D and innovations are crucial towards realizing sustainable forest management; and
- the importance of fostering greater integrity, professionalism and dedication of forestry personnel, as well as in enhancing forest law enforcement towards sustainable forest management,

From the resolutions generated from our last MFC, it is clearly indicated that there are many existing good indicators this far that we can use as an important new basis and guidance to go into the future of our forest sector development in the country. In FDPM, we have already set clearly our visionary journey into the future, especially towards 2020 by further reinforcing our FDPM Vision, namely "**To be the Agency of Excellence in the Sustainable Management of Tropical Forest**" to all level of our departmental staff. In this endeavor, all forestry staff in FDPM have been urged and encouraged to work harder and more diligently in order to realize this meaningful FDPM Vision. Similarly, many field forest officers are also urged and encouraged to equip themselves with most up to date knowledge and skill in order to impart their role and responsibilities more effectively during the process of making decision for the future formulation of effective forest management prescription. In addition, they have also been advised to take on board some new approaches in their future undertakings, such as mastering multi-tasking abilities in their readiness to embark strategies managing PRF for multiple values.

It is also inevitable that new planning tools be made available to facilitate their follow-up actions as well addressing new forestry future strategies. In this context, efficient computer-based working tools, such as GIS, Remote Sensing are being installed for effective data collection, processing, analyzing and information handling. More and more geospatial data, physical data, economic data, environmental data, and social data are critically needed to generate fruitful and meaningful information for more effective forest management. All these information are very crucial to be addressed to reflect the relevance of forestry not only for the benefit of present generation but also for future generations, particularly when our nation will attain a "High Income and Developed Nation" status in 2020. I also do hope that forestry sector will continue to provide many more job opportunities in line with the implementation of multiple values of forest approach. In this context, I hope you have benefitted from my deliberation on "**The Future Prospect of Forestry in Malaysia: My Dream and Aspiration in 2020".**

V. CLOSING

In domestic situation, we will continue to engage into intra-agencies or intra-sector consultation and dialogue. We cannot work in cello anymore but to work together through collaboration or partnership between all interested parties. As we are aware, business is no longer as usual. We will continue to strive and indulge ourselves in the "Blue Ocean Strategy" approach in our future forestry endeavors. We need also to participate actively at the regional and international forestry related fora, namely UNFF, UNFCCC, CBD and CITES, just to name a few. May I conclude by deliberation by saying "Think globally but act locally".

With these remarks, I would like to conclude my speech and wish all of you a meaningful and fruitful deliberation.

Thank you very much for your patience and indulgence.

Wabillahi-taufik-walhidayah.

Assallamualaikum Warahmatullahi-wabarakatuh.

5.3 KEYNOTE ADDRESS BY TUAN HAJI SAPUAN AHMAD, DIRECTOR OF FOREST DEPARTMENT SARAWAK

Terima kasih saudari pengacara majlis.

Bismillahirahmanirahim,
Assalamualaikum Warahmatullahi Wabarakatuh

Yang Berbahagia Datuk Sam Mannan
Pengarah Jabatan Perhutanan Sabah,

Yang Berbahagia Dato' Hj. Nor Akhirrudin bin Mahmud
Timbalan Ketua Pengarah Jabatan Perhutanan Semenanjung Malaysia,

Yang BerBahagia Datu Haji Ali bin Yusop
Ketua Pegawai Eksekutif dan Pengarah Urusan, *Sarawak Forestry Corporation,*

Para delegasi, peserta, pemerhati Persidangan dan pihak rakan media,

Yang Amat Berbahagia Tun Jeanne Abdullah, Datuk-Datuk, Datin-Datin, tuan-tuan dan puan-puan yang saya hormati sekalian.

Salam Sejahtera dan Salam 1 Malaysia.

I am truly and deeply honoured to present a Keynote Address at this 17th Malaysian Forestry Conference at this majestic and panoramic Magellan Sutera Harbour Resort in Kota Kinabalu, Sabah.

Firstly, I would like to congratulate the Sabah Forestry Department and especially my distinguished colleague, Yang Berbahagia Datuk Sam Mannan, the Director of Sabah Forest Department for successfully organising and hosting this 17thMalaysian Forestry Conference.

I have been regularly attending the Malaysian Forestry Conference (MFC) and I always savour the experience of being in the MFC. The MFC is always fruitful as we gained tremendous insight into the challenges and opportunities common to all of us foresters. Another added feature of these MFC was that friendships, networking and partnerships were forged and several of those are still thriving among all the Malaysian foresters.

It is timely that the theme of this 17th MFC entitled '*A Century of Forest Management: Lesson Learnt and the Way Forward'* was chosen. It is apt that we reflect on the lessons that we have learnt and strategise our way forward in terms of managing our forests.

The past century has left us with numerous lessons to be learnt and the future challenges us to innovate and be adept to pave the way forward for forestry to be significant and relevant with the changing of time.

The question that is always being posed to us– *'Is forestry still significant and relevant in today's era where land use pressure is so immense with the world population projected to reach 11 billion by the end of the century?'* I am also sure most of you have frequently heard whispers that forestry is a sunset industry.

Let me pose this scenario from the global perspective as forestry management needs to be seen as a global endeavour but having its local effects.

Ladies and gentlemen,

Forestry and its Global Significance

The lesson learnt over the century has shown us that the challenges in forest management globally have evolved from just managing forests as a source of wood products to become an agent of multiple benefits and services.

There is now a more intense interest in the world's forests, especially with the growing awareness of their role in the global carbon cycle. To some, sound forest management was seen to be a panacea for climate change. This has further highlighted the essential role of forests as the lungs of the Earth. The world has now recognized what we foresters have known for a long time – that forest is critical to healthy lives and healthy economies.

The Food and Agricultural Organisation United Nations in its 2012 State of the World's Forest Report indicated that forests currently cover about 4 billion hectares, about 31 percent of the earth's land surface.

These areas provide approximately 1.6 billion people with food, medicines, fuel and other basic necessities and over two thirds of known land-based species live in forests.

Forest products make a direct significant contribution to the shelter of at least 1.3 billion people, or 18 per cent of the world's population. The recorded number of people living in homes where forest products are the main materials used for walls, roofs or floors is about 1 billion in Asia alone.

The formal forest sector employs some 13.2 million people across the world and at least another 41 million are employed in the informal sector.

Forests also provide employment and livelihood for a large proportion of the population – especially in developing countries – and often act as an economic safety net for most in times of need.

But as we deliberate, strategize and developing action plans on how to evolve our forestry sector, pressing global issues are also facing us constantly. There are many lessons learnt from the past centuries that have now been inherited by our generation. Uncontrolled forest degradation and deforestation have been one of them.

Forest Degradation and Deforestation

Periodic deforestation by our forefathers has accompanied population growth and development for thousands of years, throughout the world. One of the most important transitions in human history is the change from hunter-gatherer cultures to the early agricultural activities of Neolithic people. This change in human culture is closely related to an increasing exploitation of forests. Hence, many regions of Europe have repeatedly been subject to deforestation.

Today, it is also hard to believe that during the early part of the third millennium BC, vast forests were growing in the Middle East. In the middle of the 19th century, the French novelist Chateaubriand stated that *"forests precede civilizations, deserts follow them"*.

Deforestation is still an issue facing the world today as human development and land use for other purposes become more intense. FAO, based on its various reports and assessment summed up that the net global deforestation rate, taking into account increases as well as decreases in forest area, was estimated at 11.3 million hectares per annum.

But we have learnt a grave lesson from our forefathers and have made positive way forward. The deforestation issue has received positive responses from our generation.

The global community has unanimously agreed that the underlying causes of deforestation and forest degradation are interrelated and are often socio-economic in nature which includes poverty.

There has been numerous 'way forward' that has been taken by our generation and has addressed the deforestation concern fittingly.

Among the initiatives globally taken was the move towards sustainable forest management, synergising regional, international collaboration through numerous conventions and forest restoration.

Many measures to promote sustainable forest management have been developed, including a trend towards incorporating sustainable forest management (SFM) as a broad national goal, increasing stakeholder participation, and greater openness to voluntary and market-based approaches.

Global – State of the Forests

As we made amends for the lessons learnt from the past, the question that arises is 'Have we done enough both globally and locally?' The FAO has done its Forest Resource Assessment (FRA) 2010 to assess the state of the forests globally recently. Let me share with you a few key findings from the FRA 2010 Report. Among the major key findings from the FRA Report include the rate of deforestation shows signs of decreasing and large-scale planting of trees is significantly increasing the forest area globally.

Primary forests account for 36 % of forest area and on a global average. The area of planted forest is increasing and now accounts for 7 % of total forest area in the world. Between 2000 and 2010, the area of planted forest increased by about 5 million hectares per year.

National parks, game reserves, wilderness areas and other legally established protected areas cover more than 10% of the total forest area in most countries and regions. The area of forest within a protected area system has increased by 94 million hectares since 1990.

Forests still store a vast amount of carbon. Forests contain more carbon than the entire atmosphere. The world's forests store more than 650 billion tonnes of carbon. Sustainable management, planting and rehabilitation of forests can further conserve or increase forest carbon stocks in the future.

The FRA Report showed that forests still have a critical and significant role to play and showed that we have learnt our lessons and have made the way forward to enhance our forestry management over the century.

Ladies and Gentlemen,

Now let me now share with you on issues closer at home and in my heart on what are the lessons learnt and the way forward that Sarawak has undertaken over half of a century on its forest management.

Sarawak's Forestry – Lesson Learnt and the Way Forward

Sustainable Forest Management

The forest industry sector plays a very important role in Sarawak's economy, contributing RM 6 – 8 billion to the State annually over the years.

Sarawak realised that in order to sustain its timber industry as a major revenue earner for the State, Sarawak needed to move forward from its comfort zone of 'sustaining its timber yield' to embracing a more challenging and evolving concept of 'sustainable forest management'. Sustainable forest management is the way forward for the State.

It is this concern that led to the state to make a bold move in the 1970s and invited the Food and Agriculture Organisation (FAO) of the United Nations to Sarawak to study our forests and make recommendations on our forest management.

In 1989 yet again, our former and visionary Chief Minister of Sarawak, the present TYT personally invited the International Tropical Timber Organization (ITTO) to send a mission to Sarawak during the Sixth Session of the International Tropical Timber Council in May 1989, held in Abidjan, Côte d'Ivoire to assess sustainable utilization and conservation of tropical forests. This includes advice on our genetic resources and maintenance of the ecological balance. Such an independent Mission was unprecedented in international forestry cooperation. The ITTO made a few critical recommendations to the State but overall found that forest management in Sarawak was of a higher standard than in most other tropical timber producing countries.

The State government is going to further strengthen its sustainable forest management policies and practices by encouraging timber certification schemes by our big logging operators. Our present Yang Amat Berhormat Chief Minister has also recently reiterated that he wants concession areas within the Heart of Borneo areas to obtain Sustainable Forest Management certification by July 2017 at our recently concluded Seminar on Sustainable Forest Management 2014 in Kuching. Sarawak will strive to make sustainable forest management as a green corridor for human development.

Conservation and Protection of Biodiversity

50 years ago when conservation and protection of high conservation value areas was a far distant word, Sarawak's colonial masters had gazetted the Bako National Park in 1957. The British probably gazetted the areas more as a recreational area for them because of its beautiful bays and sandy beaches. As Sarawak gained independence, the conservation persevered on. Sarawak has now 51 totally protected areas covering 831,778 hectares of both land mass and water bodies. Sarawak's totally protected areas now serve numerous functions and purposes. Protected areas have emerged as one of the world's most important and effective tools and strategy for safeguarding biodiversity. Their importance now ranges from conservation of biological diversity, storehouses of genetic material, provision of essential ecosystem services for human welfare, and contribution to sustainable development.

Participatory Forestry and Strategic Partnerships

The way forward both in sustaining our forest resources and enhancing our protection of forest is by encouraging participatory forestry.

Globally now, there is a thrust towards community based and non-government organization involvement in forestry. With a sense of ownership comes greater responsibility to protect and conserve. Private companies, such as *Petronas, Fuji –Xerox* have now become much more involved in our forestry program, such as the *Bakau* Planting program at our RAMSAR site: the Kuching Wetlands National Park.

It is also important for Sarawak to form strategic partnership with various stakeholders. Various strategic conservation partnerships on a government to government basis with Japan, Netherlands, German, Denmark, USA, Australia, New Zealand, India and China have been forged to provide technology transfer, funding and expertise.

Joint Scientific research and programs have also been developed with academic institutions such as Salford University, Lincoln University, Universiti Malaysia of Sarawak, Universiti Putra Malaysia and Universiti Malaysia Terengganu. These collaborative efforts will promote greater cooperation and sharing of scientific information. We have also initiated wildlife conservation programs with creditable NGOs, such as the World Wildlife Fund (WWF), the Wildlife Conservation Society (WCS) and Malaysian Nature Society. Sarawak will host the International Hornbill Conference in 2017.

Local community collaborative programs have also been initiated under our community initiatives services programs. The Special Wildlife Committee, Special Park Committee and the Honorary Wildlife Rangers have also been established to assist in various forestry and conservation management issues.

Regional Cooperation - the Way Forward

We could not adopt a 'stand-alone approach' in managing our forests. Issues on forestry and conservation are common grounds affecting us and it is borderless. We need also to move forward as a region. The Heart of Borneo Initiative and other regional cooperations have shown that this is possible.

There is now a greater synergy among Malaysia, Brunei, Indonesia and others in respect to the sharing of experiences, research and general information. Based on the homogeneity of the region, each country can benefit from the lessons learnt from its neighbour. These synergies must exist not only at the level of governments but also at the academic and institutional levels.

Forestry Plantation Programs

Sarawak in the past has also learnt the lesson on the need to address the degradation of its forested areas by massive shifting cultivation. The Permanent Forests Estates of Sarawak was also affected by shifting cultivation activities.

The way forward for Sarawak was at that point of time was to initiate a large–scale reforestation program in 1984 in order to restore unproductive shifting cultivation land particularly in the Permanent Forest Estate to productive forests. Now, the State has set aside an area of 1 million hectares for forest industrial plantation for the sustainable supply of timber for timber industries. At the same time, it will lessen pressure on the remaining natural forests and will eventually for conservation of biodiversity.
I believe that we as the forestry community must be at the forefront of the campaign to restore not just forests but also degraded land in all our ecosystems.

Policies and Legislations

Sarawak is blessed with a wise and pragmatic government of the day. One of the fiercest lessons learnt by Sarawak is being adaptive to the challenges facing the forestry sector over the years. The ever evolving definitions of legality and sustainability by various international organizations and consumer countries, without these group fully understanding the complexities of managing the tropical forests, has bogged us down unnecessarily in our quest on balancing between our State's forest and economic sustainability. But over the decades, with the more demanding and changing expectations globally on the forestry sector, Sarawak realised that it needs to think and operate outside of the "forest" box.

Policies on forest management must explicitly address forest roles in providing food, energy and shelter. Sarawak has developed its Forest Policy in 1954. It is a policy that has withstood the test of time for five decades. But now Sarawak recognises the need to look beyond the trees and embrace a more holistic landscape approaches.

The Sarawak Land Use Policy has now been developed to provide a more holistic and comprehensive approach on land use. The policy's main objectives are to optimise land use for sustaining economy, global competitiveness, to mitigate land use conflicts apart from maintaining environmental integrity and biodiversity.

The Land Use Policy has set 6.0 million hectares for Sarawak's Permanent Forests Estates (timber production forests), 1.0 million hectares as Totally Protected Areas (which is the national parks, nature reserves and wildlife sanctuaries), 4.0 million hectares for agricultural purposes while the remaining 1.4 million hectares are for settlements and others.

Sarawak has now 4.3 million hectares gazetted as Permanent Forests Estates, 831,778 hectares as totally protected areas and 323,625 hectares as forests plantations.

Our legislation has also been improved and amended to abide with the changing times and needs. The Forest (Planted Forests) Rule 1997 was legislated to encourage the establishment of large scale plantations through the investment of the private sector. The Forest Ordinance 1954 is also in the process of amendment.

Human Capital and Operational Improvement

One of the most critical lessons that need to be learnt is our constant improvement of the human capital within our organisation. As a way forward, we have re-engineered our approaches and operations of the "old Forest Department ways of doing things" into a modern organization that needs to handle a rapidly changing and globally demanding environment. The traditional Forest Department has undergone major management improvement and forestry staff is now equipped to operate within the modern management sector principles. The mind-set and delivery system have been streamlined to work within performance measures, such as Balanced Score Cards, Key Performance Index (KPI), Standard Operating Procedures (SOP) and is now more customer-driven. Strategic plans were also being developed and constantly improved to meet the challenging times. Values, such as integrity, accountability and environmental stewardship were also encouraged and instilled in our organization.
Sarawak Forestry Corporation was also established to assist the Forest Department on all operational matters.

Conclusion

As a responsible government of the day, the Sarawak Government is fully aware that the socio-economic well-being and quality of life of the present and future generations of Sarawak, rest upon the wise management and sustainable use of the natural forests. We are also reinforcing our strategic directions to ensure sustainability of our production forests, our rich biodiversity, protecting our catchments and water resources and enhancing community benefits of the forests.

To conclude, I believe that the only way forward is to think and act beyond traditional forestry. We may win a few battles but we will lose the war. However, if we join forces with like-minded groups, on common issues on forestry and environment, half of your battle is already won.

Sekian,
Wabillahi taufiq walhidayah,
Wassalamualaikum warahmatullahi wabarakatuh.
Thank you.

WORKSHOP SESSION I

FOREST MANAGEMENT: TECHNOLOGY, INNOVATION AND PRACTICES

PAPER 1: 1

FOREST COVER MAPPING USING GEOSPATIAL TECHNOLOGY IN PENINSULAR MALAYSIA – TOWARDS THE ENHANCEMENT OF FUTURE SPATIAL - BASED FORESTRY REPORTING

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Forestry Department Peninsular Malaysia

ABSTRACT

Forest is an important asset that provides tangible and intangible benefits to mankind. As the population grows and technology becomes advanced, the demand for land has also increased. In developing countries, forest becomes an important land bank for future development. However, adverse effects to the environment such as climate change and global warming have been linked to the accelerating rate of deforestation and the degradation of forests by those countries. The availability of timely, consistent and accurate information on the forest land resource particularly its extent and quality is crucial as an indicator for forest management and conservation performance. The integrated use of remote sensing and geographical information system (GIS) or geospatial technology, has enabled the production of statistical information derived from the geospatial data where the statistical size of a forest area is constant with the graphical map of the area. Thus, it prevents any dispute after reporting, which were formerly present when solely using non-spatial text or tabular data. Time-series data is vital for forest cover change monitoring and assessment where element of using geospatial technology has begun to incorporate in the reporting process. The Forestry Department of Peninsular Malaysia (FDPM) has embarked on a forest cover mapping exercise for several years combining satellite imagery interpretation and GIS overlay analysis as a means to enhance the eminence of its reporting to ensure its integrity towards the attainment and protection of the country's forest resource, particularly the permanent reserved forest. This paper looks at the knowledge and experience gained from this technology used for forest cover mapping, issues and challenges that appear from its implementation and recommendation towards the enhancement for future spatially-enabled forest resource reporting for more effective future forest management.

1.0 Introduction

Forests play important multiple roles to stabilise the environment, among its function is as carbon stockings which stabilise the climate. Issues of climate change and global warming are associated with human activities such as deforestation which reduces the size of the forest and degrades the forest quality while negatively affecting its ability to stop carbon emission.

Forest change monitoring has become significant since the United Nations Conference on Environment and Development (UNCED) in 1992. As a nation with tropical forest cover, Malaysia is not exempted from submitting forest status reports at regional and global levels such as through the Country Report for the Convention on Biodiversity (CBD), Forest Resource Assessment (FRA), Monitoring, Assessment and Reporting (MAR), ASEAN Senior Officers of Forestry (ASOF) and ASEAN Ministers on Agriculture and Forestry (AMAF). The information will also be used as the base for the country's effort in implementing the carbon scheme such as the Reducing Emissions from Deforestation and Forest Degradation (REDD) which may provide monetary incentives through conservation and rehabilitation of the country's forests.

In 2010 and 2011, the Ministry of Environment and Natural Resources (NRE) conducted several meetings to pursue forest cover mapping on a pilot basis using geospatial technology involving several agencies, including Forestry Department Peninsular Malaysia (FDPM). The initial definition for forest as agreed was:

"Land covering an area of more than 0.5 ha with trees having height of more than 5 meters at maturity and with canopy coverage of more than 30% or trees enable to reach the thresholds mentioned *in situ* derived from satellite imageries. Excludes land dominated for agriculture and urban purposes but include water bodies."

For REDD, the areas to be taken into account will be the Permanent Reserved Forests (PRF) and the Totally Protected Areas (TPA) under the administration of the Department of Wildlife and National Parks (DWNP).

2.0 Methodology and Procedures of Forest Cover Mapping Using Geospatial Technology

Forest cover mapping using geospatial technology by FDPM was initially started to complement NRE's requirement to produce forest cover information of Peninsular Malaysia which will be of minimal dispute. FDPM uses an integration of remote sensing and Geographical Information System (GIS) procedures to accomplish the task. Software used are ERDAS Imagine, ArcGIS and ArcView 3.x. SPOT 5 satellite imageries are obtained from Remote Sensing Agency Malaysia (ARSM) covering 68 scenes for Peninsular Malaysia. All imageries received and processed were already pan-sharpened/fused imageries to a spatial resolution of 2.5 meter and georeferenced to the West Malaysian RSO map Projection. imageries chosen were those with the least cloud cover (less than 30% cloud cover), available. Whenever needed, additional ground control points (GCP) were added to improve the accurate positioning of the imageries.

2.1 Preliminary Testing Method

Digital image processing, beginning with Unsupervised classification (UC) was conducted using a test imagery scene to generate several classes. Each class was identified through overlay analysis using GIS layers, i.e. PRF boundaries, Land Use Map produced by the Department of Agriculture (DOA), National Forest Inventory Map and georeferenced scanned topography map produced by the Survey and Mapping Department of Malaysia (JUPEM). After matching each feature with the different colours generated through UC, Supervised Classification (SC) was performed to improve the results. However, the classification output of SC was only slightly better than that of UC. No proper accuracy assessment was done due to the unavailability of current ground data for comparison. The SC raster output was converted to GIS shapefile vector format. The vector layer was then overlayed with the same imagery scene to check for classification inconsistencies and to enable correction/editing. Once again, relevant GIS layers were used as support and reference during editing. The re-digitising and correcting proved to be a tedious and cumbersome task, thus the exercise was not duplicated for the remaining scenes.

2.2 Visual Interpretation

Recognising targets is the key to interpretation and information extraction (UiTM 2000). Despite the decades of remote sensing application, Ghorbani *et al*. (2013) found that visual interpretation still produced higher accuracy than digital image classification for Landsat TM and Google Earth imageries. Previously, FDPM has been using visual interpretation technique to extract vegetation features from Landsat TM imageries (FDPM, 1994). However, there has been no specific guidance produced by the agency on applying the technique for the 4 bands SPOT imageries. Nevertheless, the elements for visual interpretation for the latter imagery remains the same – tone, shape, size, pattern, texture, shadow and association. Using the combination of vector layers of PRF boundaries, Land Use Map produced by the Department of Agriculture (DOA)(use forest feature only), National Forest Inventory Map and topography map(use forest feature only) enabled the early creation of the 'rough' forest cover layer in vector shapefile format. Overlayed with SPOT imagery using false colour band combinations of 4,5,3, on- screen digitising was conducted to delineate visually the forest feature (based on the definition agreed by FEOC) with on and off comparison made to the other related layers (where relevant, the same delineated boundary of the other layer is used to maintain boundary consistency). The forest delineation was further refined to separate the four (4) main forest types; inland forest, peat swamp forest, mangrove forest and forest plantation, again referring to the related layers for guidance. The digitised data underwent the topology process in ArcGIS to eliminate data irregularities.

Interpretation Key of False Colour Composite (Red-3 Green-4 Blue-2) of SPOT 5 are as follows:

Dry Inland Forest

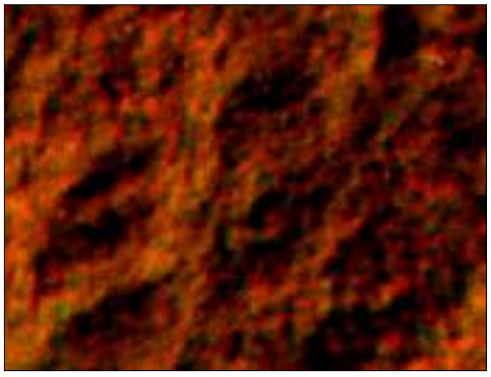


Figure 1: Virgin forest - dark chocolate colour tone, undulating surface, hilly or lowland topography and coarse texture.

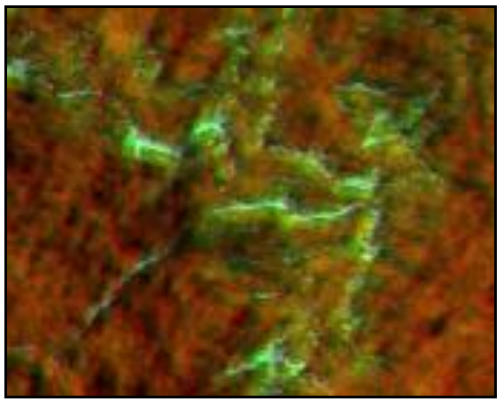


Figure 2: Logged-over forest - bright chocolate colour tone, greenish tones skid trail with corrugated surface and dominated by clustered plant due to logging activity.

Mangrove Forest

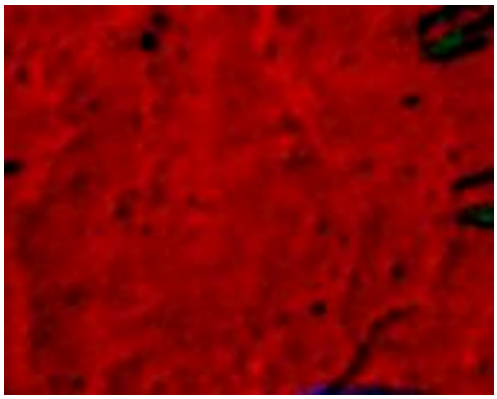


Figure 3: Virgin - Red colour tone and found along coastal riverine area topography with uneven texture.

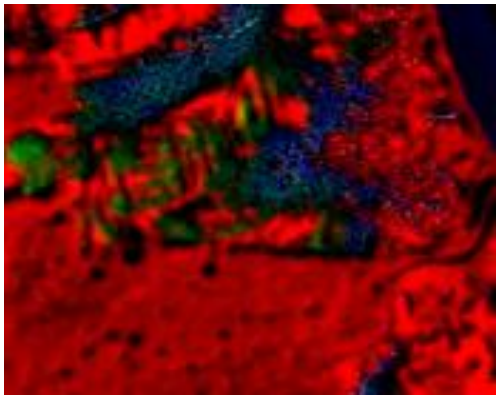


Figure 4: Logged over forest - clustered red colour tone and the land surface appear bluish and bogs.

Peat Swamp Forest

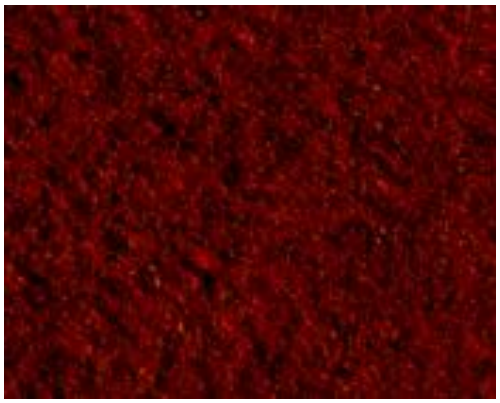


Figure 5: Virgin - Dark Chocolate colour tone with slightly rough texture and found in freshwater swamps near the coast.

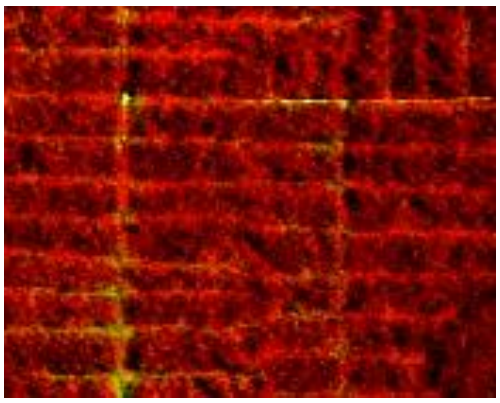


Figure 6: Logged over forest - There are skid trails or canals visible due to logging activities.

Forest Plantation

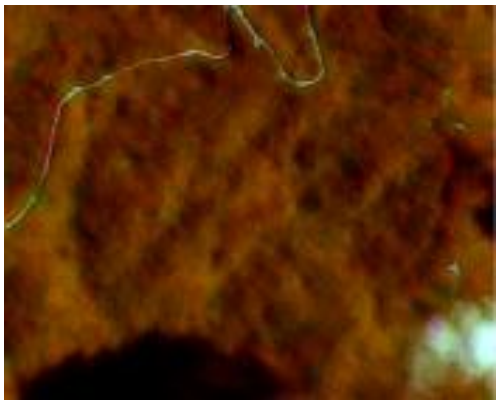


Figure 7: Dark Chocolate and reddish colour tones and it often found in moderate hilly or lowland area.

2.3 Data Verification

Random 10% checks were performed by different personnel on the 'clean' data and several ground truthing exercises were also done but on a limited scale due to budget constraints. Further validation exercises were carried out for the Forest Cover geospatial data of 2011-12 (but not done for 2009-2010) in 2013 through hands-on geospatial verification workshops conducted with geospatial and field personnel of the 12 state forestry departments. Uncertain/vague/grey areas due to the probable misinterpretation of non-forest to forest in the data were marked and recorded while certain ones were rectified during the workshop. Further ground and aerial surveillance were implemented by the SFDs with assistance from the FDPM Headquarters. The verified data (through the officially signed acceptance letter of the respective SFDs) were to be endorsed for usage by FDPM. The verified data from each states were merged into one official Peninsular Malaysia forest cover geospatial map data.

The preliminary and current methodology used for the project is as shown in Appendix 2. FDPM will refine the method as technology and the availability of new remote sensing imageries and alternative means, evolve through time.

3.0 Results and Discussion

3.1 Forest Types by State in 2011 - 2012

Table 1 : Forest Types by State in 2011 - 2012.

No	State	Inland Forest (Ha)	Forest Plantation (Ha)	Peat Swamp Forest (Ha)	Mangrove Forest (Ha)	Total
1	Johor	375,325	28,891	5,814	21,423	431,453
2	Kedah	314,583	1,240	-	7,200	323,023
3	Kelantan	738,565	15,145	-	461	754,172
4	Melaka	6,254	-	45	734	7,033
5	Negeri Sembilan	170,799	4,359	-	1,596	176,754
6	Pahang	1,736,659	25,348	112,227	5,215	1,879,449
7	Perak	999,217	1,221	-	40,906	1,041,344
8	Perlis	11,731	332	-	27	12,090
9	Pulau Pinang	8,653	-	-	1,673	10,326
10	Selangor	137,846	6,787	81,906	21,599	248,139
11	Terengganu	643,863	4,663	23,072	3,958	675,555
12	Federal Territory KL	457	-	-	-	457
		5,143,952	87,986	223,064	104,792	5,559,793

In 2011-2012, Pahang has the largest forest cover in Peninsular Malaysia, followed by Perak and Kelantan respectively. In terms of forest type, Pahang again has the largest tracts of inland and peat swamp forests, while Perak has the most sizeable mangrove forests. For forest plantation, Johor was found to have the largest acreage of the forest type. SFD Melaka reported the existence of 45 Ha of peat swamp forest. This area is actually a *Gelam* forest (*Melaleuca*) that can be categorized as wetland (fresh water swamp) forests under the MS1759 feature and attribute code.

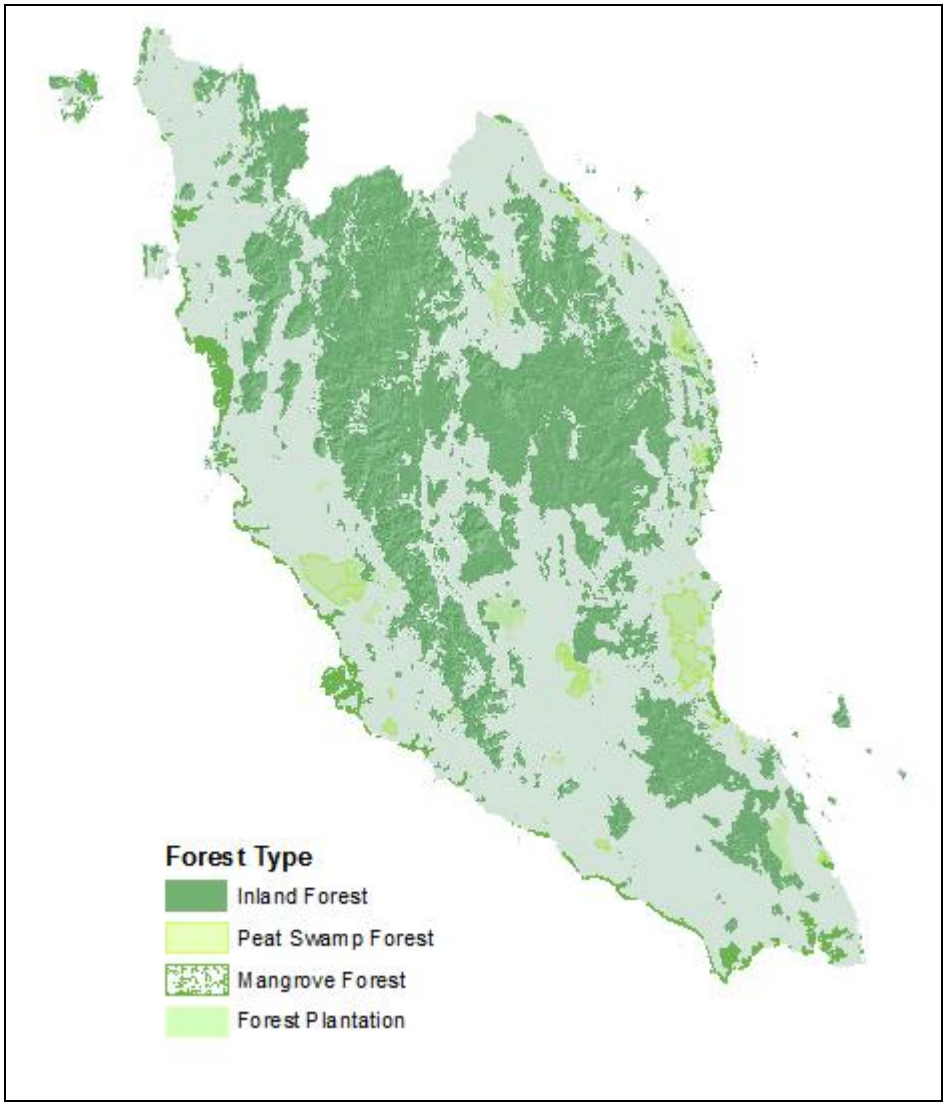


Figure 8: Forest Cover Map of Peninsular Malaysia 2011-2012 (By Forest Type).

3.2 Forest Cover in PRFs by State 2011-2012

		Forest Cover In PRF				PRF (Ha)			
No	State	Inland Forest (Ha) (1)	Forest Plantation (Ha) (2)	Peat Swamp Forest (Ha) (3)	Mangrove Forest (Ha) (4)	Total (Ha) (5)	Forested (Ha) (6) (1+2+3+4)	Non-forested (Ha) (7) (5-6)	Non-forested (%) (7)
1	Johor	271,532	26,874	3,612	12,300	348,996	314,317	34,679	10
2	Kedah	277,182	1,183	0	5,211	304,196	283,576	20,620	7
3	Kelantan	525,727	12,649	0	0	622,951	538,376	84,575	14
4	Melaka	3,919	0	0	63	4,893	3,982	911	19
5	Negeri Sembilan	146,418	1,929	0	0	154,578	148,347	6,230	4
6	Pahang	1,257,682	23,918	100,985	2,077	1,473,170	1,384,662	88,508	6
7	Perak	906,697	1,177	0	35183	974,112	943,058	31,054	3
8	Perlis	9,018	299	0	11	10,195	9,327	868	9
9	Pulau Pinang	4,461	0	0	125	5,101	4,586	515	10
10	Selangor	122,216	6,299	79,363	13,717	251,759	221,596	30,163	12
11	Terengganu	481,799	4,384	14,126	909	545,936	501,218	44,718	8
12	Federal Territory KL	49	0	0	0	69	49	20	29
	Total	4,006,699	78,713	198,085	69,597	4,695,955	4,353,095	342,860	7

Table 2 : Forest Cover in PRFs by State 2011-2012.

In 2011-2012, 93% of the PRFs have forest cover. Through satellite imageries interpretation, degraded and non-forested areas can be further delineated. Higher resolution imageries will enable the determination of rehabilitable and non-rehabilitable areas for FDPM's action such as enforcement for encroached areas or areas without authorisation; consideration for Use Permits, reforestation through enrichment planting or other suitable treatments for forest recovery.

3.3 Forest Cover in Non-PRFs 2011-2012

No.	State	Inland Forest (Ha) (1)	Forest Plantation(Ha) (2)	Peat Swamp Forest(Ha) (3)	Mangrove Forest (Ha) (4)	Total (Ha) (5)	Cadastral lots and TPAs (Ha)* (6)	Potential Forests for PRF (Ha) (5) – (6) (7)
1	Johor	103,793	2,017	2,202	9,123	117,135	54,229	62,906
2	Kedah	37,401	57	0	1,989	39,447	5,498	33,949
3	Kelantan	212,838	2,497	0	461	215,796	118,466	97,330
4	Melaka	2,335	0	45	671	3,051	2,042	1,009
5	Negeri Sembilan	24,381	2,430	0	1,596	28,407	11,165	17,242
6	Pahang	478,977	1,430	11,242	3,138	494,787	284,258	210,529
7	Perak	92,520	43	0	5,722	98,285	17,316	80,969
8	Perlis	2,713	33	0	16	2,762	401	2,361
9	Pulau Pinang	4,192	0	0	1,548	5,740	3,030	2,710
10	Selangor	15,631	488	2,543	7,882	26,544	11,371	15,173
11	Terengganu	162,064	278	8,946	3,049	174,337	100,135	74,202
12	Federal Territory KL	408	0	0	0	408	309	99
		1,137,253	**9,273**	**24,978**	**35,194**	**1,206,698**	**608,219**	**598,479**

Table 3 : Forest Cover in Non-PRFs 2011-2012.

*Cadastral lots data 2008 and Totally Protected Areas under the authority of the Department of Wildlife and National Parks (DWNP). Column (7) and the corresponding geospatial data of this Table can be used as reference to locate potential forests outside of PRFs that can be proposed as PRFs to increase the country's protected forests and by forest types.

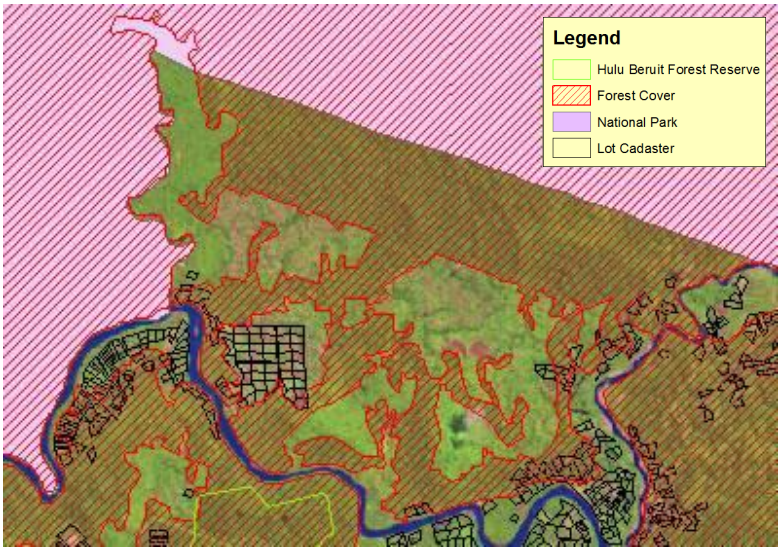


Figure 9: Forests bordering Taman Negara with high potential to be gazetted as a PRF. Requires additional information gathering from PTG or the Land Office on the ownership or non-ownership status of the land before a proposal is sent to the State Authority.

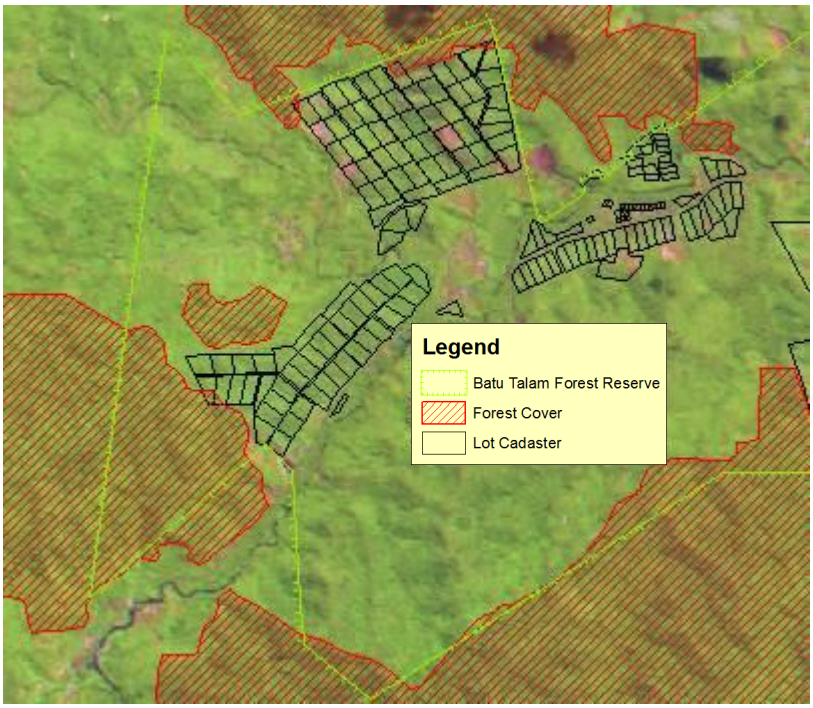


Figure 10: Areas encroached for agriculture detected in Batu Talam Forest Reserve. In this case, the State Authority needs to be informed in deciding the relevant appropriate actions to be taken in ensuring that the state will not be at a loss. Non-productive areas within production forests of the PRFs may provide incorrect calculation of the annual coupe in FDPM's implementation of sustainable forest management.

3.4 Comparison of FDPM's Forest Cover Geospatial Data with Forest Cover Data from Other Sources

3.4.1 Comparison with FDPM's Annual Report 2012 (Forest Acreage)

State	Annual Report (Ha)	Forest Cover Geospatial (Ha)	Difference (Ha)	Difference (%)
Johor	466,792	431,453	(35,339)	-8
Kedah	327,721	323,023	(4,698)	-1
Kelantan	812,196	754,172	(58,024)	-7
Melaka	5,339	7,033	1,694	32
Negeri Sembilan	158,417	176,754	18,337	12
Pahang	2,068,605	1,879,449	(189,156)	-9
Perak	1,027,404	1,041,344	13,940	1
Perlis	11,532	12,090	558	5
Pulau Pinang	7,809	10,326	2,517	32
Selangor	250,860	248,139	(2,721)	-1
Terengganu	649,739	675,555	25,816	4
Federal Territory KL	2,049	457	(1,592)	-78
JUMLAH	5,788,463	5,559,793	228,670	-4

Table 4: Comparison with FDPM's Annual Report 2012 (Forest Acreage).

The size of forest cover for the year 2011-2012 using SPOT 5 satellite imagery interpretation is 4% less in comparison to the size stated in FDPM's Annual Report 2012. The Annual Report used statistical data which were derived and updated from previous statistical reports and may not be supported by updated maps to potray the acreage stated.

Forest Cover in JPSM annual report refers to the amount of the Permanent Reserved Forests area plus forested land area outside the Permanent Reserved Forests. Forest Cover in Geospatial interpretation refers to forested area interpreted using SPOT 5 satellite imageries which include forested land in Permanent Reserved Forests and forested land outside the Permanent Reserved Forests. Open area in the Permanent Reserved Forests is not taken into account such as forest opening, rivers, lakes, roads and development areas.

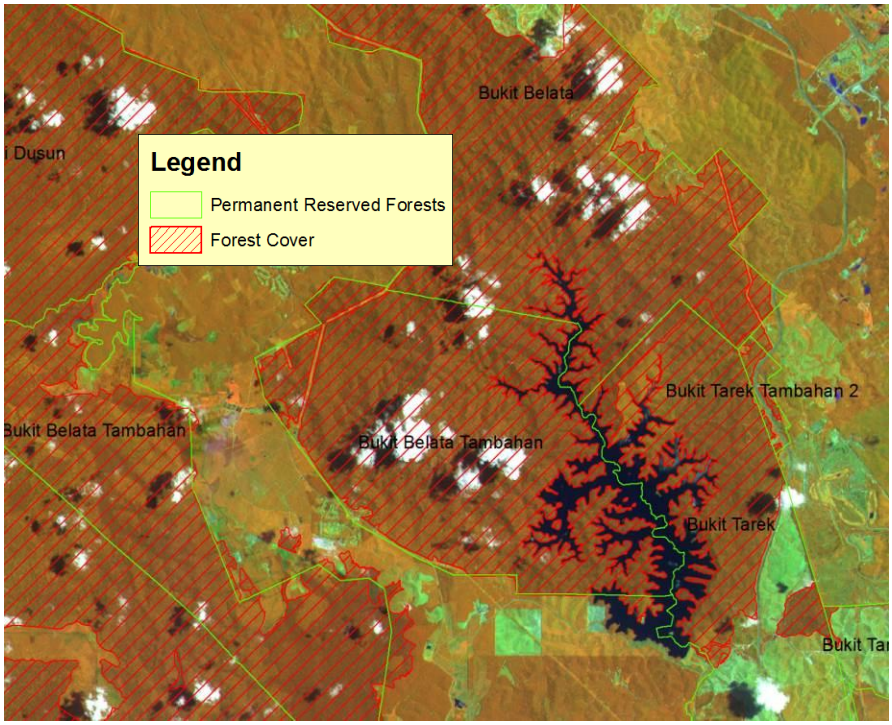


Figure 11: The lake area that is not counted as Geospatial forest cover in Bukit Belata Tambahan FR and Bukit Tarek FR.

Figure 12: The transmission line area that is not counted as Geospatial forest cover in Bukit Belata FR.

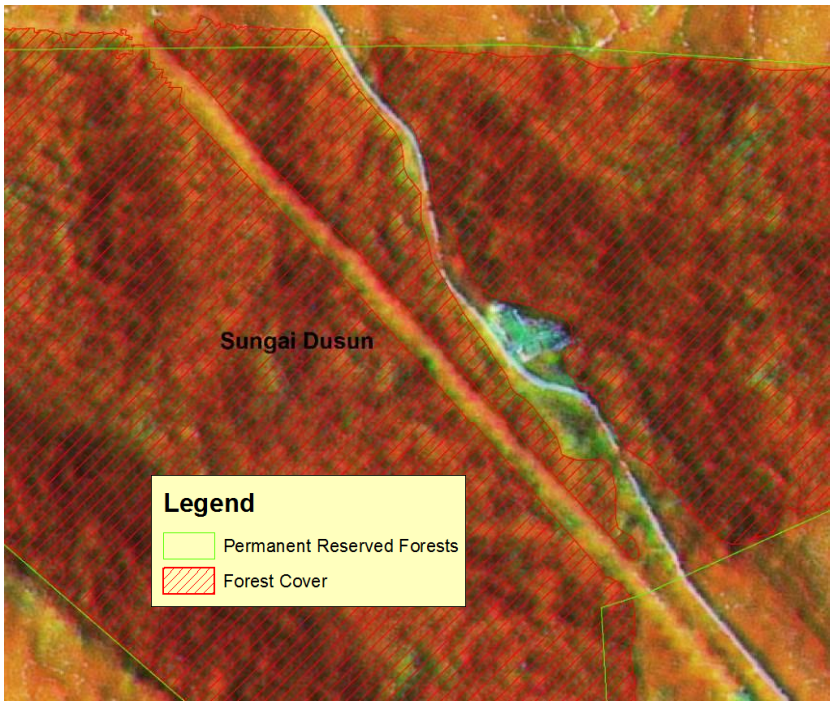


Figure 13: The transmission line and road area that is not counted as Geospatial forest cover in Sungai Dusun FR.

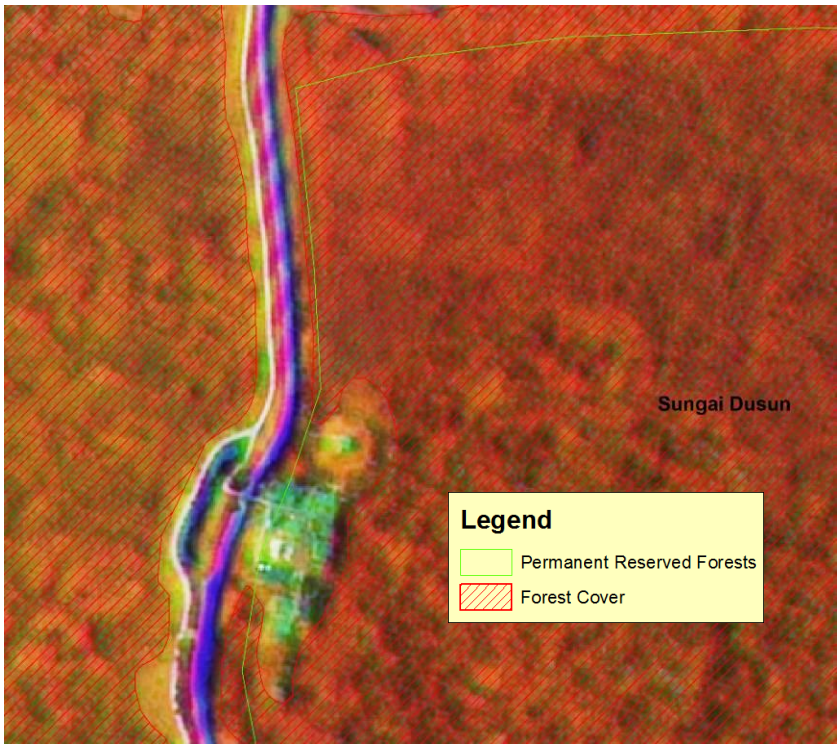


Figure 14: River and development area are also considered as non-forested area that is not accounted as Geospatial forest cover even though it is located inside the Permanent Reserved Forest.

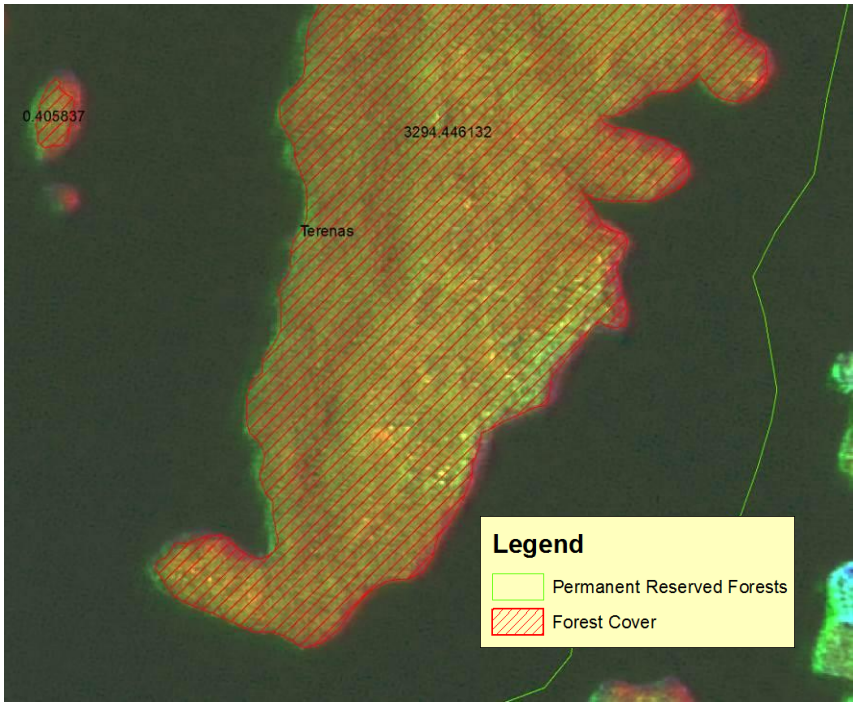


Figure 15: Forested area that is less than 0.5 ha which is inside the Permanent Reserved Forests is still considered as forested area whereas outside the Permanent Reserved Forests it is not considered as Geospatial forest cover.

3.5 Mapping of Forest Types according to MS1759

MS1759 is a standard to promote geospatial data dissemination and sharing at national level. It consists of features and attribute codes for 12 data categories. Under the Vegetation category, the Forest sub-category has 27 codes as shown in Appendix 3. The Miscellaneous sub-category of the same category includes feature codes such as bamboo and screw pine which are part of forest vegetation. The forest cover geospatial data of 2011-2012 is used as the basis for the MS1759 forest type geospatial data in development by FDPM. Among the features developed are Dryland Forest types by elevation using contour intervals as the threshold for the different types and several edaphic forest types, particularly those based on geological formation, developed in combination through GIS overlay analysis with data provided by the Mineral and Geoscience Department (JMG).

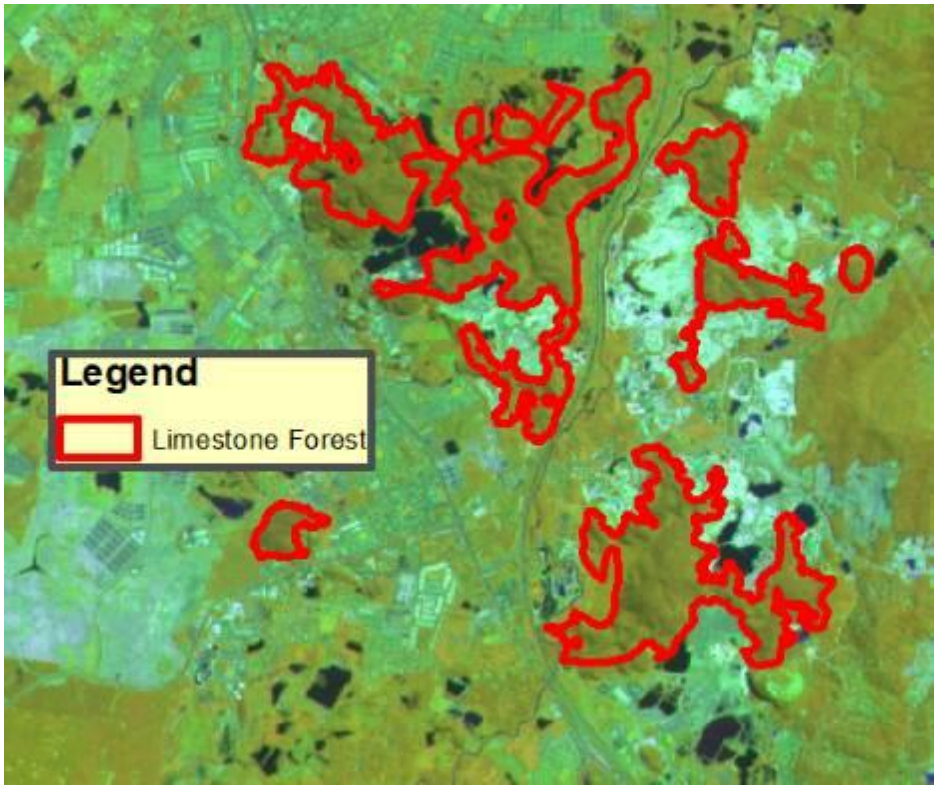


Figure 16: Limestone forest in Perak as delineated from SPOT 5 imagery using False Colour band combination.

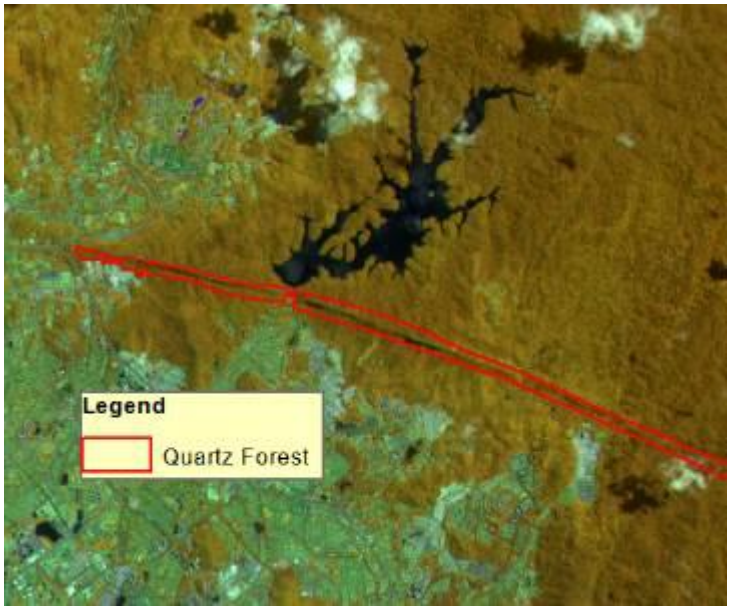


Figure 17: Quartz forest in Selangor as delineated from SPOT 5 imagery using False Colour band combination.

4.0 Way Forward, Implementation Status by FDPM

As one of the main agencies responsible and custodian for the development of the Vegetation category geospatial data as stated in the Implementation of the Malaysian Geospatial Data Infrastructure (MyGDI) No. 1 Year 2008 Circular, FDPM has implemented forest cover mapping for Peninsular Malaysia for the year 2009-2010 and 2011-2012 using SPOT 5 satellite imageries. Forest cover mapping for 2013-2014 is in progress. A working paper entitled "Comparison between National Forest Inventory IV Map and Forest Cover Mapping using SPOT 5 satellite imageries" was presented during the 31st State Forestry Department Directors' Conference (SFDC) in 2011. The paper highlighted on the differences of the forest cover acreage and forest types' statistics generated by geospatial technology in comparison to statistics published in the annual report. In 2012, FDPM established an important cooperation project with the Malaysian Remote Sensing Agency (ARSM) to facilitate the continuous receival of satellite imageries for the development of the forest cover geospatial data on a bi-annual basis which will be further used to enrich the quality of the PRFs and forest types data as well as developing a forest cover delineation and interpretation methodology which will be more accurate and time saving. The duration of the project is from 2012 to 2020 (please refer to Appendix 1). In the same year, the 32nd SFDC decided that the methodology used should be discussed in details at the FDPM's Forest Enforcement and Operation Committee (FEOC).

In 2013, FEOC made several decisions as stated below:-

i. Forest cover mapping using satellite imageries to commence every two years to monitor forest changes

ii. Further study on the usage of geospatial information to fill the quarterly forest resources information Forms (BUH 1-5) and other reports such as the Annual Report

iii. Forest cover redefined to "Land covering an area of more than 0.5 ha with trees having a height of more than 5 meters at maturity and with canopy coverage of more than 30% except in high altitude areas. Include forests in islands and PRFs under Sustainable Forest Management but exclude water bodies such as natural or man-made lakes, major rivers and land dominated for agriculture and urban purposes."

For the REDD project, PRF data for 2011 has been updated with the State Forestry Departments (SFD) through several series of discussions and deliberations conducted in 2011 and 2012. Further checks were also performed with the Malaysian Land Survey and Mapping Department (JUPEM) to obtain the correct PRF boundaries. Where available, PRF boundaries data were rectified using the existing adjacent cadastral lots and Certified Plans (Pelan Akui) boundaries. Other data used are the PRFs pre-composition maps prepared by licensed surveyors. However, its application depends on the approval of the SFD. The geospatial data for the TPA was developed by FDPM using relevant maps and certified plans information provided by DWNP. The data developed was sent back to the department for verification. Through the feedback received in 2012, only the Taman Negara and Krau Game Reserve data require rectification. Further discussions with DWNP continued in 2014 to finalise the TPA data.

On the appropriateness of the use of geospatial data for the BUH forms and other official reports, the following challenges need to be addressed:-

i. On the size of forested land, satellite imageries with cloud-free or minimal cloud cover need to be obtained on an annual, or better still quarterly basis for all scenes. This could be addressed through the acquisition of SPOT 6 and 7 satellite imageries, which has a temporal resolution or revisit period of every 1.5 days in comparison to SPOT 5 (26 days).

ii. To distinguish the administrative status of a forested land whether it's a state land or an alienated/private land requires ownership data produced in geospatial format from the Land and Mines Office (PTG) or the Land Office. This includes ownership of land parcels with temporary grant or Temporary Occupancy License (TOL) which have not been surveyed and issued with Certified Plans. Cadastral lots geospatial data produced by JUPEM only show land parcels with Certified Plans. A meeting towards uniformity of PRF data for Pahang was held in 2013 involving JUPEM (Federal and State), PTG Pahang, SFD Pahang and FDPM. PTG Pahang stated that steps are being taken to develop geospatial data for the required land parcels but the release of the information which is categorised as classified needs to be addressed before further decision can be made.

iii. The geospatial boundary data of the PRFs need to be regularly updated once a new PRF is gazetted for establishment or parts or whole of a PRF is gazetted for excision. Execution capabilities in geospatial mapping in the SFDs should be enhanced by having adequate full-time operator and equipment in addition to the coordination of information between the State and District Forest Office (DFO). The practice of clear-felling in a particular PRF in the field before an official excision gazette is published (although there exists an approval note from the State Executive Meeting Council (MMKN)) should be stopped because it will cause problems in the future if the de-gazettement is delayed or not done. Furthermore, the practice will leave the PRF without a forest cover thus the land becomes vulnerable to encroachment or conversion to other land use ,e.g. for development, as it is no longer a forest.

iv. For Forest Functional Classes information filling in the BUH form, the challenge in terms of readiness by the SFDs is the same as (iii). The gazette documents of PRFs should be properly kept and recorded. Working papers on the proposed gazettement should be prepared and submitted to the proper State Authority for endorsement and approval.

5.0 Summary

The method for forest cover mapping using geospatial technology still cannot elude the use of visual interpretation which can greatly complement and enhance the quality of the information derived from supervised or unsupervised classifications. Overlay analysis with relevant GIS layers and other type of space and airborne imageries such as Landsat 8 and AISA will increase the accuracy of the output. The forest cover data which is agreed and verified by the SFDs with its data quality and methodology integrity corroborated, will be used as basis to update forest cover map information in the following years.

The sensor characteristics of a satellite, namely the spatial, temporal, radiometric and spectral resolutions and the interpretation method used influence the accuracy of the forest cover map information produced. A higher spatial, spectral and radiometric resolutions plus frequent temporal resolution images may enable the development of a finer more-detailed and timely (e.g. quarterly) reporting of forest cover map information in the future. However, it may affect the trend of traditional forest cover acreage statistics reporting due to its detailedness (Addition through detection and inclusion of small/tiny forest areas but reduction when small/tiny non-forest pockets are subtracted and non-forest trees can be delineated from large forest areas). The lower the resolutions, the more generalised and less accurate the output of the forest cover information will be.

The “forest” and “forest cover” definitions also affect the extraction process and the forest cover map information produced. In Peninsular Malaysia’s context, the definition for forest may include neglected/abandoned rubber plantations in the future where its tree composition have been mixed with wild shrubs and other trees, such as occurring in Bukit Kiara in Kuala Lumpur and Bukit Gasing in Petaling Jaya, Selangor which are not considered as forest in the previous forest cover mapping exercise. Trees planted along roadsides/ road reserves and trees in parks which fulfil the forest definition of FAO will be able to be mapped through the availability and procurement of higher spatial resolution imageries such as SPOT 6 and Pleiades in the future.

The application of geospatial technology for forest cover mapping which produces accurate, timely and consistent information is the right step forward to boost sustainable forest management in the planning, management and monitoring of the country’s forest resources, while providing real evidence when dealing with negative forest cover repo rting from irresponsible parties. Geospatial data, consisting of integrated map and automated area calculation of the map makes the information more transparent and with integrity in comparison to a statistical figure without the support of a map.

The availability of conducive geospatial infrastructure, continuous on-the-job geospatial training of personnel and management support within SFDs will expedite geospatial data usage in replacing conventional mapping and analysis of forest areas in the near future.

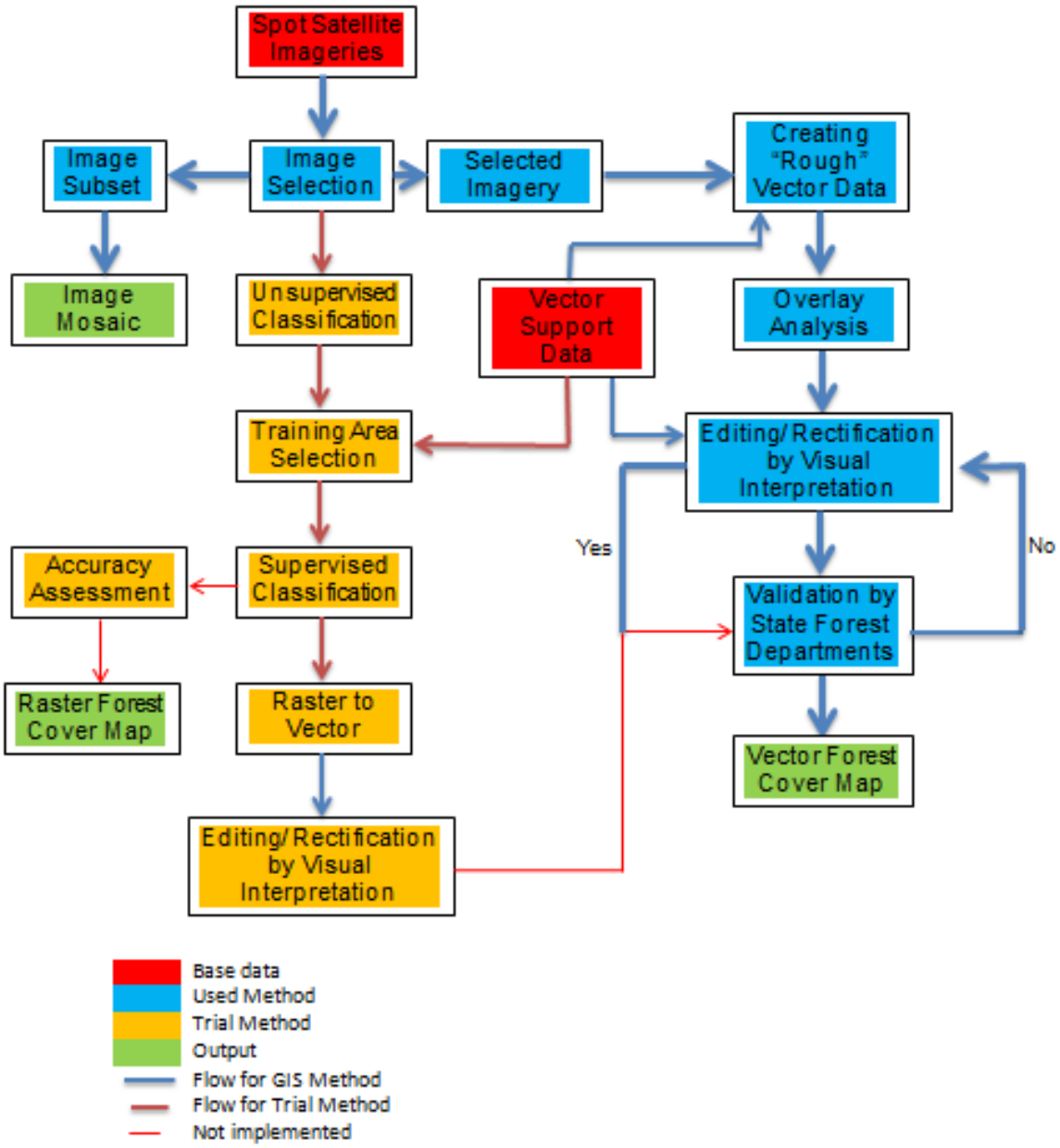
Appendix 1

Forest Cover Mapping Project Gunn Chart

Activity/Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
Interprete SPOT 5 imagery									
Develop Forest Types MS1759									
Forest Change Analysis									
Intepreter high-resolution images(SPOT 6,7, Plaiedes, hyperspectral)									
Forest Cover Mapping frequency to annually									
Review of Forest cover definition (e.g. inclusion of urban forest and rubber plantations)									
Propose additional PRFs									
Propose additional PRFs for protection/preservation									
Study on Carbon Stock									
Propose rehabilitation of Degraded Forest									
Apply information for National Forest Inventory VI									

Appendix 2

Forest Cover Mapping Methodology



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Appendix 3

Excerpts from MS1759 Feature and Attribute Codes for Vegetation

VB0000 – Forest
VB1000 – Dryland Forest
VB1010 – Sub-alpine Forest
VB1020 - Upper Montane Forest
VB1030 - Lower Montane Forest
VD1040 - Upper Hill Dipterocarp Forest
VB1050 - Hill Dipterocarp Forest

VB1060 - Lowland Dipterocarp Forest
VB1070 – Heath Forest
VB1080 – Limestone Forest
VB1090 – Quartz Forest
VB1100 – Beach Forest
VB1110 - Coastal Hill Forest
VB01120 – Ultramafic Forest
VB2000- Wetland Forest
VB2010 – Mangrove Forest
VB2020 – Peat Swamp Forest
VB2030 – Freshwater Swamp Forest
VB2040 – Ripirian Forest
VB2050 – Nipah Forest
VB3000 – Planted Forest
VB3010 – Acacia
VB3020 – Hevea
VB3030 – Teak
VB3040 – Sentang
VB3050 – Pine
VB3060 – Eucalyptus
VB3070 – Kelampayan
VB3080 – Karas
VB3090 – Mixed
VB3100 – Others
VC0000 – Miscellaneous
VC1010 – Bamboo
VC1020 – Screw Pine
VC1030 - Scrub/shrub
VC1040 – Riung
VC1050 – Grass
VC1060 – Jatropha
VC1070 – Agroforestry
VC1080 – Barren land
VC1090 – Cleared land

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PAPER 1: 2

PENGURUSAN HUTAN: TEKNOLOGI, INOVASI DAN AMALAN (*TECHNOLOGY, INNOVATION AND PRACTICES*)

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ABSTRAK

Penggunaan teknologi maju telah lama diterapkan dalam amalan pengurusan hutan di Negeri Sarawak. Salah satu aspek penggunaan teknologi berkenaan adalah dalam pemantauan sumber hutan melalui kemudahan cerapan hiperspektral udara yang telah ditubuhkan di Jabatan Hutan Sarawak pada tahun 2009. Gabungan operasi sistem taktikal udara [*Combined Aerial Tactical System* (CATS)] dengan penguatkuasaan telah menunjukkan hasil dengan peningkatan rampasan aktiviti pembalakan haram. Antara aplikasi yang telah berjaya dibangunkan adalah penganggaran biojisim (*biomass*) dan stok karbon untuk tanaman bakau, *Forest Clearing Tool* serta kaedah pemantauan ladang hutan. Melalui kepakaran serta pengalaman yang telah diperolehi dalam operasi serta pembangunan aplikasi berasaskan cerapan hiperspektral berkenaan, pihak jabatan telah dapat mengembangkan penggunaan teknologi tersebut di dalam serta luar negara.

PAPER 1: 3

BRIDGING CONSERVATION AND SUSTAINABLE FORESTRY TO SHAPE THE FUTURE OF FOREST MANAGEMENT IN SABAH

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Sabah Forestry Department

ABSTRACT

The Sustainable Forest Management concept was introduced in Sabah in 1997 to address concerns of deforestation and forest degradation. Since its inception nearly two decades ago, Sustainable Forest Management (SFM), conceptually and practically, is changing the way forests are being managed in Sabah. It involves not only the functions and services provided by forests but is also about meeting the global concerns and expectations in managing forests with regard to the environment. It also addresses transparency in doing business. Much progress has been achieved in reversing the previous trends of forest degradation and poor governance of the past. These are reflected in the increase of forest areas designated under SFM with a number of private Sustainable Forest Management License Agreement / Long Term License (SFMLA/LTL) holders participating in its implementation. Forest restoration and forest enhancement have been greatly intensified as the timber streams from second-growth forests become a source of wood supplies in the years to come. Sabah also has been at the forefront of promoting forest certification, as Deramakot Forest Reserve was the first natural tropical forest certified under the Forest Stewardship Council (FSC). At the same time, the progress towards forest certification in other forest reserves has been very encouraging. The strategy to capitalize on the strength of SFM practices is being explored for its contribution to the mitigation of climate change and to maximize their full range of economic and non-market benefits. Special attention is given to Reduced Emission from Deforestation and Degradation (REDD+) and other ecosystem services as an economic opportunity are emphasized with the implementation of several pilot projects. This paper discusses the progress of SFM implementation in Sabah and the strategy in moving forward in line with a new understanding of the complexities and challenges of forest management towards a higher standard of responsible forestry.

1. INTRODUCTION

Forests are important to our ecological, economic and social wellbeing. They provide wood and non-wood products, recreational opportunities and other non-market goods and services such as water and clean air. The global demand for its numerous functions and services is increasing in recent decades. Climate change, however, poses enormous challenges for forests and people. It is an economic issue, a social issue, a security issue and, above all, a moral issue (Freer-Smith 2009). It is now accepted that the concept of forest management extends beyond the forest boundary and that forestry is a part of sustainable landscape management. If forests are managed according to the principles of sustainable forest management, then optimizing its various functions, including climate change mitigation are fully consistent with the objective of managing them for sustainable growth (Broadmeadow & Carnus 2009).

The Sustainable Forest Management (SFM) concept was introduced in Sabah in 1997 to address concerns of deforestation and forest degradation. Since its inception over nearly two decades ago, SFM, conceptually and practically, is changing the way the state's forests are being managed. Domestic legislation and policies on forestry have had to respond to rapidly changing international regimes in which trade and increasingly environmental issues play a greater role (Sam *et,al*. 2011). Thus, the practice of sustainable forest management (SFM) in managing forest resources has evolved from sustainable timber production to incorporate multiple-use, protection and conservation, with greater emphasis on goods and services that contribute substantially to public benefits.

Accordingly, because of increased awareness on the importance of biodiversity conservation and value of ecosystem services of forests, many tropical countries have recently changed forest management regulations to make them compatible with the principles of sustained yield and biodiversity preservation (Montagnini & Jordan 2010). There has been an exponential increase in the number of protected areas in recent years (Chape *et al*. 2005). The global network of protected areas now covers 11.5 per cent of the world's surfaces area (Terry *et al*. 2013). The rapid expansion of protected areas since the mid-1980s has been driven by a number of factors, each pursuing its own set of vested interests; central governments, large international non-governmental organisations as well as national NGOs, international financial organisations, local communities and even the private sectors (Hall 2012).

Nevertheless, the strategy of creating protected areas in high biodiversity locations remains the cornerstone of conservation practice (Kramer *et al*. 1997) and this is the case in Sabah, where the amount of forest land set aside as formal protected areas has risen substantially in recent years. According to the Director of Sabah Forestry Department (2012), the gazettement of more totally protected areas (TPAs) in 2012, has doubled the extent of such areas. The priority is on ecological connectivity of the best forest and best biodiversity (Sam 2013). This is a manifestation of the desire to excel in conservation, to protect and restore natural systems in the interest of long-term conservation and endowment for future generations and this is our forte.

The strategy to capitalize on the strength of SFM practices is being explored for its contributions to the mitigation of climate change and to maximize their full range of economic and non-market benefits. Establishing new revenue streams from non-timber products such as tourism licenses, funding for biodiversity, carbon sequestration and other ecosystem services as an economic opportunity has been initiated with the implementation of several pilot projects. If successful, these could greatly enhance the attractiveness of the land use approach – mainstreaming conservation into sustainable forest management.

With this backdrop, this paper provides an insight into conservation and forest management in Sabah, outlining a synoptic overview of the current practice of sustainable forest management from the perspectives of mainstreaming conservation aspects and sustainable forestry. The strategies in moving forward in line with a new understanding of the complexities and challenges of forest management towards a higher standard of responsible forestry are also discussed.

2. FOREST RESOURCES

Most of Sabah's forests are located within a larger ecological area, which has become known as the "Heart of Borneo (HoB)". This contains some 200,000 km^2 of ecologically interconnected rainforest in the Indonesian region of Kalimantan, the East Malaysian states of Sabah and Sarawak and the nation of Brunei Darussalam. The forests are relatively well conserved, covering about 40% of Sabah's total land area. The natural ecosystem of Sabah hosts an astounding array of plants and other life forms, of which more than 3,000 species are of trees, not including the thousands of other plant species. The wildlife population is exceptionally large. These have contributed to earn Malaysia its status as one of the world's 12 mega-diversity countries (Mittermeier *et al*. 1997).

2.1 Permanent Forest Reserves

As of December 2013, the total area of Permanent Forest Reserve (PFR) was 3.614 million ha, an increase of 5,481 hectares from the total area in 2012 of 3.609 million ha. The percentage of PFR in relation to Sabah's total landmass of 7.362 million ha is about 49%. The PFR includes Class I – Protection Forest Reserve (836,526 ha), Class II – Commercial Forest Reserve (2.17 million ha), Class III – Domestic Forest Reserve (6,919 ha), Class IV – Amenity Forest Reserve, Class V – Mangrove Forest Reserve (238,049 ha), Class VI – Virgin Jungle Forest (102,043 ha) and Class VII – Wildlife Reserve (137,735 ha). Another 0.27 million ha outside the PFR are gazetted as Parks, Wildlife Sanctuary and Wildlife Conservation areas under various other laws and legislation **(Figure 1)**.

Thus, the percentage of legislated forest areas in relation to Sabah's total land mass is about 53%. In addition, out of this 3.8 million ha, about 1.3 million hectares are within the TPAs category, which is well above the 10% target set by IUCN on all countries, at about 18.6%. The State is determined to further increase its TPAs to 2.1 million ha within the next 10 years, or 30%.

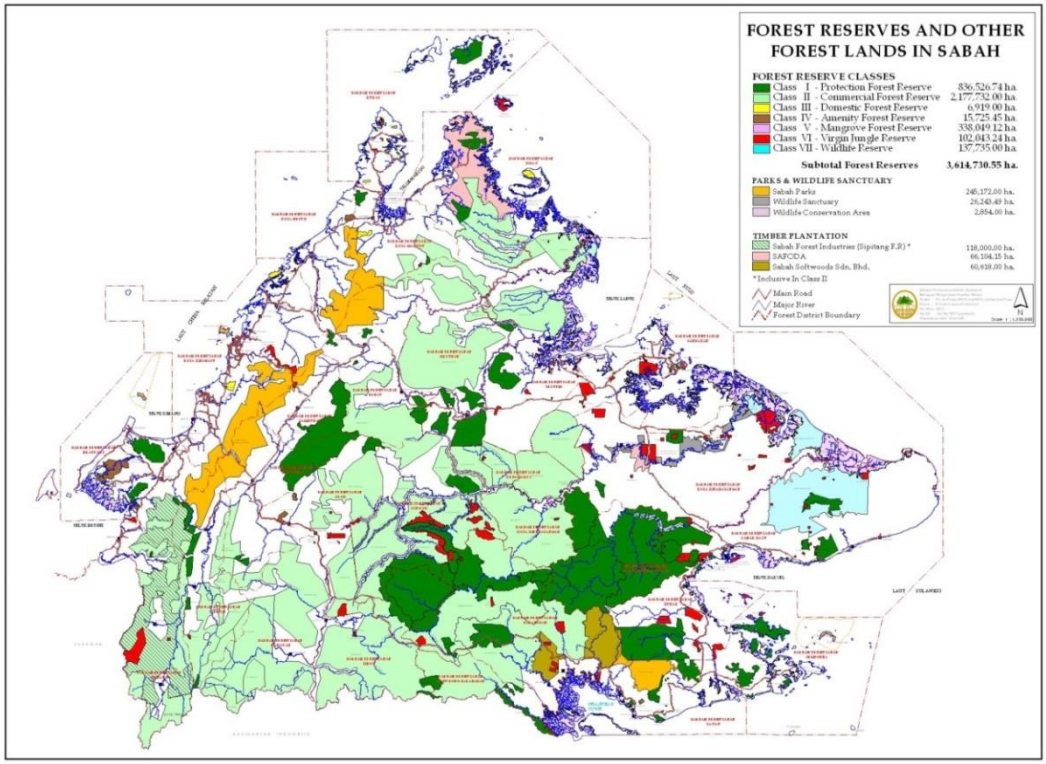


Figure 1: Map showing forest reserve classes and other protected lands in Sabah.

As shown in **Figure 2**, the trend of Protection Forest Reserve (Class I) is increasing in area since 2007. This figure is expected to go up with the state's commitment to further increase its Protection Forest Reserves (Class I) to 1 million hectares particularly those forest ecosystems which are rich in biodiversity in line with the requirement of the Convention on Biological Biodiversity (CBD), by 2014.

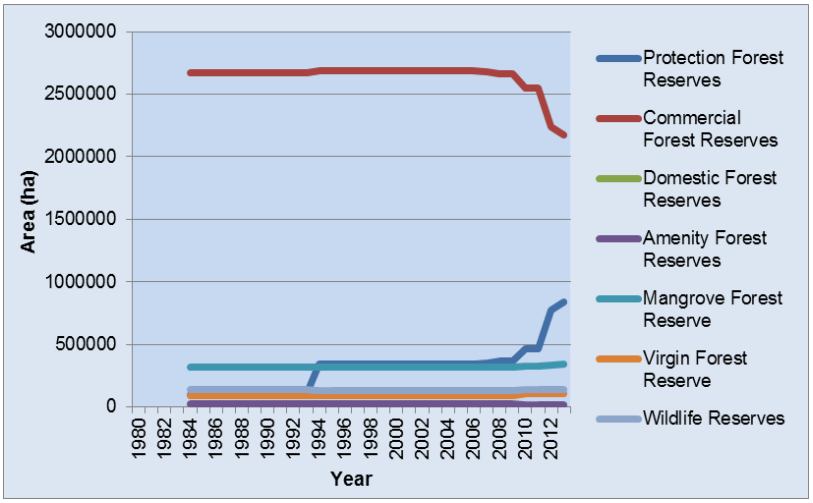


Figure 2: Total area (ha) of forest reserves according to classes from 1984 to 2012.

In order to achieve the dual objectives of economic utilization and environmental conservation, as well as to facilitate optimal forest management and control, the PFRs in Sabah are classified into seven (7) classes based on their specific functions (see the Table below).

Class	Type of Forest Reserve	Forest Function	Area (ha)
Class I	Protection Forest	Forests conserved for the protection of watershed and maintenance of the stability of soil, water conservation, and other essential climatic and environmental factors. Logging is not permitted in these areas. There are currently 74 forest reserves of this class throughout Sabah making up 23.14% of the total PFR. Logging is prohibited.	836,526.74
Class II	Commercial Forest	Forests allocated for harvesting to supply timber and other forest produce, contributing to the state's economy. Harvesting is carried out according to Sustainable Forest Management (SFM) principles. Collectively, there are 30 locations throughout Sabah, making up 60.25% of the total PFR.	2,177,732.00
Class III	Domestic Forest	The produce from this forest classification, including small amount of timber, is for the consumption of local communities only and commercial use is not allowed. Collectively, there are 9 locations throughout Sabah, making up 0.19% of the total PFR.	6,919.00
Class IV	Amenity Forest	Forests primarily for providing amenity and recreation to the local inhabitants. Recreational facilities may be provided in attractive sites, notably often on roadsides, within these reserves. Exotic tree species are sometimes planted to enhance the amenity value of these areas. Collectively, there are 23 locations throughout Sabah thus making up 0.44% of the total PFR.	15,725.45
Class V	Mangrove Forest	Forests for supplying of mangrove timber and other forest produce to meet the general demands and multi-uses. There are a number of tree species but the *Rhizophora* sp. is the most common species harvested, and the products range from firewood to fishing stakes and charcoal. Collectively, there are 30 locations throughout Sabah, making up 9.35% of the total PFR. This type of forest may also be used for eco-tourism development.	338,049.12
Class VI	Virgin Jungle	Intact forests conserved strictly for forestry research purposes including biodiversity and genetic conservation. Logging is strictly prohibited in this type of forest reserve. Collectively, there are 60 locations throughout Sabah, making up 2.82% of the total PFR.	102,043.24
Class VII	Wildlife Reserve	Forests conserved primarily for the protection and research of wildlife. The Sumatran Rhinoceros is one of the endangered wild animals living in the Wildlife Reserves. Logging is prohibited. There are currently 5 Wildlife Reserves making up 3.81% of the total PFR.	137,735.00

Source: SFD Annual Report 2013.

2.2 Forest Cover: Past and Present

In the 1970s, the State's total forest cover based on the state-wide forest inventory report was 6.36 million ha or about 86% of total land mass and 91.6 % was primarily Dipterocarp forest. Based on recent statistics reported by SFD (2013), the total forested area of the state has shown a declining trend, from 5.6 million ha in 1980 to 4.4 million ha in 2012. This is due to the massive land development in areas outside of forest reserves for agriculture, particularly large-scale oil palm plantations during the period from 1990 to 2000 and it has since stabilized thereafter. The magnitude of forested area change is shown in **Figure 3**.

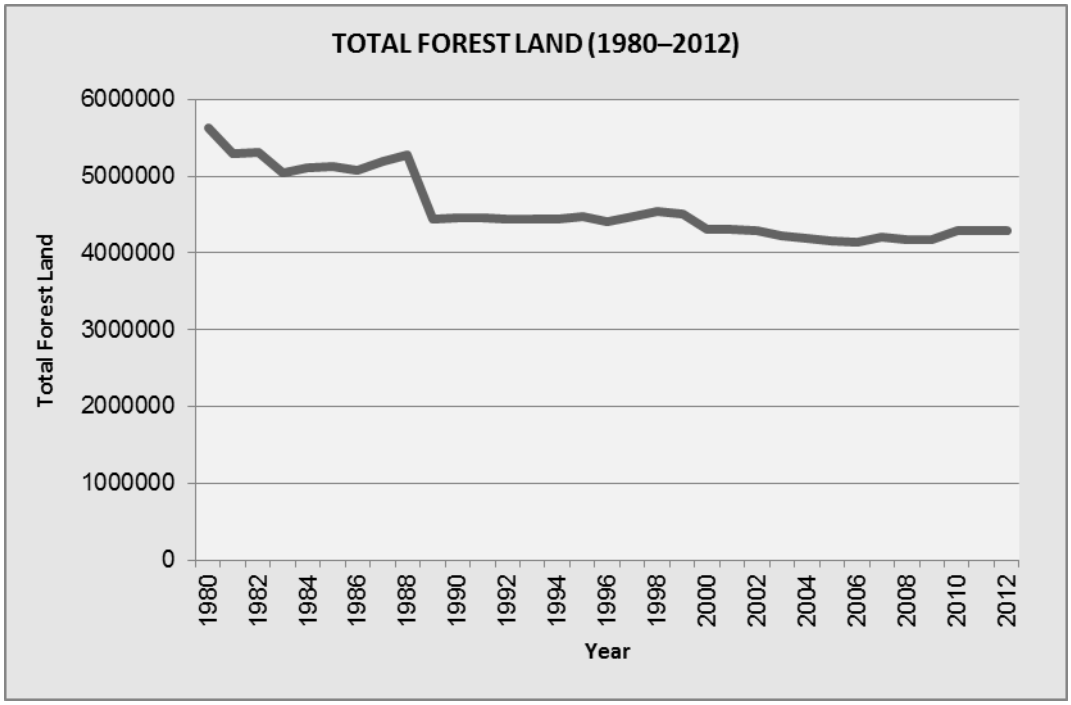
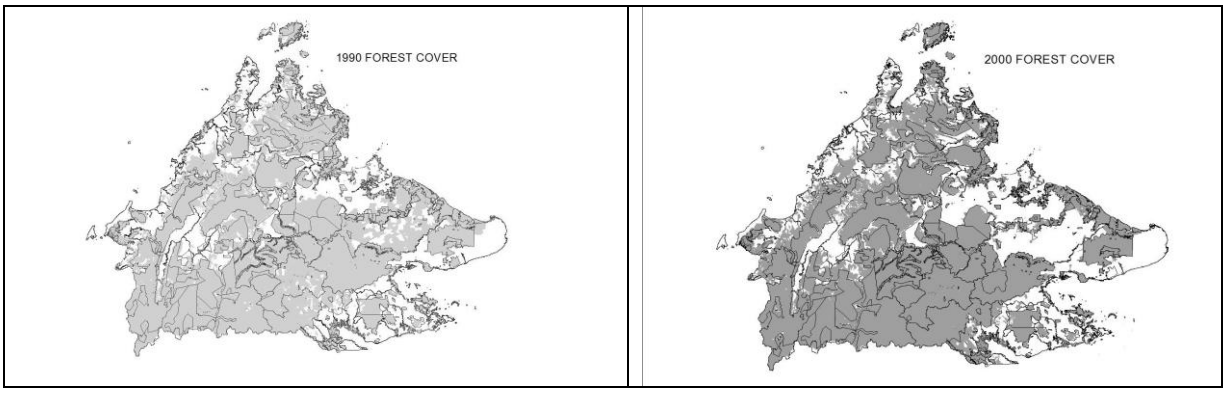


Figure 3: Forest lands based on published statistic by the SFD, from 1980 – 2012.

(Source: Sabah Forestry Department 2013).

The forest cover in 1990, 2000 and 2010 was based on remote sensing technologies to ascertain the deforestation trend in establishing the baseline scenario for Sabah. The total forest land for the years 1990, 2000, 2010 and 2012 were 68.4%, 60%, 60.3% and 60.5% respectively. A snapshot of the forest cover for these periods is shown in **Figure 4**.



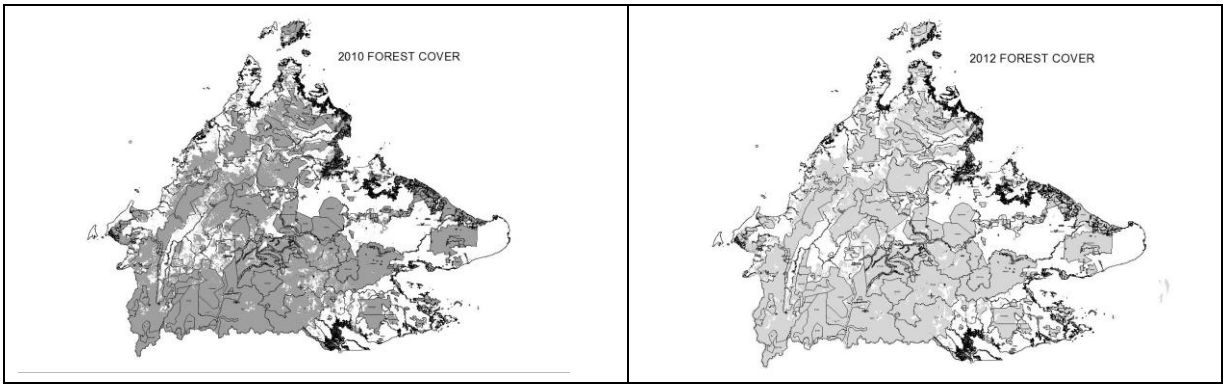


Figure 4: Changes of forest cover from 1990 to 2012.

3. CONSERVATION AND SUSTAINABLE FORESTRY

What are conservation and sustainability, and are they always compatible? Many would assert that conservation and sustainability are one and the same in which they should not act singularly but work together to achieve the eventual goal of maintaining an ecosystem. In general terms, the word sustainability is usually used to mean sustainable production while "conservation" is commonly used to mean conserving the diversity of plants and animals that live in the world and sometimes includes the concept of conserving the various genetic strains within species as well as the actual species themselves.

According to Boncina (2011), there are two main approaches to nature conservation in forest management. In the segregation approach, nature conservation is one of the management objectives which is limited to protected forest areas, while the integration approach considers the economic, social, and ecological components of sustainable forest management at the same time and place. In some countries, the segregation approach is combined with the integration approach to ensure sustainable forest management.

The elements of what constitutes good forest management change over time, but the bedrock features of forest tend to remain fairly constant. It is human beings' perception of forests and how forest resource base is utilized that shifts constantly (Wang 2004). In the early 1980s, forest management focused towards the "Sustainable Forest Management' (SFM) paradigm, which embraced the notion of sustainable development: 'development to meet the needs of the present without compromising the ability of future generations to meet their own needs' popularized by the Brundtland report Our Common Future (WCED 1987). The previously prevailing notion of sustainability, as applied in forestry for over two centuries, had focused on sustaining timber yields (Wiersum 1999; Kant 2003). SFM then broadened the scope to both present and future generations' needs, to multiple beneficiaries and stakeholders—but also to multiple products and services, thus also building the case for Multiple – Use Forest Management or MFM (Pearce *et al*. 2003; Kant 2004).

In recent decades, with the increasing needs to consider nature conservation in forest management, many tropical countries have changed forest management regulation to make them compatible with the principles of sustained yield and biodiversity preservation (Montagnini & Jordan 2010). The ITTO and Forest Stewardship Council Principles, criteria and indicators for SFM have also given special emphasis to preservation (Boyle & Sayer 1995).

Similarly, with the passage of time forest management in Sabah has undergone an evolution from a mercantilist and production view of the forest to recognizing forestry's multiple roles. As the benefits from forests go beyond timber, forests should, therefore, be managed for optimum benefits, tangible as well as intangible, whereby maintenance of ecological integrity remains paramount. This paves the way for the integration of conservation and sustainable forest management in managing forest resources in Sabah. This management approach, amongst others, are to protect, conserve and restore habitat areas in forest reserves, by setting aside an appropriate conservation zones in FMU Licenced areas as well as to establish and/or enhance sufficient areas of Forest Reserves (Class 1) to safeguard against the threat of ecological isolation of current protected areas, maintain the potential to support viable wildlife populations for many species – and indeed maintain the connectivity. This move is in recognizing the value of forests as a natural asset, particularly with the growing importance of forest ecosystems and biodiversity.

3.1 Conservation in SFM Practice

The Sabah Forestry Department, having recognized the forest damage caused by unsustainable logging under the short-term licensing system, in the 1990s, advocated the implementation of the State Forest Policy which formed the basis for sustainable forest management (SFM). The early experience in implementing the SFM concept began in 1989 when Deramakot Forest Reserve (DFR) was chosen as a model for a well-managed forest under the collaborative project between the Sabah Forestry Department and the German Agency for Technical Cooperation (GTZ). The project was a big success, and the DFR was the first tropical forest in the world, certified under the Forest Stewardship Council (FSC) in July 1997. Subsequently, translating SFM concepts into real practice was started in September 1997 when the Sabah State Government in a smart partnership with the private sector signed long-term licence agreements known as sustainable forest management agreements (SFMLAs), where 18 forest areas within 27 forest management units (FMUs) were allocated to 10 companies for a period of 100 years, to be managed according to the SFM principles, with Deramakot as the model.

After about 15 years in implementing SFM, the SFMLA system has made significant steps in improving the management of the state forest resources toward sustainability and conservation. The number of SFMLA holders participating in the implementation of SFM in Sabah has now increased to 29, covering about 1.8 million ha or 81% of the State's Commercial Forest Reserve. It is our target that the Deramakot model be expanded to cover all forest areas in Sabah in a step-by-step and systematic approach.

Under the SFMLA system, the SFMLA holders are to carry out their forest management activities based on the 10-year Forest Management Plan (FMP). The plan details how the FMU area can be sustainably managed through multiple-use forest management concept where social, economic and environmental aspects are taken on board. This includes zoning in which the FMU areas are divided into production and protection zones. The areas with slopes exceeding 25^{o}, areas with high conservation value and riparian reserves are set aside for conservation and maintained for watershed, biodiversity, and as wildlife corridors. Community forestry is another component where the benefits to the local communities are taken into account.

The Sabah Forestry Department (SFD) also manages several forest management units (FMUs) of about 827,935 ha as SFM Projects, which are mostly based on conservation management regime, in order to strengthen the SFM implementation in Sabah (**Table 1**). Two of the SFM Project areas, i.e. USM and Tangkulap-Pinangah SFM Projects, were certified under the FSC forest certification scheme. The other SFM project areas also are going to be certified under the FSC scheme. Why do we certify the FMU areas which are managed purely for conservation? The main reason is to protect the FMU areas for the long-term interest of the state because once certified it means that more stakeholder participation, bringing many people on board, and therefore transparency and credibility in managing the area are enhanced. This institutionalized arrangement can attract like-minded people, philanthropists, companies and NGOs, and engage with the Sabah Forestry Department to provide support technically and economically. We are optimistic that there are potential incomes to be generated in the future from the conservation areas such as indirect income from eco-tourism, and also expected income from payment of environmental services (PES) and income from carbon. It also brings transparency and credibility to the management.

In 2013, for instance, Sabah had generated about RM5.7 billion from the tourism sector, and it is expected to increase to RM6.0 billion in 2014. On income from carbon, the study done by Nobou *et al.* (2009) in Deramakot and Tangkulap Forest Reserves found that by implementing SFM, it can sequester 54 tonnes of carbon per hectare. Taking into account our production forests of 2.6 million hectares, this would mean that we have the potential of sequestering about 140.4 million tonnes of carbon. With the current market price of carbon at the voluntary market of between USD1.18 – USD5.63 per tonne, this would mean that implementing SFM will potentially generate carbon value of between USD166 million – USD790million. Realizing the potential future income from carbon, in 2013, SFD has amended the Forest Enactment 1968, to include forest carbon as a forest produce.

Table 1: SFM Projects Directly Managed by SFD.

No.	SFM Project	Location (Forestry District)	Area (ha)
1.	Deramakot	Dermakot	55,507
2.	Ulu-Segama Malua (USM)	Ulu Segama Malua	243,862
3.	Trusmadi (FMU 10)	Tambunan / Keningau	74,736
4.	Tangkulap - Pinangah	Deramakot	50,070
5.	Ulu Kalumpang, Mt. Wullersdorf, Kalumpang & Madai	Kunak	62,795
6.	Northern Gunung Rara	Kalabakan	55,942.6
7.	Timimbang Botitian	Beluran	13,610
8.	Lower Kinabatangan-Segama Ramsar Site	Kinabatangan	78,803
9.	Pin Supu	Kinabatangan	4,696
10.	Pulau Sakar	Lahad Datu	760
11.	Darvel Bay	Lahad Datu	138.5
12.	Telupid Forest Reserves Complex (TFRC)	Telupid	170,000
13.	Sg. Mangkuwagu	Tongod	8,335
14.	Sugut	Beluran	8,680
Total			**827,935**

Generally, based on lessons learned, the important benefits of implementing SFM are as follows:

(a) Improvement of forest quality through silvicultural treatment and enrichment planting

Works on forest restoration/enrichment planting and silviculture in natural forests are continued as the SFM main activities. This is important to enhance the growing stock of the natural forests, as we are confident that in the years to come, timber streams from these forests will become significant again. Moreover, silvicultural activities are expected to maintain the food chain and ecosystem habitat to provide the food sources that wildlife depends on and to provide for frugivorous insects (Peter *et al*. 2006).

The total area of natural forests rehabilitated through silviculture treatment and enrichment planting/forest restoration now is approximately 261,517 ha. Based on the statistics over a period of five (5) years, from 2009 to 2013, the trend of the accumulated total forest areas treated and restored is steadily increasing at an average rate of 14% and 16% for silviculture treatment and enrichment planting respectively (**Figure 5**). This shows that these activities are consistently carried out annually and progressing well over the years.

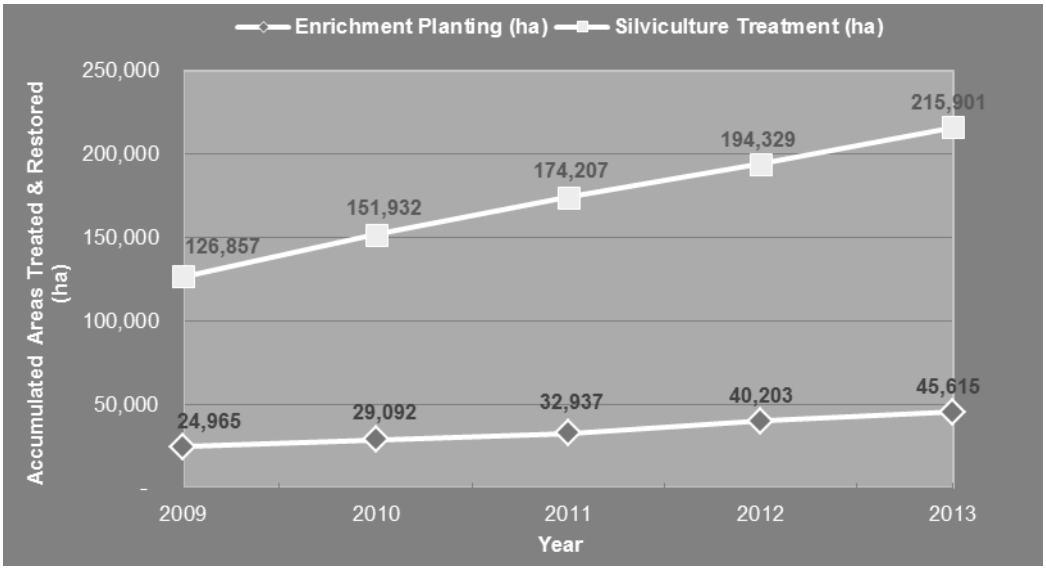


Figure 5: Trend of the Accumulated Total Forest Areas Treated and Restored (2009-2013).

(b) Implementation of reduced impact logging (RIL) can reduce damage to residual timber stands

One of the main activities in SFM is the implementation of RIL (Reduced Impact Logging) to mitigate degradation of the forests and also conservation of the environment. It is the state government's policy that RIL is compulsory for harvesting in the NFM (Natural Forest Management) areas. Based on the study done by the SFD, RIL can reduce 50% damage to residual stands as compared to conventional logging. This in turn minimizes the cost of tending treatments and speeds up the natural recovery of trees. By controlling damage through the implementation of RIL, it was possible to retain an extra 25 – 45 tonnes of carbon per hectare two years after logging, rising to 90 tonnes of carbon per hectare after 40 years as a result of improved regeneration (Frederick & Heidi 2011).

(c) Zoning the steep areas, riparian reserves and areas with HCV as conservation areas is important for wildlife protection

Wildlife conservation beyond borders of parks or other fully protected areas is paramount for the effective and comprehensive conservation of biodiversity in the landscapes of Sabah. As most commercial forest reserves are used for the production of timber, sustainable management of these forests is of great importance to ensure the long-term conservation of some of the most threatened species in Sabah.

Generally, under the SFM system practiced in Sabah, about 23% of the licenced areas are explicitly designated as off-limits to harvesting for ecological reasons. These types of sites or areas are set aside and delineated in forest management plans to protect sensitive areas, critical habitats, riparian reserves, wildlife corridors, and High Conservation Value Forests (HCVF). They contribute significantly to the protection of wildlife in the licenced areas.
According to Imai *et al*. (2009), SFM with reduced-impact logging applied to degraded natural forests can help to mitigate the deleterious logging impacts on the diversity of vertebrate species. Salt licks (HCV 1), for example, which is an essential element for mammalian species will be left out as conservation sites in forest planning (Matsubayashi *et al*. 2006). The rapid assessment using aerial surveys carried out by Alfred (2009) in Segaliud-Lokan Forest Reserve (57,240 ha) - managed based on SFM concept by KTS Plantation Sdn Bhd, has estimated about 1,426 Orang utans in the reserve. The results suggest that with proper zoning, such as the establishment of conservation areas and wildlife corridors within the SFM Licenced areas, it significantly contributed to maintain viable populations of critically endangered Orang utans. The experience at Deramakot shows that this is also applicable to other endangered large mammals.

(d) Increasing production of plantation timber reduces pressure on natural forests

Currently, most of forest harvesting is carried out in the degraded areas which have been designated for Industrial Tree Plantations (ITP) development. Although the timber harvesting in the NFM areas has continued to decline, it is offset by an increase of production from plantation timber. It hit 1 million m^3 in 2011, with a total production of 1,234,777.75 m^3. Forest plantations continued to play an important role in producing timber. The total production of plantation timber in 2013 was approximately 1,277,046 m^3. In relation to this, ITP planting also continued to make progress and now about 239,170 ha of forest plantations have been established in Sabah. Sustainable supply of plantation timber will reduce pressure on natural forests and this contributes in the enhancement of conservation effectiveness.

(e) Forest certification enhances transparency in the implementation of SFM

As for forest certification, it is the policy of the State Government of Sabah, to have all long term licenced areas, certified under any internationally recognized forest certification scheme by 2014. We believe that certification can build up credibility and bring continuous improvement to forest management. This is vital to protect the future of our forest resources because, once certified under SFM, the social, economic and environmental needs of society are addressed in one swop. On top of that, a certified forest means more stakeholder participation and this provides protection from those who may have a desire to turn back the clock and re-introduce the "Tragedy of The Commons" in managing the forest resources. Currently, Sabah has 446,570 ha of fully certified forests and 417,192 ha of partially certified forests, totalling approximately 863,720 ha.

3.2 Totally Protected Areas (TPAs)

Forest conservation through creating the TPAs is one of our main agenda in the implementation of SFM in Sabah. The International Union for Conservation of Nature (IUCN) defines protected areas (PAs) as "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Dudley 2008). Creation of the PAs free from human influence is crucial in order to halt the loss of biodiversity (Hogkins *et al*. 2006, in: Ancrenaz & Ambu 2009). Dudley (2008) also stressed that protected areas are essential for biodiversity conservation. According to him, today the protected areas are often the only hope we have of stopping many threatened or endemic species from becoming extinct. In Sabah, protected areas include protection forest reserves, virgin jungle reserves, wildlife reserves, state parks (Sabah Parks), wildlife sanctuaries and wildlife conservation areas (**Figure 6**).

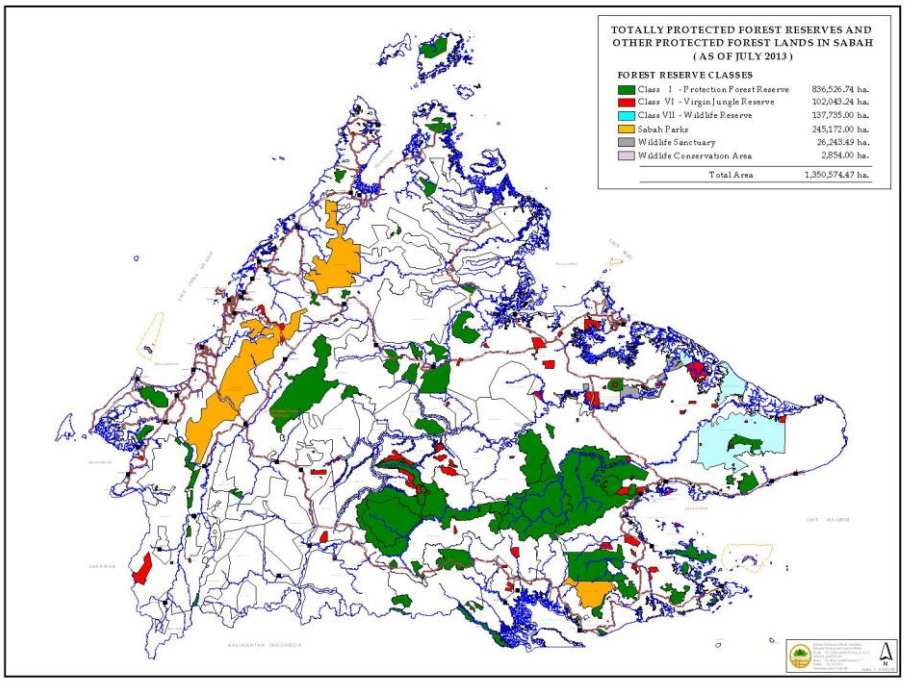


Figure 6: Totally Protected Areas in Sabah.

Currently, Sabah has a total of approximately 1.35 million of the TPAs that is 18% of Sabah's total land area, which is well above the IUCN guidelines of 10%. This is an increase of 60% as compared to just 840,000ha in 2004. This is a huge sacrifice made by the State Government of Sabah in the interest of long term conservation and an endowment for future generations, and this makes Sabah amongst the world leaders in terms of its foresight and progressiveness in protected area planning.

The Sabah State Government is planning to increase the TPA from some 18% to 30% of Sabah's total land area or from 1.35 million ha now to about 2.10 million ha in the next 10 years. The priority is on ecological zones that are biologically rich, and the areas will be identified progressively and reclassified to Class I protection forests in stages. Although the areas have been selectively logged, they remain key habitats for endangered Orang utans, Bornean clouded leopards, Sumatran rhinos, Pygmy elephants and other wildlife.

Connectivity between the PAs is another aspect emphasized by the Sabah Forestry Department to ensure long term wildlife conservation in Sabah. Reclassification of Northern Gunung Rara Commercial Forest Reserve to protection forest to connect Danum Valley, Maliau Basin, Imbak Canyon and Ulu Segama Malua is a big success in terms of the establishment of connectivity between the PAs in Sabah. This island of PAs of approximately 478,060.84 ha is one of the biggest established contiguous protected areas in Malaysia.

4. FOREST CONSERVATION INITIATIVES

The Sabah Forestry Department has been pursuing alternative sources of revenue to support its operations. One of these sources of revenues is linked to Reducing Emissions from Deforestation and Degradation (REDD). Early preparatory works related to REDD readiness for Sabah initiated by SFD have included formulation of REDD policy at the state level, including modalities and sources of financing. Initial work undertaken by the Sabah Forestry Department to attract REDD investment includes: (a) commissioning a third party to quantify the carbon potential in the 3.6 million ha forest reserves, which was estimated at 566 million tonnes worth US$2.8 billion (Sabah Forestry Department, 2010); (b) requesting the state cabinet to identify carbon as a forest product in order to establish ownership of carbon; (c) adopting best practices (e.g. RIL) to reduce carbon emissions linked to timber harvesting; and (d) accelerating forest rehabilitation programme in disturbed forests now reported to be 125,000 ha. In addition, Sabah has also established a bio-banking facility through the sale of Biodiversity Conservation Certificates, and to date a total of 21,500 certificates have been sold. These initiatives remain at an experimental scale; their real impact would only be realized if they are replicated at state level.

Sabah has maintained an open door approach to engagement with national and international-government and non-government initiatives. Although it has not been smooth sailing all the way, what is now emerging from this engagement may be considered a model framework for sustainable development. Currently, some of the major projects being implemented with the assistance from our international partners are briefly elaborated below:

- **Malua Wildlife Habitat Conservation Bank (MWHCB)**

  In 2007, a foreign partner, New Forests Pty Limited, has offered an innovative approach by the establishment of an eco-products bank, which is to create a commercially sustainable model for large-scale conservation and rehabilitation in the Malua Forest Reserve. The MWHCB is the first of its kind of model of investing in tropical rainforest conservation on a commercial basis. The marketing approach taken is based on the area biodiversity sales. The basic concept of MWHCB is to sell Biodiversity Conservation Credits (BCCs), with each certificate representing 100 square meters of rainforest restoration and protection. This financial mechanism will be able to translate forest conservation into a tradeable product so that biodiversity conservation could compete with other land uses on a commercial basis through the selling of Biodiversity Conservation Certificates.

- **UNDP-GEF Project on "Biodiversity Conservation In Multiple-Use Forest Landscapes in Sabah, Malaysia"**

  In recognition of Sabah's efforts in SFM and conservation, the UNDP has agreed to fund a project on multi-use forest landscape planning and management at a 260,000 ha active production forest area at the Kalabakan-Gunung Rara Forest Reserves. The project was approved by the GEF in June 2012, with a total budget of USD 4.4 million over a period of six years (2012-2018).

Based on the project document, the project proposes to achieve its objective through three interconnected and complementary components. The first component focuses on strengthening Sabah's policy framework to mainstream biodiversity and to finance its conservation within the multiple-use forest landscape, along with the support to improve institutional capacity. The second component involves demonstrating how to operationalize the multiple-use forest landscape management concept, where lessons learnt will be made available for replication throughout Sabah and elsewhere. The third component focuses on developing innovative sustainable financing options appropriate for the land uses within the project landscape.

- **Pilot EU-REDD+ Project**

The European Union (EU) is financing a project named "*Tackling Climate Change through Sustainable Forest Management and Community Development"* to address reduction of carbon emissions from deforestation and forest degradation, conservation of forest carbon stocks and to involve local communities more closely in sustainable forest management initiatives. The overall objective is to contribute to the sustainable and low carbon development of the State of Sabah while the specific objective is to improve Sabah's REDD+ readiness and implementation through demonstration activities to strengthen community engagement in forest protection and pro-poor sustainable forest management. This project will be supported by a contribution from the EU of 4 million euros over a period of four years (2013-2016), together with co-financing from the Sabah Government and local stakeholders.

Aristotle once said, "For the things we have to learn before we can do them, we learn by doing them". There is really only one way to learn how to do something and that is to do it, **Learning** by **Doing**. Adaptive management is "learning by doing". While current scientific knowledge does not provide definitive answers to all of our forest and conservation resource questions, SFD, has built in a process to adapt and change forest practice rules as new scientific learning becomes available.

5. THE CHALLENGE OF SFM

5.1 The critical issue with respect to Sabah's protected area system is the lack of necessary funding and implementing capacity to sufficiently protect and manage conservation areas. Protected or conservation areas without sufficient management are often referred to as "paper protected areas", i.e., they exist on paper but on the ground the conservation objectives are not being met. For example, stand improvement, boundaries demarcation, enforcement of protected area boundaries, etc. are expensive and labour-heavy endeavors. In any national setting, for formal protected areas to be secure, economic security is required. Only once this is achieved, can conservation efforts extend beyond protected areas and into the landscape setting. Economic security also provides for political security.

5.2 In terms of land use competitiveness, the forestry sector has to compete with agriculture. Based on the current scenario, financially, the average annual productivity of the oil palm industry is about 18 times more productive per hectare than the forestry sector. A single hectare of oil palm may yield 5,000 kilograms of crude palm oil (CPO), or nearly 6,000 liters of CPO, making the crop remarkably profitable when grown in large plantations — one study that looked at a 10,000 hectare-plantation suggests an internal rate of return of 26 percent annually (Sandker *et al*. 2007). As such, vast swathes of land are being converted for oil palm plantations.

Given the economic attractiveness of the oil palm development scenario to district and national government stakeholders, as well as to key local people, the question is whether conservationists have alternative development options. However, the area is vast and the size of payments (needed to get profit increases similar to those offered by the oil palm scenarios) would range between US$25–50 million/year. This is probably beyond most budgets for conservation. Certification of forest products and ecotourism alone are not likely to provide incentives to halt forest conversion. Carbon payments could conceivably bring benefits as high as those derived from logging and plantations (Sandker *et al*. 2007). However, the science and politics of avoided deforestation is poorly developed, and requires urgent and major research investment. Decisions about developing plantations today cannot wait for the long process of international negotiation on mechanisms for carbon payments.

5.3 The development of industrial crop plantations such as oil palm, if unregulated in the absence of systematic management, will have significant bearing on the environment. Oil palm plantations located too close to a river system and road side, without proper provision for riparian and buffer zones, would result in

environmental impacts such as riverbank erosion, surface water run-off with fertilizers and herbicides flowing into the river system, water pollution and loss of riverine biodiversity.

5.4 Sabah is undergoing a period of dynamic change linked to socio-economic development as the State transits from an economy that was, until quite recently, driven by natural resource development – primarily forestry – to one that is more broad-based and varied. As the economy diversifies and dependence upon forestry for its traditional economic value decrease, inevitably the pressure on forest resources will continue to do so at least, the transition period of economic change.

5.5 The population growth rate of Sabah remains exponential with the potential to double every twenty five years or so. Due to land scarcity and as the populations grow, there will be the risk of encroachments into forest reserves – particularly if this is driven by necessity. Moreover, with increased levels of development, land is increasingly valued by utility and at a practical level this will assess the amount of revenue the land can generate. It is untenable that such large forest reserve areas of land generate so little income in the long run unless other values and sources of revenue are realized. Given this scenario, a strong and diverse economy is required to relieve development pressures on forest resources, and sustainable plantation agriculture in the form of oil palm has an important role to play here.

5.6 Forest income is in its lowest (RM100 million or less) today since 1970 and will remain so for the next 20 years – i.e. our period of famine, so to speak (2010 – 2030). Whilst, practicing SFM today becomes somewhat, a costly and financially unattractive enterprise for the SFMLA holders. Under the present circumstances, some of them are unable to generate adequate financial surpluses that could be reinvested in SFM. Financial assistance or facilities to finance SFM activities are therefore a main challenge for SFM (Sinajin & Musa 2009). **If it is not economic, how can it be sustainable?**

5.7 Forestry investment means a relatively long gestation period, involving decades, unlike other land-based economic activities like agriculture. A long rotation period creates investment uncertainties, because of biological and market risks affecting final returns on the investment. Such time requirements also highlight other characteristics of forestry: irreversibility and delayed cash flow. A forest can be liquidated rather quickly, but replacing it is difficult and uncertain. These uncertainties create problems in gaining access to credit and in setting terms.

5.8 At present, there are no alternative big ticket incomes that can match timber from rainforests – carbon money is an illusion at present, REDD-plus is still uncertain, direct income from tourism is minimal while the difficulty of securing biodiversity payments is illustrated by Wunder *et al*. (2004). Non-market forest produce and payments for environmental services do not pay at present and if it is available, one has to comply with the many pre-requisites – lengthy processes.

5.9 Certification attempts to change economic incentives by creating markets for environmental goods for which consumers will be willing to pay a premium. The expected premium is important because there are higher costs associated with certification. These include changes in management practices that reduce timber supply from a given area and lead to increased timber supply costs through greater operational restrictions. In addition, there are additional costs associated with certification (auditing, increases in planning and monitoring, etc.). To date, however, such premiums have failed to fully materialize. Thus far, market access or threats of market actions do not appear to be significant in explaining the adoption of certification.

5.10 Several constraints need to be addressed before carbon offset and Payment for Ecosystem Services (PES) can be considered a reasonable tool for promoting conservation and sustainable forest management. The limited institutional and human capacity of PES - related fields are clearly not equal to the challenges it faces in Sabah. It is necessary to build institutional and human capacity in Sabah, which is going to be a gradual process and will likely take several years.

6. STRATEGIES TO THE WAY FORWARD

6.1 Forest Certification

It is clear that certification is by no means a panacea. However, if the movement is helping to generate domestic debate and awareness within the State and to lead to improved forest management, then it should be encouraged, without excessive expectations of what certification can achieve in the short to medium term. As a matter of policy, Sabah will proceed with forest certification as it can promote good governance, improved performance and brings credibility. Furthermore, certification can aid in government monitoring of the industry, as it serves as an independent verification of private operations.

6.2 PES as an Economic Instrument

Despite the growing scepticism, the potential of REDD+, PES and other innovative mechanisms to offset decline in revenue due to the SFM implementation and increase of TPAs, will be seriously explored as economic instruments for forest management. Although PES is not 'silver bullets' for conservation or development as economic incentives often may not be suitable to manage all environmental problems and may not be a sufficient guarantee for ecosystem services provision. Nonetheless, where direct payments for marketed environmental services are appropriate, conservation can be made a more competitive land-use over conversion.

Therefore, additional revenues are hoped from the sales of carbon offsets and other ecosystem services such as watershed services. A major constraint is that biodiversity conservation currently yields no direct revenue, except as a by-product of carbon storage.

6.3 Financing through partnerships

Management and maintenance of vast conservation areas are very costly and labour-heavy endeavours. As such there is an urgent need to have in place plans and strategies that allow for the long term sustainable financing and management of these areas. In the long term, it will be the quality of management that maximizes benefits and better secure the areas.

International and domestic funds, grants and loans such as provided by UNDP – Global Environment Facility, EU, JICA, Sime Darby, Nestle, etc., are important tools to help bridge the financial, technological and capacity gap in the implementation of conservation and SFM efforts in Sabah. The development of a sustainable tourism plan of the potential conservation areas is also being considered. Sabah will continue to expand its friendship networks: NGOs, Corporations, Environmental Philanthropists, Governments, Research organisations, to improve on the governance of State's forest resources.

There is increasing discussion at national and international forums of the need for financial transfers from outside to compensate the state for protecting its forests. Innovative programs based on carbon and biodiversity credits and the like are based on the premise that countries like Malaysia should not alone bear the financial burden of protecting forests which provide global benefits, in terms of carbon sequestration and biodiversity.

6.4 Nature Tourism

Tourism, being the third highest contributor to the state's economy after agriculture and manufacturing, is envisaged to be a key economic driver for the services sector in Sabah. It contributed 7.4% of Sabah's GDP in the 8th Malaysia Plan and 10% in the 9th Malaysia Plan (IDS 2007). Sabah's tourism strength lies mainly in its nature attractions, underpinned by many nature and wildlife conservation areas and parks.

The existing network of protected areas will be enhanced and new nature-based sites will be developed to showcase the biodiversity of Sabah's rainforests habitats, and their associated flora and fauna. The development of the potential tourism sites will be guided by a careful planning and management consistent with Sabah Tourism Development Policy.

6.5 Intensify Research & Capacity Building

Policy and management decisions are often made on financial grounds. However, the economic value of the benefits that people derive from ecosystem services, may not be fully recognised and hence, ecosystem considerations may not be incorporated adequately into decision-making processes. As an old management adage said that "You Can't Manage What You Don't Measure".

The topic of PES is relatively new and continues to evolve. New methodologies and guideline in this field particularly valuation of regulating services of ecosystems are expected to be introduced. Given the multi-disciplinary nature of PES, there is a need to build a pool of expertise, especially in the field of valuation of ecosystem services, understanding of economic and market instruments of ecosystem services, the Monitoring, Reporting and Verification (MRV), the Environment and social safeguards (ESS), etc. All these are beyond the current scope of forestry and hence will require capacity building and training.

The introduction of innovative solutions such as mosaic forest plantations to provide a more viable economic return of land use options is still in its infancy. Research on the practical implications – benefits and impacts – of mosaic development, particularly as a potential partner of integrated conservation management, must also be seen as a priority and natural opportunity.

6.6 Enhance Inter-Agency Coordination

In general, with a few exceptions, all the problems and issues of management of conservation fall within the purview of several agencies. Currently, there is an overlap in jurisdiction and responsibility for natural resource management.

While the Forestry Department has the dominant role in managing resources in forest reserves, other protected and conservation areas outside forest reserves are under the jurisdiction of several agencies. As there are many stakeholders involved in managing the areas, conflicting policies, overlapping of powers and regulations may occur in its management. Due to the lack of coordination amongst the agencies, there are obvious instances of encroachments into forest reserves by plantation owners and smallholders, and worse still, land alienation (titled) within the forest reserves boundaries. Therefore, the inter-agency coordination must be enhanced as it is the best way to address issues and threats to conservation areas.

7. CONCLUSIONS

Sustainability in forest management is a dynamic and evolving concept, reflecting changing social values and changes in the scientific understanding of the effects of human activities on the functioning of forest ecosystems. A truly sustainable forestry must reflect ecological, economic, and social objectives, the most challenging trade-off for policymakers may be between short-term needs and long-term assurances.

In this respect, since the state government has subscribed to the SFM concept in 1997, much had been achieved in reversing the previous trends of forest degradation and poor governance of the past. At the very least, forests are being managed systematically, restored, and given protection, with participation of our SFM partners. Our journey in managing our forests sustainably requires finding a balance between environmental, economic and social benefits.

However, the question "forests for whom and for what?" (Clawson 1975) can perhaps never be answered once and for all. It must be revisited periodically as societal needs and conditions change and as humans gain a more complete knowledge of what is needed to sustain the regenerative capacity of forest ecosystems to meet current and anticipated needs.

As that pioneering American Forester, Gifford Pinchot, the 1st Chief of the US Forest Service said in 1905, **"where conflicting interests must be reconciled, the question shall always be answered from the stand point of the greatest good of the greatest number in the long run.** This is the most important forestry concept, like the Lord's Prayer for some foresters, and therefore, our Forte (**Sam Mannan 2011**).

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PAPER 1: 4

INITIATIVE TO REGREEN AMANJAYA FOREST RESERVE: A BETTER SOLUTION THROUGH CARBON OFFSET PROJECT?

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ABSTRACT

Amanjaya Forest Reserve (FR) with the extent of 18,866 hectares has been gazetted on May 9, 2013 to support the Federal Government's commitment to implement the Central Forest Spine (CFS) project, which aims to create an ecological network (ecological linkages) between fragmented forest blocks separating Royal Belum Forest Reserve and Temengor Forest Reserve in Gerik. It is estimated that the carbon content in Amanjaya FR amounted to 2.45 million tonnes (average 130 tonnes.C.ha^{-1}). The carbon content can be increased to 3.8 million tonnes (average of 200 tonnes.C.ha^{-1}) through reforestation with the support from various quarters. Through a feasibility study done by the Forestry Department of Peninsular Malaysia (FDPM) on 13% or 2,472 hectares of Amanjaya FR, it is estimated that about 70% of Amanjaya FR consists of open areas (either canopy open or half open canopy) that need appropriate reforestation activities. For forest enrichment planting and forest plantation method, average cost per hectare by Perak Forestry Department (FD) are RM1,500 and RM4,000 respectively. This will cost Perak FD RM16.9 million to RM45.3 million to regreen the degraded forest areas in Amanjaya FR. Through Forest Carbon Offset Project initiated by the State Government of Perak, it is calculated that the cost of regreening Amanjaya FR can be turned into forestry incomes. It is estimated that 8.30 mTCO_2e with a conservative estimated price of RM10/ton, RM83 million will be generated and at the same time avoiding the release of 8.30 mTCO_2e to the atmosphere. Through this project, the forest will be locked-up in 30 years and the average yearly income that can be generated is RM2.78 million. The income will be credited to the Kumpulan Wang Pembangunan Hutan (Cess Fund), managed by Perak FD and will be used to regreen Amanjaya FR.

1.0 INTRODUCTION AND BACKGROUND

1.1 Amanjaya Forest Reserve (AFR) basically serves as an ecological linkage between fragmented forest blocks separating Royal Belum Forest Reserve and Temengor Forest Reserve in Gerik. AFR is located at the East-West Highway, connecting Gerik in Perak and Jeli in Kelantan. The East-West Highway was built in 1970, at the midst of the Communist Insurgency War from 1968 to 1989. The defense-related highway was built to cut off the Communist terrorist from their safe havens in the neighboring country. The 3 km wide forests from the upper to the lower part of Belum at the road stretch from Gerik, Perak to Jeli, Kelantan were logged during the construction of the East-West Highway for security and defense reasons. Nevertheless, after the surrender of Communist terrorists in 1989, the completion of the highway had created human-wildlife conflict, particularly big mammals such as the elephants as the forest blocks are separated apart and became fragmented.

1.2 Fast forward, the State Government of Perak had agreed that most of the 3 km wide Stateland Forest stretches along 40 km of the East-West Highway to be managed by the State Forestry Department. Hence, the Stateland Forests, an area of 18,866 hectares, were officially gazetted in 8 February 2013 as Permanent Reserved Forest. The forest is called Amanjaya Forest Reserve (AFR). This gazettement signifies the concern of the State Government of Perak to support the implementation of the Central Forest Spine (CFS) project, but also the long term conservation national initiatives such as the Tiger Conservation Action Plan, National Physical Plan and National Biodiversity Policy.

1.3 Perak Forestry Department (PFD) carried out remote sensing mapping to map out vegetation class through canopy density visualization of a pilot area of AFR. Worldview2 satellite image with high resolution of 0.6m, dated April 2012 was used to visualize canopy density variations in a pilot area of 2,427 hectares. It was found that about 70% of the pilot area can be categorized as degraded forest (low stock forest) as shown in Table 1. Subsequently, with the assistance of Forestry Department

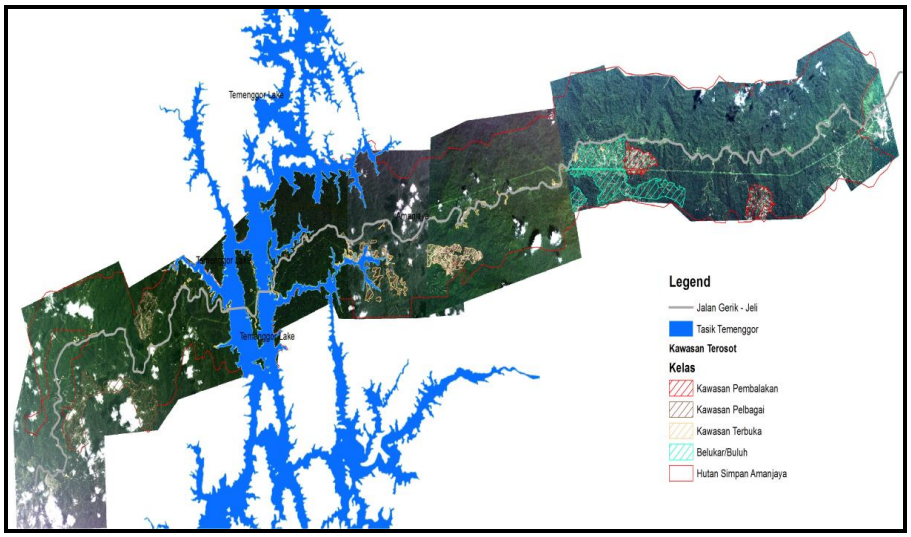
Peninsular Malaysia, heavily degraded forests based on vegetation (bamboo infested and open area) was also carried out and mapped (Figure A).

1.4 There is no specific study to calculate carbon content in AFR, PFD uses the national figure as a baseline. It is noted that the amount of carbon density in Malaysia varies according to forest types. It is estimated that carbon density may range from 70 tonnes of biomass per hectare (32.9 tonnes.C.ha^{-1} or 120 tCO_2e) of young/sparse forest to 400 tonnes per hectare (188 tonnes.C.ha^{-1} or 690 tCO_2e) of virgin forest. Highly degraded forests may have even 60 tonnes of biomass per hectare (28.2 tonnes.C.ha^{-1} or 104 tCO_2e). If PFD uses a conservative figure of Malaysia, it is estimated that the carbon content in AFR amounted to 2.45 million tonnes (average 130 tons.hectare^{-1}). The carbon content can be increased to 3.8 million tons (average of 200 tons.hectare^{-1}) in 30 years after replanting.

Table 1: Summary of Result of Canopy Density Survey of a Pilot Area in Amanjaya FR Using Worldview2 Image.

No.	Location/altitude	Close Canopy (ha)	Degraded Forest		Total Pilot Area (ha)
			Broken Canopy/Half Canopy (ha)	Open Canopy (ha)	
1.	Ridge/ >840 meter a.s.l.	467.25	589.94	21.63	1,078.82
2.	Intermediate/ 620 – 840 meter a.s.l.	46.25	589.94	23.71	659.90
3.	Valley/ <620 meter a.s.l.	221.16	430.55	36.67	688.38
		734.66 (30.23)	1,610.43 (66.35%)	82.01 (3.38%)	2,427.10

Figure A: Amanjaya Forest Reserve Satellite Mapping.



2.0 CARBON OFFSET

2.1 A carbon offset is a reduction in emissions of carbon dioxide or greenhouse gases made in order to compensate for or to offset an emission made elsewhere. Carbon offsets are measured in metric tons of carbon dioxide-equivalent (CO_2e) and may represent six primary categories of greenhouse gases; carbon dioxide (CO_2), methane (CH4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF6). One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases.

2.2 There are two markets for carbon offsets. In the larger compliance market, companies, governments, or other entities buy carbon offsets in order to comply with caps on the total amount of carbon dioxide they are allowed to emit. This market exists in order to achieve compliance with obligations of Annex 1 Parties under the Kyoto Protocol, and of liable entities under the EU Emission Trading Scheme. In 2006, about $5.5 billion of carbon offsets were purchased in the compliance market, representing about 1.6 billion metric tons of CO_2e reductions.

2.3 Carbon offset has gained some appeal and momentum mainly among consumers in western countries who have become aware and concerned about the potentially negative environmental effects of energy-intensive lifestyles and economies. The Kyoto Protocol has sanctioned offsets as a way for governments and private companies to earn carbon credits that can be traded on a marketplace. The protocol established the Clean Development Mechanism (CDM), which validates and measures projects to ensure they produce authentic benefits and are genuinely "additional" activities that would not otherwise have been undertaken. Organizations that are unable to meet their emissions quota can offset their emissions by buying CDM-approved Certified Emissions Reductions. Offsets may be cheaper or more convenient alternatives to reducing one's own fossil-fuel consumption.

2.4 Carbon offset basically involves voluntary market, including providers of different types of offsets, developers of quality assurance mechanisms, third party verifiers, and consumers who purchase offsets from domestic or international providers. It is perceived that Corporate Social Responsibility (CSR) and Public Relations/Branding are clearly in first place among motivations for voluntary offset purchases. The most common practice under this endeavor is tree planting activities. However, in global carbon offset endeavor, there are several critics to the issues of tree planting projects:

- Timing: Trees reach maturity over a course of many decades. Project developers and offset retailers typically pay for the project and sell the promised reductions up-front, a practice known as "forward selling".

- Permanence: It is difficult to guarantee the permanence of the forests, which may be susceptible to clearing, burning, or mismanagement.

- Monocultures and invasive species: In an effort to cut costs, some tree-planting projects introduce fast-growing invasive species that end up damaging native forests and reducing biodiversity.

3.0 FOREST CARBON OFFSET PROJECTS IN MALAYSIA

3.1 Sabah Foundation and Face the Future (Face Foundation) ventured into carbon-related initiatives in 1992 with the implementation of carbon-offset projects through enrichment planting and rehabilitation of degraded logged-over forests in Ulu Segama-Melua Forest Reserve. It is learnt that as of 2011, a total of 11,000 hectares have been restored, with the remaining 13,000 hectares to be rehabilitated. There was also carbon intensity research carried out by Sabah Foundation and New England Power (NEP) Company with regards to Reduced Impact Logging (RIL) application in Danum Valley Field Centre, Sabah.

3.2 In Pahang, there is a Voluntary Carbon Offset Scheme (VCOS) carried out by Malaysian Airline Systems (MAS) with Pahang Forestry Department and the Ministry of Natural Resources and Environment (NRE). In VCOS, MAS customers can voluntary contribute to the reforestation of peat swamp forest in Pahang. Since launched in 2011, MAS had collected RM150,000 and contributed to Pahang Forestry Department to reforest 5.7 hectares of degraded Pekan (Tambahan) Forest Reserve.

4.0 GLOBAL REDD+ INITIATIVES

4.1 Reducing Emissions from Deforestation and Forest Degradation includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks or REDD+ is country voluntary endeavor incentive. REDD+ is an incentive mechanism to encourage developing countries to decrease their deforestation and degradation rate. REDD+ is implemented in phases and payment is only be made based on achievement on result-based actions that will be fully measured, reported and verified (MRV) through Biennial Update Report (BUR). Furthermore, incentive payments are made based on decrease of emission and/or increase of greenhouse absorption through REDD+ activities. Payment is made after baseline calculation of the country.

4.2 The development of large emission reduction programs for REDD+ thus far occurs in the absence of a compliance mechanism. The majority of the funding is coming from bilateral and multilateral funding such as the Forest Carbon Partnership Facility (FCPF) and the new BioCarbon Fund Initiative for Sustainable Forest Landscapes. The Funds may employ results-based financing (RBF) approaches, including, in particular for incentivizing mitigation actions, payment for verified results, where appropriate. The pricing approaches for the different initiatives are fragmented between the limited numbers of other REDD+ RBF schemes at program scale. One example is Norway's International Climate and Forest Initiative, where a payment level of US\$5/tCO_2e has been used for both the Brazil Amazon Fund and the Guyana REDD+ Investment Fund.

4.3 Emission reductions transacted in the forest carbon markets such as carbon offset are generated by project-level activities, as opposed to REDD+ programs envisaged at national or jurisdictional level. In 2012, the average price for forestry offsets fell slightly to US\$7.8/tCO_2e. Prices have been declining due to limited demand and increasing supply. In early 2014, the average bid and offer for issued credits was US\$5–6/tCO_2e. Almost all project-level REDD+ emission reductions are currently transacted in the voluntary carbon market, but they are characterized by heterogeneity of demand, high price variability, and lack of transparency. However, these preconditions are difficult to achieve given the current lack of demand for carbon credits at the international level.

4.4 In case of Malaysia, the baseline or national reference level is still under development. There are several potential REDD+ Projects in Malaysia, such as the 6 million hectares of conservation area within the Heart of Borneo and 3 pilot projects involving communities in Sabah.

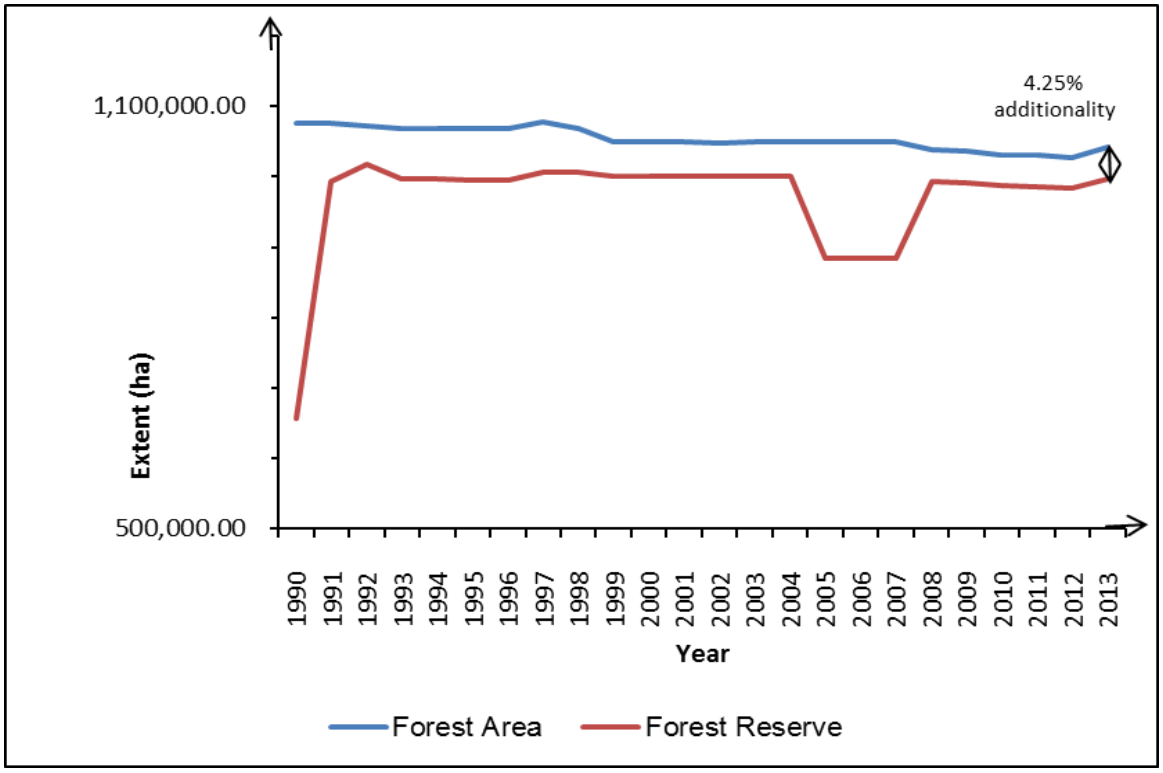
5.0 WHY NOT REDD+ IN PERAK

5.1 There are uncertainties and sceptic in the implementation of REDD+ in this country. In Malaysia, REDD+ is not perceived as very attractive as the modalities are still unclear, complicated and has a number of conditionality which may jeopardize sovereign rights of our country. Malaysia is also not seen as a critically deforested country as compared to other tropical countries. At national level, the deforestation rate in Malaysia is not high and our forests are basically soundly managed. The NC2 Report also reports that from a total of 167.44 MtCO_2 emitted in 2000, the major sources of emission were coming from energy industries sector which was the highest (35%) followed by transport sector (21%) and manufacturing industries and construction sector (16%).

5.2 Malaysia is situated in a position, at the verge of becoming a developed country. Due to those factors, Malaysia is not a favored country for financial assistance to donors as compared to other tropical country countries. There are also concerns as the states have to show the interest of local community and indigenous people through free, prior and inform consent (FPIC) practices. State Governments also have to indicate how benefit sharing is being implemented to stake holders. Furthermore, The NC2 report, published in 2011 also stressed that collectively, forest and grassland conversion was not a major source of CO_2 Emission in Malaysia as it was ranked fourth on list at 14%. Forests are still considered as net sink in Malaysia whereby carbon is sequestered by existing forested area and active reforestation and replanting program in the country. Carbon uptake of forests and woody biomass in Malaysia ranged between 240.5 MtCO_2e in 2005 to 249.8 MtCO_2e in 2000. Recent data shows that deforestation is not a major threat in Perak as the extent of forest resources in the state is stable for the last few years (Table 2). On the other hand, emission reductions in the forestry sector in Malaysia are accomplished through sound management system and timber harvesting using selective logging and Reduced Impact Logging.

5.3 On the other hand, there are also concerns on the issues of permanence and leakage in other States as REDD+ will be implemented based on national circumstances. Since 1990, the deforestation rate or rather forest land conversion in Perak is approximately at 4.53% (Figure B). With the gazettement of Amanjaya Forest Reserve of 18,866 hectares in 2013, the extent of stateland forests in Perak stands at 997,473.72 hectares or about 95.8% of the total forest land in the state. As more than 90% of the forests in the Perak are Forest Reserves and managed in pertuity, the additional forest carbon storage is not significant to be offered in REDD+. Thus, it can be safely considered that the level of avoided deforestation in Perak, the enabler for REDD+ project implementation has become so nominal.

Figure B: Differences Between Total Forest Resources and Forest Reserves in Perak (1990-2013, hectare).



6.0 PROPOSED PERAK VENTURE IN CARBON OFFSET

6.1 Deforestation can be avoided either by paying directly for forest preservation or reforestation, or by using offset funds to provide substitutes for forest-based products. Using the current global carbon offset scheme, the Malaysia NC2 Report stated that the opportunity cost for conversion of degraded forests exceeds carbon offset value. At a 1% reduction scenario of potential 13,000 hectares avoided deforestation between 2011 and 2020, Malaysia can get RM45.9 million deficit or differences between Net Opportunity cost of RM99.3 million and Carbon revenue of RM53.4 million.

6.2 From the calculated figure, it is forecasted that PFD can gain more if we try to compensate the opportunity cost of not to do deforestation in AFR. It can be value added with reforestation programme carried out through carbon offset activities. For forest enrichment planting and forest plantation method, average cost per hectare currently borne by Perak FD are RM1,500 and RM4,000 respectively. This will cost Perak FD RM16.9 million to RM45.3 million to regreen the degraded forest areas in Amanjaya FR. In view of these, it is believed that there is an appropriate method of Carbon Offsets capable to provide sufficient financial source to assist PFD in the rehabilitation of degraded forests in AFR and at the same time avoiding the release of 8.30 million tons of CO_2 equivalent to the atmosphere. The financial gain from this project will be credited to the Kumpulan Wang Pembangunan Hutan (Cess Fund), managed by Perak FD and will be used to regreen AFR.

6.3 Due to uncertainties in global carbon market as well as a low financial gain, Perak is venturing into Domestic Based Carbon Offset project that consists of a few simple venture propositions/objectives.

(i) The main purpose of Perak Carbon Offset is to solicit adequate and sustainable funds to rehabilitate degraded Amanjaya Forest Reserve. Through a feasibility study done by the Forestry Department Peninsular Malaysia (FDPM) to 15% or 2,427 hectares of Amanjaya FR, it is estimated that about 70% of Amanjaya FR consists of open areas (either canopy open or half open canopy) that need appropriate reforestation techniques.

(ii) To do tree replanting in degraded areas with a carbon offset price at RM10,000 per hectare, it will consist of site preparation, management of human resources and forest fire, planting of suitable species, infrastructure and equipment as well as monitoring and reporting.

(iii) The planting project will have a lifespan of 5 years. During initial stage of tree, due to high mortality, the dead trees will be replaced. After 5 years, the trees are no longer in need of silvicultural treatment.

(iv) The forest will be locked-out in 30 years after replanting.

(v) Funds will be channeled to *Kumpulan Wang Pembangunan Hutan* (Cess Fund) to be managed by PFD.

6.4 Benefits of the Domestic Carbon Offset proposed by PFD are as follows:

(i) Companies:

- Offsetting CO_2 emitted from various company activities such construction of new buildings, plantation etc.
- Enhancement of company image locally and internationally in green growth sustainable development.
- Carbon tax incentives.

(ii) Perak State Forestry Department:

- Sustainable and predictable allocation to rehabilitate and reforest degraded forest land.
- Rehabilitate degraded forests to be managed sustainably and systematically.
- Soil and area protection.
- Environmental protection.
- Biodiversity Conservation.
- Image enhancement on department's continuous efforts in mitigating CO_2 emission and climate change impact.
- Assistance to decrease operating allocation by the State Government.

(iii) Local Communities/Contractors

- Additional income from contractual jobs such as tree planting.
- Increase local community incomes.
- Protection from Human-Wildlife Conflicts.

6.5 PFD opines that there are better reasons behind this proposed Domestic Carbon Offset venture:-

- Carbon offset are difficult to verify due to their indirect nature. Some international providers obtain independent certification that their offsets are accurately measured even though the credibility of the various certification providers is often questioned. Certified offsets may be purchased from commercial or non-profit organizations for US$5.50–30 per tonne of CO_2 due to fluctuations of market price. It is believed that PFD can fetch higher financial assistance from interested local companies at a very much simpler carbon offset mechanism which is remodeled from their usual CSR or public relation activities.

- Accounting systems differ on precisely what constitutes a valid offset for voluntary reduction systems and for mandatory reduction systems. Formal standards for quantification exist based on collaboration between emitters, regulators, environmentalists and project developers. These standards include the Voluntary Carbon Standard, Green-e Climate, Chicago Climate Exchange and the CDM Gold Standard, the latter of which expands upon the requirements for the Clean Development Mechanism of the Kyoto Protocol. PFD believes that a good number of big companies are interested to a non-complicated accounting system for carbon reduction systems. There are big companies which are now developing new office, building and plant facilities, constructing new condominium units as well as extending new agricultural areas, among others, in their business expansion programme. Those activities are big carbon emitters and with increased awareness, the companies can be persuaded to 'green' their act through appropriate carbon offset scheme.

- There are still problem to develop baseline in Perak as it involves the measurement of emissions that occur before and after the project is implemented (carbon permanence and additionality). Domestic carbon offset ventures can eliminate tedious and meticulous measurements as required in the normal Carbon Offset scheme as long as both parties comply to an agreed upon agreement signed by both parties, as long as replanting activities are carried out successfully and maintained in an agreed upon specified duration.

- The leakage whereby implementation of the project cause higher emissions outside the project boundary is a non-issue as the domestic Carbon Offset scheme is carried out in Perak where basically all forest areas are managed by PFD sustainably.

7.0 CARBON TAX INCENTIVES FOR CARBON OFFSET

7.1 Tax and incentives are integral to the success of proposed Domestic Carbon Offset Scheme. There are opportunities for 'environmental/reforestation tax' to play a significant role in shaping future CSR and public relation activities among companies in the future. However, the tax and incentives are not attractive enough for local companies to carry out carbon offset to carry out reforestation activities in this country even though Malaysia exempted the income tax for the sale of Certified Emission Reduction (CER) units from the year of assessment 2008 to 2012. There are also plans to incorporate incorporated CER units with "Green Palm Oil", not to forest trees.

7.2 MITI (2012) listed national tax incentives are only available for companies carrying out activities relating to environmental management, among others such as follows:

- Pioneer status generation of energy from renewable energy, energy conservation, recycling of agricultural waste into value added product.

- Import duty and sales tax exemption for equipment used for the generation of energy from renewable energy and energy conservation.

- 100% tax exemption to the additional Capital Expenditure incurred to obtain Green Building Index certificate.

- Accelerated capital allowance for environmental protection equipment.

8.0 CONCLUSION

8.1 There are potential local multi-nationals and conglomerates that can be approached to carry out Carbon Offset projects. Big companies, multi nationals, corporate sectors that basically come from the emitter sectors and deal with huge carbon emission such as oil companies (Petronas, Shell, Kencana Petroleum etc), utility companies (TNB), plantation companies (Sime Darby, Tradewind, Boustead, Tabung Haji etc.) and transportation (MAS, Air Asia, Proton, Tan Chong etc.) are the potential companies to carry out reforestation projects to carbon offset their carbon footprint.

8.2 Carbon Offset can generate sufficient sustainable financing from local companies to enable PFD to carry out reforestation activities in Amanjaya Forest Reserve without difficult external conditionalities.

8.3 The current tax incentives to companies to do reforestation in Malaysia may not be sufficiently attractive even though there are increased emphasis and promotion of adoption of green technology as part of national sustainable development. The government has to devise attractive tax incentives to spur interest among local companies to carry out domestic carbon offset to rehabilitate degraded forest areas in Malaysia. This is an important step to reforest the country.

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PAPER 1: 5

HCVF ASSESSMENT: A CASE STUDY AT KUBAAN-PUAK FMU, SARAWAK

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ABSTRACT

With the support of WWF-Malaysia, a full High Conservation Value Forest (HCVF) assessment was carried out in 2012 for Kubaan-Puak Forest Management Unit (FMU) in Sarawak. It was aimed at providing the necessary management and monitoring recommendations as well as the field-testing of the 'HCVF Toolkit for Malaysia'. Kubaan-Puak is home to various Penan communities still dependent on the forest for their livelihood. It was found that all six HCVs were present, necessitating the prescription of conservation measures and continuous monitoring of each HCV. There was good acceptance of HCVF findings and management recommendation by the local communities during subsequent stakeholder consultation. The participants agreed to the formation of a Community Representative Committee and Sustainable Forest Management (SFM) Liaison Committee. The HCVF assessment was considered as successful and should contribute towards Kubaan-Puak's efforts in forest management certification.

1.0 INTRODUCTION

Sarawak is the largest Malaysian state with a land area of 124,450 km^2 and is located along the northwestern region of the island of Borneo (Chai 2006). Tropical rainforests form the dominant natural terrestrial ecosystem in the country and is recognized as the richest ecosystem in the world in terms of structure and species diversity (Yamakura *et al.* 1986, Lee *et al.* 2002, La Frankie *et al.* 2006, Hamzah *et al.* 2009) with the mixed dipterocarp forest as the dominant habitat. However logging and forest conversion pose severe threats to the tropical rainforests (Curran *et al.* 2004, Sodhi *et al.* 2004).

Despite logging being actively carried out annually, Sarawak can still maintain and protect the environment through vast areas of forested land. This is the result of Sarawak's commitment to achieve Sustainable Forest Management (SFM). SFM involves not only the continuous functions and services provided by the forest but also about meeting the global concerns and expectations in managing the forest with greater emphasis on environmental protection and conservation of biological diversity. Well-managed logging practices in production forest which produce certified timber will benefit not only the country's economy but also the conservation of biodiversity (Meijaard & Sheil 2007). One of such practices is setting aside High Conservation Value Forest (HCVF) areas within timber concession areas.

The assessment and maintenance of High Conservation Value Forests (HCVF) is prescribed under Principle 9 of MC&I (Natural Forest) under the Malaysian Timber Certification Scheme (MTCS). HCVFs are forests which have especially high ecological and/or social values. Identifying these values, knowing to whom these values are considered important, and locating the forest areas which harbour these values is an essential step for the effective assessment and management of these values (WWF-Malaysia 2009).

Unlike the other states in Malaysia, forest management certification in Sarawak is voluntary and is undertaken by the licensee or timber companies. In 2012, Sarawak Forestry Corporation (SFC) with support from WWF-Malaysia, undertook a full HCVF assessment in accordance with the requirements of the HCVF Toolkit for Malaysia for the Kubaan-Puak Forest Management Unit (FMU) in Baram.
The objectives of the assessment were:

1. To identify HCVs within the Kubaan-Puak FMU and to provide management and monitoring recommendations for the HCVs in the FMU, and

2. To field test the HCVF Toolkit for Malaysia in Sarawak.

2.0 SCOPE OF ASSESSMENT

The full HCVF scope of assessment involves six categories of high conservation values as prescribed in the HCVF Toolkit for Malaysia (2009).

Table 1: Types of HCVs.

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

(HCVF Toolkit for Malaysia 2009).

3.0 METHODOLOGY

The HCVF assessment involved a group of experts from different fields of interest (flora, fauna, social science and ecology) in SFC and focused on the western and central regions of the FMU. The HCVF assessment required a multi-disciplinary approach and the methodology employed covered the following activities:

- **Delivery of notice** to inform the local communities of the planned community consultation and gathering of information from the community.
- **Community consultation -** Consultation was done so that local communities are fully aware of the assessment activities. Doing so fulfils the principle of Free, Prior and Informed Consent (FPIC).
- **Fauna Assessment -** Two field studies were carried out. The first was a Rapid Rural Assessment with the local communities and identification of study areas. The second was data collection in the study areas.
- **Flora Assessment -** The data collection trip was conducted at the eastern part of the FMU using the random line transect method. The survey concentrated on trees and understorey plants (excluding mosses and fungi). Identification was done both on the field and at the Sarawak Herbarium.
- **Desk-top assessment**, literature review and field observation on HCV 2, 3 and 4
- **Social Assessment on HCV 5 and 6 -** Data collection was done during two field studies. The first was building relationship and river names were recorded during community consultation. The second involved an in-depth study to gain a better understanding of their livelihood. The activities included participating, observing and interviewing a family-group on camping, sago processing, blowpipe poison harvesting and processing, fishing, hunting and gathering of rattan.
- **Stakeholders consultation** on the draft report was held in Long Si'ang, Kubaan-Puak FMU. Community headmen, representatives and some observers from seven out of nine Penan groups participated in the consultation. The representative of the timber licensee (Ta Ann) also participated. WWF-Malaysia and Non-Forest Timber Product-Exchange Program (NTFP-EP) as NGOs acted as observers to the proceedings.

4.0 STUDY SITE

4.1 Location & Physical Attributes

The Kubaan-Puak FMU is located in the north-east of Sarawak in the Miri Division (Map 1). It is found at the headwaters of the Tutoh River, one of two main tributaries of the Baram River. The FMU is sandwiched between Kubaan River and Puak River, therefore the FMU is named after these two rivers – the Kubaan–Puak FMU. Both rivers are tributaries to Tutoh River. With an average north-south length of 20 km and west-east width of 30 km, the FMU covers an area of 32,023 ha.

The landscape is dominantly mountainous of Class III and Class IV terrain (above 35° for Class IV). There is a narrow strip of undulating land comprising Class II terrain on the eastern side, lying along the bank of the Kubaan River. The altitude ranges from 400 m to 1,000 m. The north-east portion comprises higher terrain with altitude above 1,000 m. The terrain mainly consists of ridges, valleys and steep slopes. Forest vegetation comprises only of two types: heath forest and mixed-dipterocarp forest.

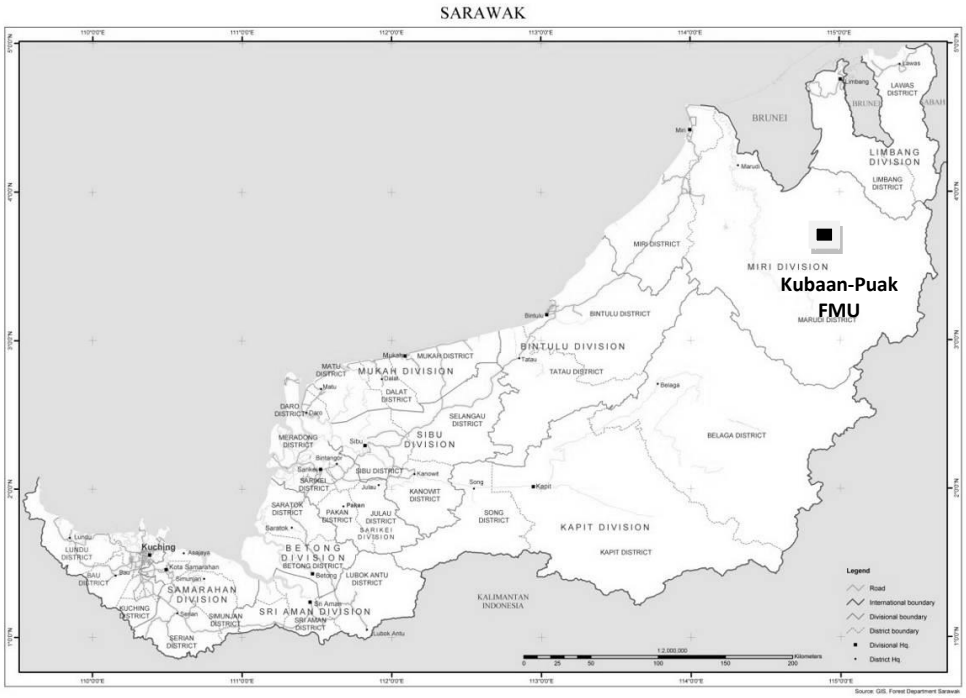
4.2 Local Communities

The community residing within and adjacent to the FMU is solely made up of Penan, many of whom are still nomadic and have only taken up agriculture and settlement fairly recently. The Penan communities in the area still maintain a mobile economic or nomadic lifestyle based on hunting-gathering activities. In recognition of this, the State Government allocated an area of 2,815 ha as Penan Area Reserve (*Magoh Penan Reserve*) for exclusive use by the Penan. The northern end of the FMU comprises a part of that Reserve (Map 2).

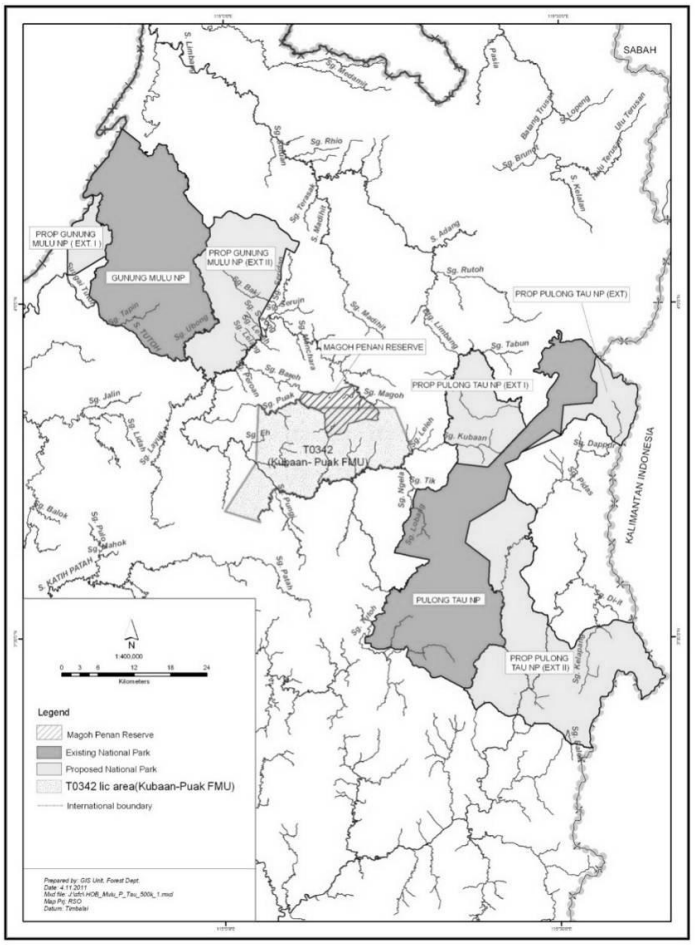
4.3 Logging and Accessibility

Logging had been carried out in the FMU since 1988 except for the *Magoh Penan Reserve* and mountainous areas to the east and north-east. Logging commenced in 1988 and temporarily ceased when the timber license was acquired by Ta Ann in 2007. As a result, the road network system inside the FMU has not been maintained. Several sections have collapsed, and land vehicle transportation into the FMU is no longer possible. Therefore, walking is the only means of traversing the FMU.

Map 1: Location of Kubaan-Puak FMU in north east Sarawak.



Map 2: Kubaan-Puak FMU and nearby national parks.



5.0 FINDINGS

The assessment in the FMU indicates the presence of all six HCVs. There are four sub-HCVs and three sub-HCVs in HCV 1 and HCV 4 respectively. Out of all these sub-HCVs, only HVC 1.1 is not present.

HCV 1 is on **biodiversity values**. **HCV 1.1** on **protected area** (legally gazetted under Malaysian legislation) is the only HCV not present. The nearest distance between the FMU and two TPAs - Gunung Mulu National Park and Pulong Tau National Park is approximately 17 km and 20 km respectively (see Map 2). For **HCV 1.2,** field assessment identified 22 fauna and 37 flora species as **endangered** and **threatened.** On **HCV 1.3,** there are 14 **endemic** fauna and 50 **endemic** flora species. As to **HCV 1.4** on **critical temporal areas**, the main HCVs found are salt-licks, tree holes and protected fruit trees for wildlife.

HCV 2's assessment on **landscape-level forest** shows that the FMU does contain attributes that are significant for wildlife species to exist in natural patterns of distribution. The FMU provides a "stepping stone" for the potential creation of a wildlife corridor linking Gunung Mulu and Pulong Tau National Parks, and then to a larger landscape proposed for conservation management under a multi-lateral governmental cooperation between Brunei, Indonesia and Malaysia i.e. the Heart of Borneo.

As for **HCV 3** on **ecosystems**, about 28.3% of the FMU is heath forest which is accorded high priority and 67.3% as lowland and upper dipterocarp forests that are accorded medium priority for conservation under the National Conservation Strategy.

Under **HCV 4** on **services of nature, HCV 4.1** on **watershed protection** shows that the FMU is located right at the headwaters of a catchment area for water supply intake. However, it is located far upstream, beyond the 8 km radius of protected area for water intake at the town of Marudi. Nonetheless, as the FMU contains 30% of Class IV terrain with fast flowing streams and erosion prone areas, the FMU is important for watershed protection. Assessment on **HCV 4.2** on **riparian area** shows that the FMU with its location at the head of the Tutoh River system does contain all categories of riparian zones. Assessment on **HCV 4.3** pertaining to attributes that can **both prevent and cause forest fire** suggests that this HCV is present**.** As fire-break, the vast web of streams and rivers in the FMU can prevent fire from burning dry materials on the forest floor. However, located next to the FMU is a forest plantation of fast-growing tree species (*Acacia mangium)*. During the first four years of planting, *Acacia* is susceptible to fire, posing a fire hazard to the FMU during extreme dry weather.

As for **HCV 5** assessing whether the forest is fundamental to **meeting basic needs of local communities,** Kubaan-Puak is home to the Penan communities of Ba Puak, Long Si'ang, Ba Kajau and Ba Tepen. Seven more Penan communities are located adjacent to the FMU. Most of them still depend on forest as hunter-gatherers, practicing a mobile economy. They depend on a variety of food, defined as "core" food for staple and "relish" for other types of food. Other uses pertain to material needs and medicinal purposes.

With the presence of HCV 5, Kubaan-Puak therefore also contains **HCV 6** pertaining to **cultural identity of local communities.** The attributes important to Penan, amongst others, are camp grounds, sago clusters, important fruit groves, death sites and burial grounds, and places of memorial significance.

6.0 RECOMMENDATIONS

The management and monitoring recommendations for each HCV are based on conservation specifications and timber harvesting methodology of the Reduced Impact Logging Guidelines. Where relevant, reference is made to guidelines developed by the forestry authorities in both Sarawak and Malaysia. The management recommendations are presented in Table 2.

As to the second objective of field-testing the HCVF Toolkit in the context of Sarawak, two recommendations were made. The first pertains to reclassifying the three categories of dipterocarp forests into only two – lowland and upper dipterocarp forests. The second is to include the assessment on fish and amphibians as they are good indicators of forest conditions.

7.0 STAKEHOLDERS CONSULTATION

As part of the requirement under Principle 9, a stakeholder consultation on the HCVF findings was conducted at Long Si'ang during which the communities by consensus accepted the findings and management recommendations. The participants agreed for separate forums to address other issues pertaining to harvesting operations and rights of indigenous peoples as well as to participate in the formation of Community Representative Committee and SFM Liaison Committee to be formed by SFC together with other relevant stakeholders.

Table 2: List of Recommended Management Prescriptions according to the HCVs.

HCV	Attribute	Management Prescription
1.2	Protected, Endangered and Threatened Wildlife species	Compliance of DF Circular No 6/99 on prohibiting commercial hunting as the major threat over wild life
	Flora species protected under Wildlife Protection Ordinance	Protection from timber harvesting
	Endangered and threatened species under IUCN and Appendix II of CITES	Conduct Permanent Sampling Plot (PSP) assessment to determine sustainable harvesting volume
1.3	Endemic flora species	- Ditto -
1.4	Critical temporal areas such as salt licks, tree holes with juvenile animal and protected fruit trees	Creation of buffer zones
2	Landscape-level forest important for wildlife species to exist in natural patterns of distribution	Maintain Kubaan-Puak as a potential stepping stone towards linking Gunung Mulu and Pulong Tau National Parks
3	Ecosystems - Heath Forests	Conduct further studies to determine sustainable harvesting volume against soil erosion
	Ecosystems - Lowland and Upper Dipterocarp Forests	Strict compliance to RIL Guidelines on harvesting methodology
4.1	Watershed protection	- Ditto -
4.2	Erosion Control	• Creation of buffers over riparian areas • Strict compliance to RIL Guidelines on harvesting methodology
4.3	Barriers to destructive fire	• Adopt adjacent plantation forests' fire prevention management plan • On-time collaboration with adjacent plantation forest managers on monitoring weather pattern and out-break of fire
5	Resources vital to meeting basic community needs	• Protection for four selected plants vital for community needs and survival • Adopt procedure to enable "Plant Utilization Prior to Logging" by the communities
6	Areas important for cultural identity of local communities	Creation of buffer zones over contemporary camp sites, sago clusters and important fruit groves, death sites and burial grounds, and selected memorial areas

8.0 CONCLUSION

With the exception of HCV 1.1, all other HCVs were assessed to be present in Kubaan-Puak FMU. The assessment exercise is considered a success in terms of acceptance by stakeholders of the resulting recommendations. The HCVF Toolkit has been proven to be useful and practical in identifying areas of high conservation value in Sarawak.

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PAPER 1: 6

ACHIEVING NO NET LOSS OF BIODIVERSITY CONSERVATION IN MULTIPLE-USE FOREST LANDSCAPES: A 21st CENTURY CHALLENGE

Jeflus S. Sinajin[1] | Lee Ka Han[1] | Siti Zubaidah Abdullah[2]
[1]GoM-UNDP-GEF Project, [2]Sabah Forestry Department

ABSTRACT

Multiple-use forest management is envisioned by many as a preferable alternative to timber-dominant management models, and satisfies the demands from multiple stakeholders. At the outset, this approach appears to be relatively simple to implement with no net loss of biodiversity. However, conserving forest biodiversity with no net loss at the landscape level alongside economic development is a defining challenge of the 21st century especially when the current condition of the forest is generally highly degraded, coupled with changes to land-use from its original form. One such example is the Government of Malaysia-United Nations Development Programme-Global Environment Facility (GoM-UNDP-GEF) Multiple-use Forest Landscapes Project, which is located at Yayasan Sabah's Sustainable Forest Management Licence Agreement area. The project serves as a model to catalyze innovation in processes and increases management know-how in achieving an optimal balance across potentially competing uses. The paper begins with a short background of the project and then highlights the project's objectives, outcomes and overall outputs. However, during the project planning and conception, there were a series of land-use changes in the project landscape as a result of decisions taken by the state government, which consequently, have raised various opinions among many stakeholders, including the UNDP. These emerging issues: land-use changes, concerns and implications of biodiversity in the project landscape, are discussed in this paper. The paper then discusses the future of biodiversity in the project landscape, that is, whether the no net loss of biodiversity can be attained, and recommends immediate actions to be implemented to reduce biodiversity impacts. Lastly, the paper looks at some challenges of achieving no net loss of biodiversity and beyond.

1.0 BACKGROUND

The elements of what constitutes good forest management change over time, but the bedrock features of forest tend to remain fairly constant. It is human beings' perception of forest and how forest resource base is utilized that shifts constantly.

(Wang 2004, p. 209)

1.1 It is these shifts in forest perceptions that heavily influence the current search for new management alternatives to avoid forest conversion to privately more competitive land uses. There had been an acceleration of forest conversion (especially outside the forest reserves), as well as, forest degradation within the forest reserves associated with overharvesting forest resources over the last 30 years in Sabah. These trends have resulted in the progressive loss and degradation of the biodiversity in the forest landscape. It was reported in the Government of Malaysia-United Nations Development Programme-Global Environment Facility (GoM-UNDP-GEF) Project Document that the GoM-UNDP-GEF Multiple-use Forest Landscapes Project in Sabah represents one such landscape. Therefore, the concerns about the environmental impacts of the onslaught of our forests in Sabah had a decisive role in the search for novel forest management models of which, sustainable forest management (SFM) was introduced, primarily focused on sustaining timber yields. SFM then broadened the scope to both present and future generations' needs, to multiple beneficiaries and stakeholders - but also to multiple products and services, known as multiple-use forest management (MFM) - a mainstream concept in forestry. To accommodate this, the GoM-UNDP-GEF project was proposed and was subsequently approved in 2012. The project serves as a model to catalyze innovation in processes and increase management know-how in achieving an optimal balance across potentially competing uses.

1.2 The GoM-UNDP-GEF Multiple-use Forest Landscapes Project is located at Kalabakan Forest Reserve (Partly) and Gunung Rara Forest Reserve (Partly), which is part of Yayasan Sabah's Sustainable Forest Management Licence Agreement (SFMLA) area – see **Figure 1**. The project has a total area of approximately 261,264 ha, which is ≈36% larger than the State of Malacca.

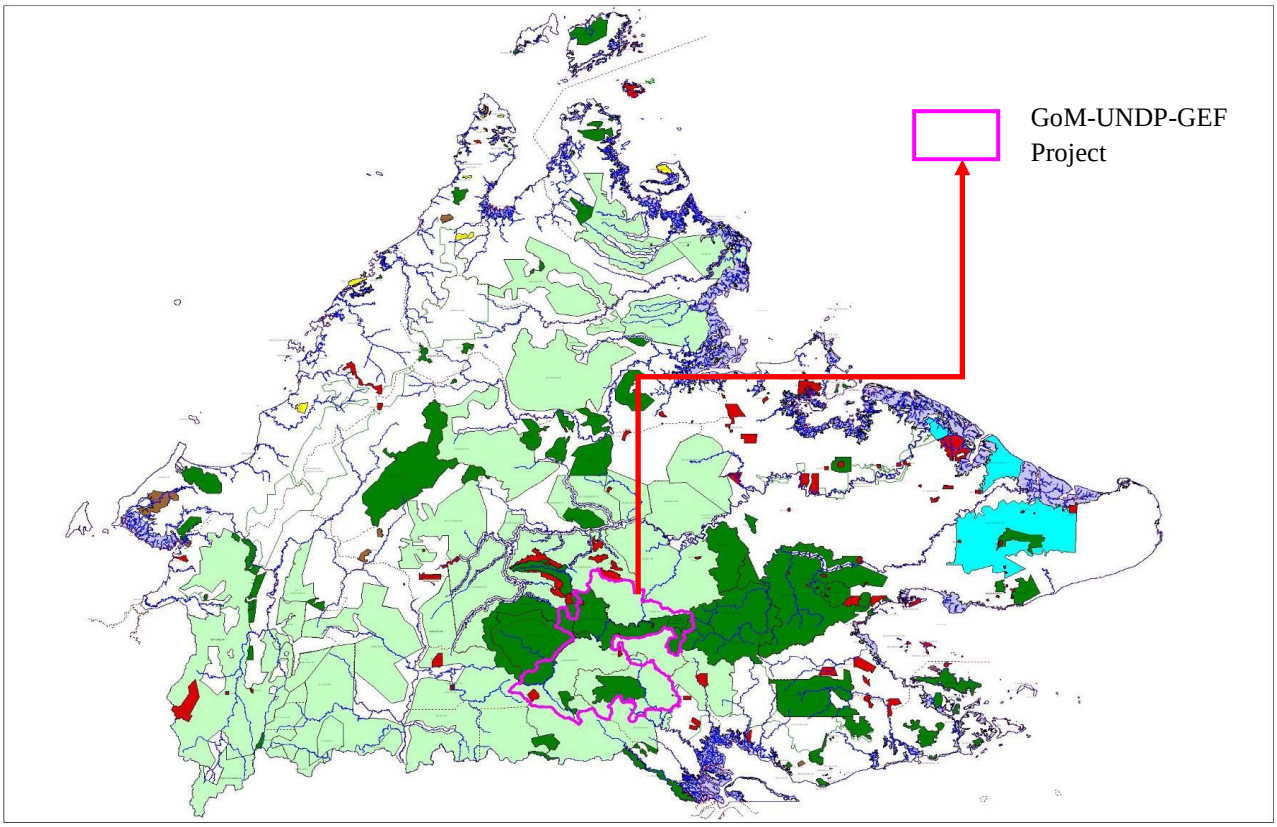

Figure 1: Location of the GoM-UNDP-GEF project area.

1.3 Detailed forest biodiversity[1] and ecological assessments have yet to be undertaken in the project landscape. However, based on information and on assumptions from the more comprehensively described forests of the adjacent SAFE (Stability of Altered Forest Ecosystems) Project[2] and surroundings, that is, Ulu Segama and Malua Forest Reserves and the forests surrounding Maliau Basin, the Technical Working Group (TWG)[3] reported that they have high confidence that forests in the project landscape – even in their generally degraded state – retain considerable ecosystem importance and high levels of biodiversity of economic and ecological importance including, in all likelihood, viable populations of rare and endangered species. The project landscape also forms an important connecting landmass to three protected areas in Sabah, namely, the Maliau Basin Conservation Area, the Danum Valley Conservation Area and the Imbak Canyon Conservation Area. All these conservation areas have since been gazetted into Class I Protection Forest Reserves (Totally Protected Areas – TPAs); and respectively known as Maliau Basin FR, Danum Valley FR and Imbak Canyon FR.

[1] Forest biodiversity means the variability among forest living organisms and the ecological processes of which they are part; this includes diversity in forests within species, between species and of ecosystems and landscapes – International Convention on Biodiversity, 1992.

[2] See: www.safeproject.net – particularly relevant given the similarly degraded nature of the forest at this site.

[3] The TWG was formed to advise the Project Board on issues relating to biodiversity, with specific reference to the proposed changes to land-use within the GoM-UNDP-GEF Multiple-use Forest Landscapes Project.

2.0 PROJECT OBJECTIVE, OUTCOMES AND OUTPUTS

2.1 Project Objective

2.2 The objective of the GoM-UNDP-GEF project is to develop an innovative landscape-level land-use and forest management model that is sustainably funded by revenues generated within the project area that would result in no net loss (NNL)[4] of biodiversity, specifically by:

- Collecting and compiling of biodiversity-related data as a baseline;
- Developing and using an ecological economic model to determine the optimal combination of land-uses;
- Preparing a landscape level management plan; and
- Undertaking a pilot implementation of Reducing Emissions from Deforestation and forest Degradation (REDD+), biodiversity offset and Payments for Ecosystem Services (PES) schemes.

2.3 In its original form/plan (the Project Document[5]), the commercial focus of the GoM-UNDP-GEF project was on natural forest management (69% of the project area) and industrial tree plantations (17%) with forest restoration of degraded forests by enrichment planting (as part of the existing INIKEA project) and full protection each accounting for approximately 7% of the project landscape.

2.4 Project Components and Overall Outputs/Activities

2.5 The project proposes to achieve the above mentioned objective through three components. The first component is "*An enabling environment for optimized multiple use planning, financing, management and protection of forest landscapes*". This component, which operates at state level, focuses on strengthening Sabah's policy framework to mainstream biodiversity and to finance its conservation within the multiple-use forest landscape.

2.6 GEF support will focus on ensuring that multiple use forest landscape management systems are designed, managed and financed in ways that ensure the conservation of biodiversity. This will include support for the development and implementation of policies aimed at achieving no net loss/net gain (NNL/NG) in biodiversity through fact-finding, evaluation of policy options, development of the necessary biodiversity information, policy formulation and system design and capacity building. GEF will also support the creation of an enabling environment to permit the introduction and implementation of innovative sustainable funding through REDD+, bio-banking and PES mechanisms. This component has five (5) outputs as follows:

Output 1: New State-level policies and regulations for implementing NNL/NG and incorporating biodiversity and ecological function conservation objectives into the integrated planning and management of forest protected areas and surrounding or connecting landscapes.

Output 2: New state-level policies and regulations for generating and disbursing revenues at landscape level from innovative financing mechanisms.

Output 3: Enhanced capacities of staff at institutional levels to design, implement and manage/oversee multiple-use, landscape level forest management and sustainable financing schemes, including enhanced capacities to monitor ecosystem service markets.

Output 4: Enhanced cost-effective systems for compliance monitoring and enforcement of multiple-use forest regulations.

Output 5: State and national guidelines and operational policies for multiple-use forest landscape planning, management and conservation that build on the lessons learned from work at the target landscapes.

[4] NNL is achieved when biodiversity gains from the combination of avoidance, mitigation, rehabilitation and targeted conservation actions match biodiversity losses from the impacts of a specific development project, resulting in no overall reduction of biodiversity (Jenner, N. Landscape level assessment. Fauna & Flora International e-newsletter; *Oryx – the International Journal of Conservation*).

[5] The UNDP Country: Regional (Sabah, Malaysia) Project Document was approved in 2012. You may also get more information about the GoM-UNDP-GEF Project and/or download the Project Document at: http://www.my.undp.org/content/malaysia/en/home/operations/projects/environment_and_energy/80468_forestlandscapes.html

2.7 The second component is the "*Demonstration of multiple-use forest landscape planning and management system*". Under this component, the project will define and work to implement an optimal mix of production and conservation land-uses within the target landscape. In order to do this, GEF support will be utilized to: (i) select/develop and implement an environmental economic land-use planning model that incorporates biodiversity and ecosystem function targets within the forest landscape; (ii) prepare a landscape management plan based on a combination of land-uses selected using the model, and; (iii) support pilot implementation of the landscape-level management plan. As a result of project activities, species and ecosystem biodiversity will be conserved in 261,264 ha of the Kalabakan-Gunung Rara Forest Reserves area within a sustainably managed forest landscape; and pressure on the adjacent conservation areas will be decreased. This component operates at the landscape level and has three (3) outputs as follows:

Output 1: Economic model to determine optimal mix of production and conservation land uses to maximize sustainable revenues from, and conservation of, the demonstration landscape.

Output 2: Landscape-level management plan based on optimal combination of land uses including PAs and sustainable production.

Output 3: *Pilot, adaptive implementation of landscape-level management plan, including new PA establishment and implementation of sustainable use management system based on sustainable off-take, monitoring and enforcement.*

2.8 The third component focuses on developing innovative "*Sustainable financing of protected areas and associated forest landscape areas demonstrated at the pilot site*". Under this outcome, the project will support the design and development of three alternative revenue generation schemes and disbursement using pilot modalities of REDD+, biodiversity offsets, and PES for scaling-up to the whole project landscape. There are seven (7) outputs/activities under this component. They are:

Output 1: Environmental economic and financial analyses of actual and potential land-use scenarios, incorporating estimates of landscape level total economic value, including ecosystem services, conservation and other values.

Output 2: Pilot implementation of revenue generating mechanisms.

Output 3: Detailed operating and financial agreements between SFD and private sector and other partners.

Output 4: Financial accounting and monitoring of agreements.

Output 5: Tested and operational systems for allocation and re-injection of revenues into PAs and landscape level management.

Output 6: Tested and operational financial systems for benefit-sharing.

Output 7: Adaptive financial management, including shifting balance of desired uses based on changes in ecosystem markets.

3.0 EMERGING ISSUES

3.1 In its "Original Plan", the project focused on conservation (protected areas) and natural forest management (NFM) with relatively limited areas (≈ 45,000 ha) allocated for the development of mixed timber plantations – **see Table 1 and Figure 2**.

3.2 In July 2013 and early 2014, the Sabah Forestry Department (SFD) outlined plans for major changes to the project landscape (the "Current Plan") that would effectively double the extent of plantation cover to almost 90,000 ha, including over 33,000 ha of oil palm plantations - a crop specifically excluded in the Project Document submissions - **see Table 1 and Figure 3**. The NFM component, on the other hand, was reduced to approximately 50,000 ha.

Table 1: Summary of the three land- use plans scenario[6].

Land-Use	Original	Current	TWG	Remarks
	Gross Area (Ha)			
Natural Forest Management (NFM)	180,426	52,198.7	23,500	SFD has publically stated that under the Current Plan much of the area allocated to NFM would be re-classified as Class I Forest Reserve.
Industrial Tree Plantations (ITP) or Agroforestry	43,821	5,641.7	9,937	Mostly rubber plantations.
Protected Areas	18,517	115,430.9	156,237.5	Mostly Class I reserves
Forest Restoration[7]	18,500	0*	0*	*INIKEA area – in original document allocated as a restoration area. Now classified as a Class I Forest Reserve.
Mosaic Plantations	0	52,069	33,512	Formerly under NFM
Oil palm Plantations	0	33,724.2	35,878	Not in original project document.
Organic Agriculture	0	1,957.3	1,957.3	This was decided before the project conception.
Research Plots	0	242.2	242.2	
Land Cover	**Net Area (Ha)**			
Continuous Natural Forest	217,443	167,630	179,738	Assumes unbroken forest over an area >5,000 ha.
Fragmented Natural Forest	13,146	39,065	31,720	Forest patches embedded within plantations <100 ha.
Mosaic, ITP & Agroforestry Plantations	30,675	30,962	24,691	Assumes 70% conversion of ITPs, 50% conversion in mosaics.
Oil palm Plantations	0	23,607	25,115	*Assumes 70% conversion*
Land Cover	**Total Area (Ha)**			
Natural forest	230,589	206,695	211,458	
Plantation/non-forest	30,675	54,569	49,806	

3.2 The extent of the protected areas, including a crucially important forest link between Danum and Maliau, however, had been expanded under the Current Plan, rising from less than 20,000 ha to over 110,000 ha – of which, approximately 95,000 ha have since been formally gazetted as Class I Protection Forest Reserves.

[6] Adopted from the TWG Report, 2014. Rapid assessment of the GEF-UNDP-SFD Multiple-use Forest Landscapes in Sabah project.

[7] Restoration activities will continue as part of the INIKEA Project – but this area has now been re-designated as a fully protected Class I Forest Reserve.

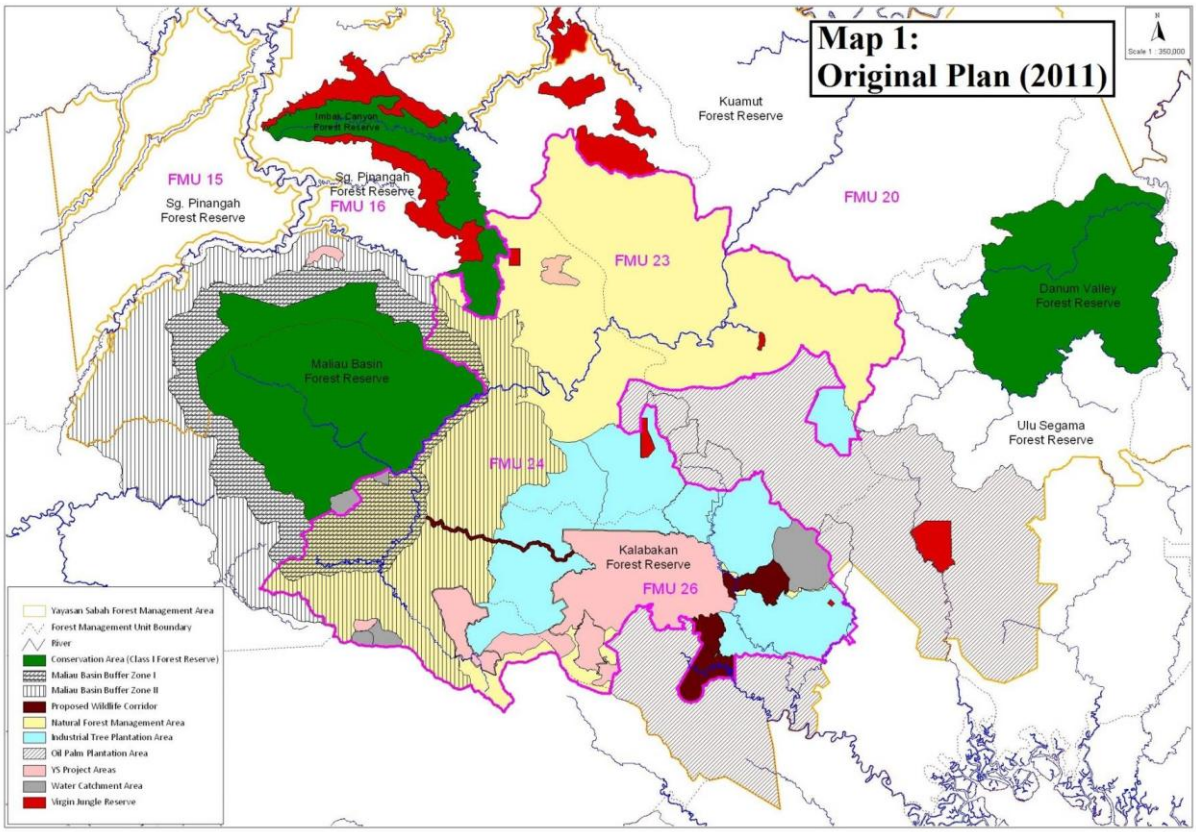

Figure 2: Land-use in the project area, based on Original Plan – 2011.

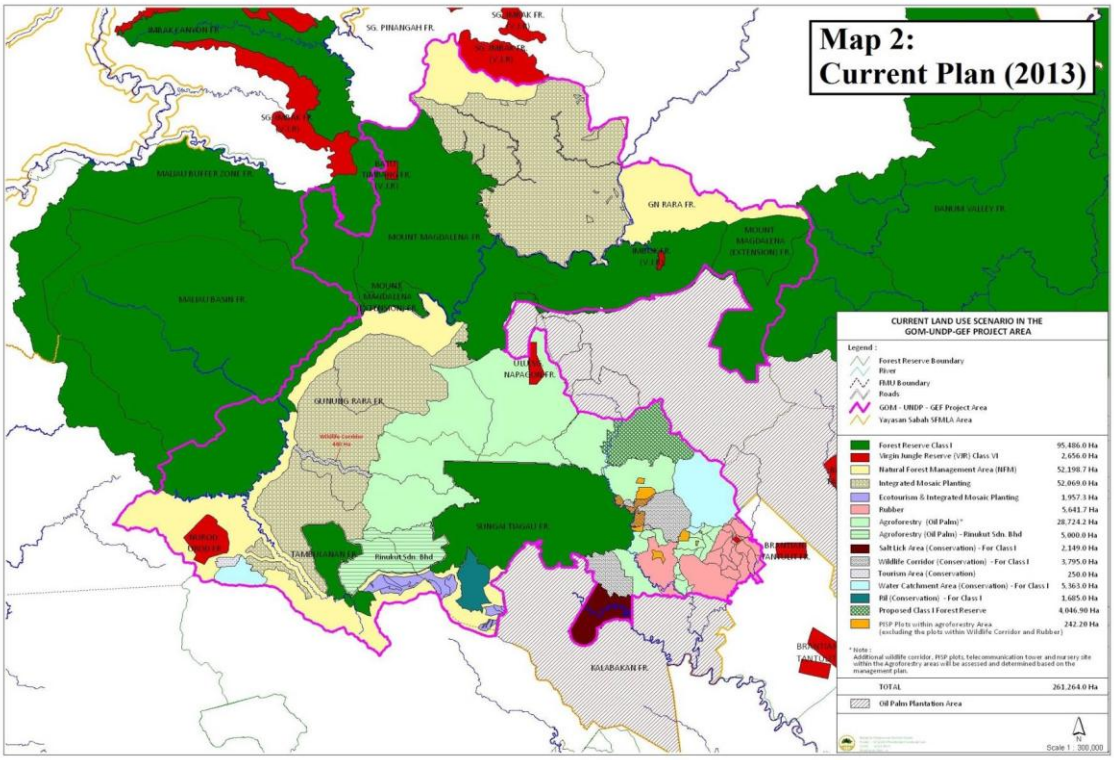

Figure 3: Land-use in the project area, based on the Current Plan 2013.

3.3 These changes, especially the inclusion of oil palm and "integrated mosaic"[8] plantations, neither of which land-use had been mentioned in the original Project Document were being driven through a complex mix of socio-economic and government policy – direct drivers of changes in biodiversity and ecosystem services. At the same time, the long waiting period from project proposal (2009) to project approval (2012), reduced enthusiasm for the project concept. The long gestation period does not reflect practical realities in decision-making.

3.4 However, these land-use changes were heavily debated among the project participants during the Inception Workshop and the Strategic Results Framework Workshop, which were held in July 2013 and October 2013 respectively. The participants, including UNDP have raised serious concerns regarding the feasibility of achieving the Project's stated targets and the continued viability of the project itself.

3.5 The following are the concerns amongst others raised by the project participants and UNDP:

- There is a considerable argument that biodiversity is not conserved in the current land-use scenario and, therefore, the participants asked what the project is trying to achieve.
- The participants also raised the question on what would be the potential impacts and implications of the current land-use plan to the environment and biodiversity in the project area due to the changes of the land-use.
- In the current land-use scenario, the participants believed that there will be definitely significant major losses of biodiversity and natural habitat (or habitat change) and carbon; and increased soil erosion. Therefore, they were very concerned that the NNL target may not be attainable in the project landscape.
- The participants also enquired on the prospects of reducing the rate of biodiversity loss and mitigations measures required and whether offset or off-site compensation is necessary or adequate for achieving NNL of biodiversity in the project area.

3.5 To tackle these concerns/questions, a TWG comprising of experts from the SFD, Wildlife Department, NGOs and other professionals was formed specifically to undertake rapid assessment to the proposed changes of land-uses within the project area, possible impacts of these changes and how these might be mitigated to ensure that the project is viable. A site visit was undertaken by the TWG over a 3-day period in March 2014, during which period, the group had access to a helicopter.

4.0 LAND-USE CHANGES, IMPLICATIONS AND FUTURE OF BIODIVERSITY IN THE PROJECT LANDSCAPE

Landscape-level studies could give us a better understanding of the impacts of biofuel crop cultivation on biodiversity and ecosystem function because we'd understand the broader impacts beyond simple habitat comparisons.

Sini Savilaakso – CIFOR, 2014

4.1 During the rapid assessment exercise carried out by the TWG, the members came up with the following assumptions and principles[9]:

[8] The basic idea behind this "integrated mosaic planting" is to establish fast-growing and high-yielding tree plantations using a mix of three or four fast growing pioneer tree species while maintaining small patches of natural forest within the planted areas. The target proportion of planted forest to natural forest is roughly 60% and 40% respectively. The scattered patches of natural forest integrate with man-made forest to form a forest mosaic that likely supports a greater level of structural, functional and biological diversity than a monoculture.

[9] Adopted from the TWG Report, 2014. Rapid assessment of the GEF-UNDP-SFD Multiple-use Forest Landscapes in Sabah project.

- They have assigned confidence levels to their assessment of impact (and/or outcome). These indicate the confidence they have in the strength and robustness of the evidence on which assessments have been based:
  - **High confidence**: The evidence is robust and there is very little doubt about the potential impact(s).
  - **Reasonable confidence**: The evidence for their assumptions is generally robust but there is likely to be some uncertainty in terms of the magnitude of the impact(s).
  - **Low confidence**: Evidence is lacking and/or the level or direction of impact may be distinct or vary considerably.

- The TWG only assessed the consequent changes in biodiversity potential; and particularly as to whether the NNL target can be attained within the project area, is heavily dependent on fine-scale changes in the condition of biodiversity

- As a framework for quantifying biodiversity potential and consequences of the land-use changes proposed and to estimate possible mitigation, they have stratified baseline and projected land-use cover into six (6) categories with a coefficient assigned to each. Essentially, these equate to biodiversity proxies with coefficient based on either the inherent or potential biodiversity values of these forests and plantations and/or their role in supporting ecosystem functionality:

  1.0 - *Continuous pristine forests, high closed-canopy forest, and/or*
  - Forest providing crucial environmental connectivity, functions or services[10].

  0.8 - *Continuous logged-over but recovering forest with elements of high canopy, and/or*
  - Forest providing important environmental connectivity, functions or services[11].

  0.6 - *Continuous degraded and repeated logged or burned forest dominated by pioneers with high frequency of open areas.*

  0.4 - *Highly degraded open scrub with minimal tree cover, and/or*
  - *Isolated forest fragments of less than 100 ha, and/or*
  - Long-rotation industrial tree plantations (i.e., rubber)

  0.2 - *Oil palm plantations*[12]
  - Mosaic and short rotation timber plantations.

  0.1 - *Open grassland*[13].

[10] To include any totally protected areas (Class I Forest Reserves and Virgin Jungle Reserves), watershed areas and/or natural forests buffering protected areas.

[11] Generally to include once or twice logged forest retained under NFM regime (including areas of natural forest embedded within mosaic and oilpalm plantations designed as HCV).

[12] Taking a precautionary approach, given the near complete paucity of data relating to the biodiversity and other environmental impacts of mosaic plantations, the TWG has assumed that these will be broadly equivalent to the impacts associated with development of oil palm plantations

[13] The TWG attached nominal value to open grassland given its importance as a habitat/food source for large grazing mammals.

For example, the conversion of forests classified as coefficient 0.8 to oilpalm plantations (coefficient 0.2) would generate a multiplier of -0.6. The results of calculations are shown in Table 2, Table 3 and Table 4 respectively.

- Based on the principle of averted loss of biodiversity, the TWG has assigned nominal multiplier values to forest protection (0.2), forest restoration (0.15) and NFM (0.1) on the basis that under a "without project" or business-as-usual scenario, they have reasonable degree of confidence that a significant fraction of the project landscape would have been cleared for plantation development.

- They have assumed that the net areas allocated for plantation development (mosaic, oilpalm and industrial tree plantation) are broadly set – but that their recommendations will be taken into account with respect to the gross area of plantations and their placement (zoning), with particular regard to retaining well-structured high-canopy forest, maintaining connectivity and buffering capacity.

- In their assessment of forest loss as a result of the development of either mosaic or oilpalm plantations, they have assumed a conversion rate of 70% of the gross area (leaving 30% as fragmented forests). This assumption, based on conversion rates in newly developed plantations adjacent to the project site, must be re-assessed and verified as detailed plantation and HCV plans are developed during project implementation.

- When considering means by which biodiversity losses and other environmental impacts can be avoided, reduced or manipulated, they have adopted a hierarchical approach. In ascending order of net positive impact, these actions are:

Avoided deforestation
⇩
Maintained or restored connectivity
⇩
Avoided re-logging
⇩
Forest restoration
⇩
Off-site compensation

4.2 Summary key findings[14] of current condition for:

i. Areas allocated for oilpalm plantations and also earlier set aside for Acacia mangium concession

Generally, the areas are highly degraded/open with high-canopy forest mostly restricted to pockets on stepper slopes. For the purposes of assessing the impacts of conversion, the TWG estimated that the site would be classified as coefficient 0.6 (consisting of broadly equivalent areas of coefficients 0.8, 0.6 and 0.4).

ii. Areas allocated for mosaic plantations

The lower-lying areas of southern block are mostly heavily logged, while the northern areas are cleared with remnant patches of mostly pioneer dominated forest on steeper slopes with occasional inclusions of high-canopy forest. The TWG estimated these areas as coefficient 0.6.

[14] The findings from the TWG were treated as both provisional and indicative. Validation through more robust, evidence-based analyses will be essential in order to determine the nature and extent of the project impacts on biodiversity.

iii. Areas allocated for conservation/protection

Previously logged areas in a generally degraded condition but with closed canopy forest retained on steeper slopes. Existing VJRs, water catchment areas and Reduced Impact Logging areas (previously unlogged or only lightly disturbed) mostly retain significant areas of high, closed canopy forest.

4.3 Table 2, Table 3 and Table 4 summarize the scenario of the land-use cover and change under each of the project plans. For both Tables, the TWG gave nominal weighting to retaining natural forest cover on the assumption that a fraction of the landscape would have been converted to plantations had the project not existed. These provide an initial, desk-based assessment and comparison of the *possible* scale of biodiversity impacts due to project activities and hence, the likely mitigation liabilities these would generate (expressed in "habitat hectares"); and that would need to be offset to meet the NNL target. The coefficients are based on variance from the stratification of land-uses/management practices (and averted biodiversity loss) as outlined in Section 4.1, with calculations based on the TWG's assessment of forest quality made during the site visit as stated above.

Table 2: Original plan scenario.

Original Land-Use Scenario	Total Area (Ha)	Coefficient	Gain/Loss(Ha)
Protection/Conservation	18,517	0.2	3,703
NFM	180,426	0.1	18,043
Fragmented Forest	13,146	-0.4	-5,258
ITP (Rubber/*Acacia mangium)*	30,675	-0.5	-15,338
Forest Restoration	18,500 ha	0.15	2,775
Net Biodiversity Impact (Habitat Hectares)			**+3,925**

4.4 Based on the above Table, there is a reasonable confidence that original project land-use scenario – with a focus on NFM and recognizing averted biodiversity loss would have resulted in a **modest net** biodiversity gain.

Table 3: Current land-use scenario.

Current Land-Use Scenario	Total Area (Ha)	Coefficient	Gain/Loss(Ha)
Protection/Conservation	115,431	0.2	23,086
NFM	52,199	0.1	5,220
Fragmented Forest	39,065	-0.4	-15,626
ITP (Rubber/*Acacia mangium)*	3,949	-0.4	-1,580
Integrated Mosaic Planting	27,013	-0.6	-16,208
Oilpalm Plantations	23,607	-0.6	-14,164
Net Biodiversity Impact (Habitat Hectares)			**-19,272**

4.5 The extent of fragmented forest within the project landscape treble from ≈ 13,000 ha to close to 40,000 ha (as compared to the Original Plan) – see Table 3. Therefore, there is a high confidence that this level of fragmentation would result in severe environmental impacts with continued loss of species from these remnant patches as a direct consequence of habitat loss and gradual degradation of forest quality.

4.6 There is also a concern with respect to the loss and fragmentation of a significant stretch of the south-eastern buffer zone of the Maliau Basin Conservation Area (Maliau Basin FR). Therefore, there is also a high confidence that this would lead to the loss of high quality, closed canopy forest, drive major losses of biodiversity, compromise the functionality of the buffer

and hence, the integrity of the conservation area itself – and pose significant reputation risks to project partners.

4.7 There is a high confidence that the current land-use scenario would result in major additional losses of carbon, greatly increased soil erosion and severely curtailed ecosystem resilience as compared to land-use outlined in the Original Plan.

4.8 With the expanded road networks and number of staff resident within the project landscape as a consequence of the increased extent of plantation development, there is a high confidence that this would present clear risk of major biodiversity losses and ecosystem impacts as a result of hunting – with particular threat posed to large mammals and bird species. Given the placement of plantations, there is a high confidence that these threats would be very likely extend to protected areas within and adjacent to the project landscape especially the Maliau Basin FR and INIKEA Project Area.

4.9 There would be severe aesthetic impacts with associated reputational risks if areas adjacent to the Maliau Basin gate and visitor centre were developed as integrated mosaic planting.

4.10 The risks presented by the current land-use scenario, both reputational and environmental, could also negatively impact the pending serial application for World Heritage Site listing for Maliau Basin, Danum Valley and Imbak Canyon.

4.11 Based on the results of the TWG findings as highlighted above, there is a high confidence that the current land-use scenario would result in major biodiversity losses that would render no net loss target of the project unattainable; and that biodiversity impacts could only be mitigated through major off-site compensation[15].

4.12 In this respect, the TWG in their report recommended to modify the current land-use scenario as depicted in Table 4 below and shown in Figure 4.

Table 4: Summary of TWG modified land-use scenario.

Modified Land-Use Scenario	Total Area (Ha)	Coefficient	Gain/Loss(Ha)
Protection/Conservation	154,553	0.2	30,911
NFM (incl. RIL Area)	25,185	0.1	2,519
Fragmented Forest	31,720	-0.4	-12,688
Agroforestry	6,956	-0.5	-3,478
Integrated Mosaic Planting	17,735	-0.6	-10,641
Oilpalm Plantations	25,115	-0.6	-15,069
PSIP Plots	242	0	0
Net Biodiversity Impact (Habitat Hectares)			**-8,447**

4.13 While the net plantation area would remain largely unchanged under the TWG proposal, they estimated that this would result in a reduction of > 50% in biodiversity impacts as compared to the Current Plan (Table 3). The modified land-use scenario as recommended by the TWG would increase by over 40% the extent of protected forests within the project landscape and reduce habitat fragmentation mainly by reducing the gross area of mosaic plantations by ≈ 30%. Therefore, they have reasonable confidence that residual biodiversity impacts could be offset[16] through combined approach across the mitigation hierarchy[17].

[15] Off-site compensation may not achieve no net loss, for a variety of reasons. One typical reason is that the compensation is not designed to achieve no net loss.

[16] Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures

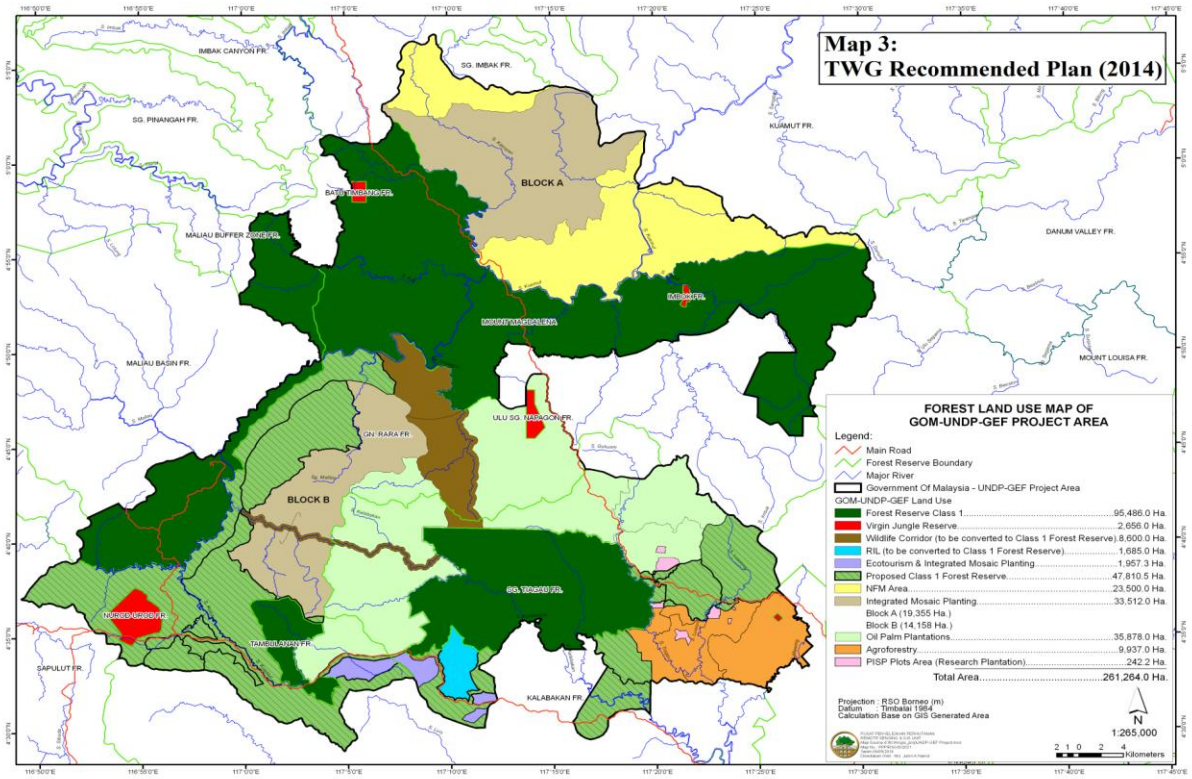

Figure 4: Land-use in the project area based on the TWG Plan 2014.

5.0 RECOMMENDATIONS TO REDUCE IMPACTS ON BIODIVERSITY

When decision makers are faced with a choice between short-term development initiatives versus longer-term sustainable livelihoods or conservation of priority biodiversity areas, we need to have persuasive arguments underpinned by verifiable data.

Michelle Pfaffenthaler, Environmental Specialist, Namibia.

5.1 While waiting for a thorough and more robust, evidence-based analyses, which will be carried out in the project area in order to determine the nature and extent of the project impacts on biodiversity, the TWG had recommended the following actions to be implemented by the SFD immediately:

- To carry out collation and analysis of data in order to verify and refine estimates for achieving NNL for the TWG's land-use recommendations (see Table 4);

- To revise plans for the southern block of mosaic plantation to reduce its gross area to <15,000 ha and retain a substantial (mostly > 5km wide), fully protected natural forest buffer (with Protection Forest Reserve - Class I status) to the Maliau Basin Forest Reserve;

have been taken. - BBOP, 2013. *To No Net Loss and Beyond: An Overview of the Business and Biodiversity Offsets Programme (BBOP*), Washington, D.C.

[17] A set of prioritised steps to alleviate environmental harm as far as possible through avoidance, minimisation, restoration and offsetting of detrimental impacts to biodiversity. In the case of the GoM-UNDP-GEF Project, this is likely to focus on restoration of the fully protected forests and areas of key importance for maintaining landscape connectivity. Offsite compensation will be via the conservation of forests neighboring the project landscape.

- To establish a > 7,000 ha corridor between the INIKEA area and Mt. Magdalena FR to maintain north-south connectivity of natural forests within the project landscape;

- To retain approximately 23,000 ha north of the Kuamut River (areas already allocated to Empayar Kejora Sdn Bhd) under a regime of NFM; and to be managed by the SFD in accordance with the FSC Principles;

- To retain under NFM, areas currently allocated to mosaic plantations in the south-west of the project area along the Kuamut River; and

- To suspend further plantation development (oil palm and mosaic) pending the submission of detailed conservation plans and mitigation strategies, incorporating High Conservation Values and High Carbon Stock assessments.

5.2 Apparently, the TWG in their report recognized that it may not be possible to achieve NNL within the project area during the lifetime of the project or even beyond and, therefore, recommends that NNL be achieved through off-site compensation via the conservation of forests neighboring the project area.

6.0 THE CHALLENGES OF ACHIEVING NO NET LOSS AND BEYOND

Despite an increase in conservation efforts, the state of biodiversity continues to decline, according to most indicators, largely because the pressures on biodiversity continue to increase. There is no indication of a significant reduction in the rate of decline in biodiversity, nor of a significant reduction in pressures upon it.

Secretariat of the Convention on Biological Diversity (2010), Global Biodiversity Outlook 3, May, 2010, p.17

6.1 Achieving a 'no net loss' of biodiversity or reducing biodiversity loss will be a substantial and complex challenge in the project area. These challenges, amongst others are as follows:

- Pressures on oil palm and mosaic plantations land-use

  There is a complex and significant pressure on oil palm and mosaic plantations land-use. As stated earlier, the nature of land development in plantations and the level of fragmentation would lead to the loss of high quality, closed canopy forest and drive major losses of biodiversity. The magnitude of the challenge of slowing the rate of biodiversity loss is demonstrated by the fact that the direct drivers[18] of biodiversity loss are projected to either remain constant or to increase in the near future.

- Commitments to action

  It will be a great challenge for the SFD to address and implement either sufficiently or effectively in respect to the project area as per recommendations in Section 5.1. It will be a challenge for the SFD to commit resources (manpower and financial), forging new partnerships, and measuring the progress and impact of such initiatives.

- Developing NNL and biodiversity offsetting policy

[18] In the case of the project, the direct drivers are socio-economic and political factors.

The achievement of the NNL objective under the multiple-use forest landscape will require the development of a policy framework in the state. The state also needs to develop requisite new policy measures for biodiversity off-setting. This policy requirement has been recognized; and was included in *Output 1* under Component 1 in the Project Document (see Section 2.6). However, developing NNL and off-setting policies involves a long process before they can be approved by the state government. In the process, there will be many hurdles and challenges. Amongst them include the information on the subjects such as large amounts and credible data that have to be gathered and analysed; the demands from society including forms of participation in the process focusing on support; the challenging questions including: What counts as an offset? How much does it count? Where the offset should be located? When does it need to be operational and for how long? How should risks be managed and what if the offset fails?; the difficulty in valuing or pricing of biodiversity that would have to be undertaken, etc. – all these demands a high level of expertise – and would involve considerable expenditure.

- Implementation challenges

  Developing a policy is not enough. Implementing the policy (e.g. actions to restore the fully protected forests in the project landscape and areas of key importance for maintaining landscape connectivity) is also important. Again, this is a challenge because the availability of resources will always be limited. Actions to promote biodiversity received a tiny fraction of funding from the state government. Therefore, there will inevitably be an impact on the duration and timing of tasks. It may also affect the project's predicted costs. In addition, once the project is implemented, it has to be properly and independently monitored. This has to be carried out over the whole lifetime of the project and beyond, which could stretch over a number of years. Given the fact that expertise and the necessary manpower is likely to be lacking in many areas - such monitoring is likely to be less than comprehensive.

- Financial sustainability

  The project is designed to catalyze sustainable financing by capturing new sources of revenues in REDD+, biodiversity offset/NNL and PES – a crucial challenge. This is related to *Outcome 3* of the project, that is, the project needs to ensure that revenue can be generated while achieving NNL. Besides, there is a question of which revenue is to be derived because this was not well-defined as yet. In addition, the SFD would have to come up with some of the basic underlying details – i.e., what do/should the mechanisms look like; what is the status quo; what are the gaps; how would these mechanisms relate to each other, etc. – to be addressed and better clarified so that there is a foundation from which, to assess the potential for different revenue sources.

- Re-investment of portion of the revenues

  It was recommended by the TWG that the SFD would have to develop a transparent, auditable mechanism for the re-investment of a sufficient portion of the revenues generated within the project landscape over an agreed time period to support conservation, mitigation and restoration activities adequate to satisfy both the Sabah Government's co-financing commitments and the project's agreed NNL target.

7.0 CONCLUSION

7.1 The GoM-UNDP-GEF land-uses had diverged from what had been in the original plan due to changes in land-use of which, biodiversity and other environmental impacts will undoubtedly be greater than originally envisaged. However, both the SFD and UNDP have reasonable

confidence that the project can be re-aligned as per recommendations from the TWG, in accordance with its original targets and objective, subject to no further detrimental changes to land-use; the recommendations are effectively implemented; that there is a long-term commitment to best practice by following the mitigation hierarchy including quantifying and offsetting residual impacts in order to achieve no net loss of biodiversity in the project landscape.

7.2 The GoM-UNDP-GEF Project presents novel challenges but has the potential to serve as a model to catalyze innovation in processes and increase management know-how in achieving an optimal balance across potentially competing uses and providing a highly case study that reflects many of the major production, mitigation and conservation challenges facing policy makers and land management agencies across South East Asia.

7.3 It is also worth noting that the time lag between project submission and project approval must be reasonable lest it dampens the enthusiasm to move forward.

7.4 After all, time and tide wait for no man and decisions, rightly or wrongly, must be made.

WORKSHOP SESSION II

FOREST GOVERNANCE: POLICY, LEGISLATION AND ENFORCEMENT

PAPER 2: 1

FOREST LAW ENFORCEMENT AND MITIGATION OF FOREST OFFENCES IN SABAH: LESSONS LEARNT

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ABSTRACT

Law enforcement as a means to mitigate against forest offences is one of the tasks that poses a big challenge in realizing Sustainable Forest Management [SFM] implementation in Sabah. Various approaches have been initiated and im0.plemented by the state to deal with the problem. This paper presents an overview of the trends of forest offences in the state from 2001 to 2013, and also discusses the experiences and strategies introduced and implemented by the state government to address them. Forest offences are categorized based on the type of offences stipulated in various sections of the Forest Enactment 1968 and Forest Rules 1969. There were 3,054 cases with an average of 235 cases per year during the period and the number of cases per year generally decreased. Offences under 'other categories' (breach of logging license conditions etc.) was recorded to be the highest fraction that occurred (36% of the total cases) with the increase of an average of 3 cases per year. This is followed by illegal possession of timber (18%) with a decline on average of 5 cases per year. Entering forest reserves without permission was recorded at 16% with the average having declined at 7 cases per year. The trend of illegal logging in forest reserves and state lands was recorded at 12% respectively with an average decline of 17 cases per year on illegal logging in forest reserves and 11 cases per year on illegal logging in state land areas. The occurrence of illegal cultivation in forest reserves was recorded at 3.6% with an average decline of 9 cases per year and the evasion of royalty was recorded to be the lowest with 1.6% and the average decline of 4 cases per year. During the period 2001-2013, a total of 1,758 people were arrested with a total of 1,054 (60%) of them convicted with various offences committed, by the Magistrate's Court. The 'Strengths, Weaknesses, Opportunities and Threats' analysis [SWOT] that was carried out to analyse the experiences and strategies introduced and implemented by the state government had identified the 'weaknesses' such as: those associated with the size of the area under the control at the district level, and problems related to staffing and human factor of personnel that are involved with the enforcement activities. The overall 'strengths' were related to the implementation of Sustainable Forest Management [SFM] policies that is supported by strong emphasis of the Sabah Forestry Department [SFD] on the enforcement, i.e. the Division of Enforcement Investigation and Prosecution; Monitoring, Controlling, Enforcement and Evaluation [MCEE] and District Forestry Officer [DFO], which are directly under the purview of the Director of Sabah Forestry Department. The strengths are also closely related to the continuous amendments of forest laws and other supportive documents for SFM implementation, and as well as the ability of the trained SFD personnel to execute and conduct the investigation, prosecution and monitoring tasks. The 'Opportunities' were related to the development of information and communication technology facilities, support and collaboration with stakeholders including the Forest Management Unit [FMU] holders and parties from local and international communities. The challenges were related to the availability of resources, the demand and supply of logs that also affected the market price of timber. Other challenges were connected with collaboration, cooperation and partnerships with other stakeholders including communities.

1.0 Background

Forest and Forestry Development in Sabah

The paradigm of forest development in Sabah can be traced through the era of exploration, towards minimal exploitation; revenue oriented industrial-scale timber exploitation, followed by the development stage of resources oriented sustainable forest management (Pereira, 1981; Kugan & Kollert, 1996; Lintangah, 2014). A minimum extraction of forest resources by the local communities occurred during the early phase, mostly for livelihood purposes. This was followed by extraction of timber with traditional logging techniques during the era of the British North Borneo Chartered Company from 1881 until 1946. The Forest Ordinance was introduced to regulate the revenue collection of forest produce during this period (Pereira, 1981). From 1946 to 1963, when Sabah was ruled directly under the British Crown, the Sustained Yield forest management system was introduced to control timber harvesting. Forest reservation was intensified, and the practice of mechanized timber harvesting was started with the introduction of tractors in 1951 and chainsaws in the 1960s (SFD, 2007). Many new concession areas were granted to logging companies, which marked the beginning of extensive timber extraction, with timber also beginning to be processed locally by local manufacturers (Pereira, 1981; Ross, 2001). After independence in 1963, timber harvesting became the main source of state income, playing a crucial role in the initial development of the state. In the 1970s and 1980s, forestry as the mainstay of the state's economy contributed to about 60-70% of the state total income (Ross, 2001). Since then, the forest resources in Sabah have been severely depleted through uncontrolled timber exploitation and through large-scale conversion of forest areas to other uses, especially oil-palm plantations (Jilimin *et al*., 2011). Sabah's Forest Policy was restructured in 1997 to address the problems by introducing the SFM policy and licencing system that focused on a total forest management approach (ibid).

Forest Offences

Forest offence is a complex phenomenon with many definitions given. Tacconi (2007), gives the description of illegal forest activities as follows;

> "[They] include the acts related to the establishment of rights to land, corrupt activities to acquire forest concessions, unlawful activities at all stages of forest management and the forest good production chain, from the planning stage, to harvesting and transport of raw materials and finished products, to financial management".

The offences are associated with the act against forest legislation or violation of forest management regulations, contractual agreements, industry and trade regulations; and transport, financial, accounting and tax regulations (ibid). These offences are being manifested under various activities that include illegal logging, illegal forest trade, illegal timber processing and illegal financial activities. Among the negative implications of forest crimes are causing deforestation and global warming, which will lead to loss of biodiversity; and also weakening forest management, encourages corruption and tax evasion, and the incomes of the producer countries are reduced (Jilimin *et al*., 2011). Forest crime could take place due to three main factors namely: resources availability, human factors, and driving forces (Lintangah *et al*., 2008). Taconni (2007) suggested the causes of illegal forest activities that include institutional problems, lack of government capacity, corruption, the roles of business, the role of timber trade, and economic incentives and disincentives of forest management.

Forest offences have been recorded since the forest administration systems were introduced to regulate the forest and forest resources in the state. The Forest Enactment (1968) and Forest Rules 1969 legislated by the State Assembly are the main regulatory instruments for the conservation, management and administration of the various forest reserves (SFD, 2009). The enactment stipulates forest offences in various sections of the law, points out the acts of deviance toward the administration

and sound management of the forest. SFD (1993) classified the forest offences under various categories namely illegal logging, timber smuggling, transfer of log pricing, undervaluing and under grading of timber, mis-declaration of shipment details and misclassification of timber species. Lintangah (1997) categorized forest offenses stipulated in the Forest Enactment 1968 based on the severity of penalties. These include illegal felling; evasion of royalty, general offences, illegal removal of timber (timber smuggling), and illegal vehicles used in timber extraction, endangering forest by fire, encroachment in forest reserve / state land and other miscellaneous cases. Currently, SFD is monitoring and organising the record and reporting of forest offences based on the main categorization of forest offences under Section 20 (illegal felling in forest reserve), Section 23 (Illegal felling in state land), Section 30(1)(g) (Illegal possession of forest product, Section 30(A)(b)(evasion of royalty), Section 20(1)(c)(i) (illegal entry of forest reserve; Section 20(1)(b)(iii)(illegal cultivation in forest reserves; and Other categories of forest offences (Breach of logging licence conditions, etc.).

2.0 Objectives

This paper was initiated to achieve the following objectives. 1) To explore and highlight the trend of forest offences in Sabah, and 2) To identify strengths, weaknesses, opportunities and threats related to the efforts to curb forest offences in the state.

3.0 Method

This study was conducted based on the primary and secondary data that were kept by the Sabah Forestry Department. The information included records on the number of cases that occurred during the 13-year period from 2001 to 2013. These also comprised of the number of occurrences based on the type of forest offences, the number of seized machinery and timber; and the number of people who were arrested and charged, sentenced and fined by the Magistrate. The figures of fines and penalty were also examined to see the patterns and their relationships with the occurrences of forest offences. Literature reviews and analysis were conducted to classify the experience to curb forest offences based on strengths, weaknesses, opportunities and threats (SWOT).

4.0 Results

4.1 Trend of Forest Offences

4.1.1 Number of reported cases (2001 - 2013)

There was a total of 3054 cases of forest offences recorded from 2001 until 2013, with a decreasing trend on the overall pattern of occurrence. The highest number of cases was recorded in 2002 (372 cases), followed by 2005 (331 cases) and 2003 (299 cases), while the lowest occurrence was recorded in 2013 (95 cases) (Figure 1). In terms of the number of cases by categories of offences, 36% of the total cases were offence**s** under the 'other categories' including the breach of license conditions. This category increased in the number of incidents with an average of 3 cases per year. The offences under Section 30(1)(g) of the Forest Enactment, 1968 marked 18% out of the total number of cases with a declining trend of occurrences with an average of 5 cases per year. The offences of 'entering forest reserve without permission' under Section 20(1) (c)(i) make up 16% of the total number of cases with an average reduction of 7 cases per year. Section 20 on 'illegal logging in forest reserves' and Section 23 on 'illegal logging in state land area' respectively recorded 12% with a reduction of an average of 17 cases per year for 'illegal logging in the forest reserves' and the average decrease of 11 cases per year for 'illegal logging in state land areas'. The 'Illegal cultivation inside forest reserves' of Section 20(1)(b)(3) recorded 4% of the total cases with an increasing trend of average 9 cases per year. The offences of 'Evasion of royalty' under the Section 30(A)(b) recorded 2% of the total cases with an average decline of 4 cases per year (Figure 2).

4.1.2 Value of Goods Auctioned Off (2001 - 2012)

During the period from 2001 to 2013, a total of 228,194.05 m3 of logs were confiscated with an estimated value of RM 22,239,712.62 or an average of RM 97.46 / m3 (Figure 3). The total amount of fines collected during the period was RM 26,497,859.90 or with an average of RM 2,038,296.92 per annum. The estimated average value of 'fines and penalties' based on the volume of confiscated logs is RM 116.12 / m3. The calculated ratio of the 'value of logs ' to the total 'fines and penalties' is 1: 1.16. The lowest ratio, however, was recorded at 1: -0.50 in 2008 while the highest ratio of 1: 10.35 was recorded in 2013. During the same period, a total of 2,290 seizures of logging equipment were documented. A high number of seizures were recorded in 2008 (263), 2005 (284) and in 2009 (244). The value of the seized machinery was at RM 1,861,403.55. A total of 935 or 41% out of the total seized goods were auctioned or forfeited (Figure 4).

4.1.3 People arrested and convicted in court

The cases of forest offences that occurred between 2001 and 2013 involved the arrest of 1,758 people. A total of 1,203 (68.43%) out of the persons arrested have been brought to court, with 1054 persons (87.61%) convicted and sentenced by the court (Figure 5).

4.1.4 Number of cases by area

Most of the forest offences recorded during 2001 to 2013 occurred in the Tawau region (46%), followed by Keningau (20%), Sandakan (16%), Kota Kinabalu (10%) and Kudat (8%). The forest district areas that recorded a high occurrence of forest offences were Lahad Datu (13%), Semporna (10%), Kunak (9%), Keningau and Tawau (each 8%) and Sandakan 6% (Figure 6). The other forestry districts recorded less than 5% of the total number of cases that occurred.

4.2 SWOT Analysis on Forest Law Enforcement and Mitigation of Forest Offences in Sabah

The results of SWOT analysis that was based on literature and discussions on the experience encountered by SFD to curb forest offences in the state are depicted in the table below.

Table 1: SWOT Analysis on Experience to Mitigating Forest Offences in Sabah.

Strengths	Weaknesses

• Up to date law: Forest Enactment 1968 amendment - Dynamic to current requirement
  • Presumption of Proof Sec. 38
  • Enhanced fines
  • Strict Liability
• Continuous Training on Enforcement and persecution
• Team work in law enforcement is excellent - internal and external
• Sufficient infrastructure & logistic
• Sound and efficient management and administration system (IP, MS ISO, Forest Stewardship Certificate, etc..)
• Aerial surveillance by all District Forestry Officer.
• Ground patrolling during the weekend and public holidays by all field staff.
	• Area of Forest vs Man Power
	• Human factors (staff)
	  • Pattern of ages-shifting among staff - succession plan
	  • Discipline
	  • Limited Capabilities
	  • Lack of confidence in raiding operations.
	• Legal constrains – Suspect (Towkey) not recognized by witnesses (workers). Workers – Mistaken Believe of Fact.
	• Incentive – wages far below cost of living. Section 41A of the Forest Enactment is yet to be enforced.
	• Limited access to online Legal Network. Eg: CLJ, LexisNexis, etc…

Continued…SWOT Analysis on Experience to Mitigating Forest Offences in Sabah

Opportunities	Threats
• SFM Policies – SFMLA Holders • Sound and efficient management and administration system (Investigation Paper (IP), MS ISO, Forest Stewardship Certificate, etc.) • International Support • Political will & Political stability • Technology and communications • Team work in law enforcement is excellent - internal and external • Good coordination among State agencies (Secretary of Natural Resources – SFD – Lands & Surveys – etc.) • Independent Audit (GFS).	• Log Price • Supply and Demand of Logs • Human threat • Political instability • Politician interference • NCR (Native Customary Right) claims in Forest Reserves • Negative attitude of some members of the public – deliberately refuse to accept the knowledge of the importance of forests to livelihoods.

5.0 Discussion and Conclusions

Forest Offences still pose a problem in the management of forests in the state. The general trend of the forest cases recorded, however, was declining. Lintangah *et al.*, (2008) suggested that the higher number of forest offences occurrence after year 2001was a result of serious efforts and strategies adopted by the Sabah Forestry Department to address the matter, in terms of upgrading of legislation, organization, and enhancement of the enforcement and investigation personnel. Furthermore, the data recording on cases of forest offences has immensely improved with the centralization under the Investigation, Enforcement and Prosecution Division that was established in 2001. The offences under 'other categories' that included the breach of licence conditions continued to be the main challenge encountered by the Forestry Department. The number of cases under this category increased from 2001 to 2013. It became the foremost offence recorded as compared to other categories under Section 30(1)(g), Section 20(1)(c)(i), Section 20, Section 23, Section 20(1)(b)(3) and Section 30(A)(b). The amount of fines and penalties collected from the cases that occurred is relatively lower as compared with the value of confiscated logs with the average ratio of 1:1:16. There was a total of 1758 people arrested during the period with 1203 (68.43%) prosecuted in court. The conviction rate is very high with an average of 87.61% (1054 persons) prosecuted successfully or fined. Most of the cases recorded during the period occurred in Tawau region (46%) followed by Keningau (20%), Sandakan (16%), Kota Kinabalu (10%) and Kudat (8%). The forestry districts with high occurrence of cases during the period were Lahad Datu (13%), Semporna (10%), Kunak (9%), Keningau and Tawau (each 8%) and Sandakan (6%).

The strength of the SFD in curbing forest crimes is very much impacted by the SFM policy that was introduced to manage the state's forests with the cooperation and involvement by the SFMLA holders. It is also associated with the prescribed forest laws under the Forest Enactment 1968, which is reviewed regularly and amended accordingly with respect to requirements. The quality of the personnel involved in the operations is of great advantage, and is made possible through a continuous training programme on enforcement and prosecution activities. During the period of 2001-2010, the Sabah Forestry Department made enormous improvements on addressing forest crimes. SFD has organized numerous investigation and prosecution courses involving staff ranking from Forest Rangers to Forestry Officers, and also introduced the recruitment of Honorary Forest Rangers to address forest crimes in the state (Jilimin *et al.*, 2011). The high conviction rate of people arrested and brought to court indicates an enhancement in terms of investigation and prosecution ability among the workforce involved in the process (Lintangah *et al.*, 2008). The optimum level of team spirit to enforce forest law has facilitated good coordination among staff and other State agencies (i.e. Secretary of Natural Resources, Sabah Forestry Department, Lands and Surveys Department, District Office, Police, etc.). Another strength that supported the enforcement programs and activities are related to the sufficiency of infrastructure and logistics provided by the state and federal governments. These comprised the periodic aerial surveillance carried out by all District Forestry Officer and persistent ground patrolling by field staff, including weekends and public holidays. The latest development initiated by the Sabah Forestry Department was to equip chosen Forestry Officers with firearms for self-protection and prevention against perpetrators (Jilimin *et al.*, 2011).

The sound management and administration system introduced in the department (i.e. IP (Investigation Paper), MS ISO, Forest Stewardship Certificate, etc.), also contributed to the efficiency of enforcement and prosecution to curb forest offences in the state.

The significant area of forests with the limited number of manpower to look after the forest area is perceived to be weaknesses faced by the SFD in eradicating forest crimes. Human factor is another area of challenge encountered by the department. These include matters related to the pattern of age, transfer of staff, and the future succession plan of experienced and well-trained staff. The lack of discipline and confidence in raiding operations and limited capabilities among some field staff is another human factor that is susceptible to failure during the enforcement or prosecution work. The wages of the staff engaged in the enforcement and prosecution work could be considerably below the cost of living and this will not encourage performance. The incentives introduced under Section 41A of the Forest Enactment has yet to be enforced by the Forestry Department, which could motivate the workers engaged in the tasks. Some experiences on the legal aspect that have been identified as a hindrance to effective enforcement and prosecution is the identification of the primary suspect ('towkey'). There were cases where the prime suspects were not recognized by witnesses (workers), which disposed of the phenomenon of 'Mistaken Believe of Fact' of the workers involved in forest crimes. There is limited access to online Legal Network (e.g.: CLJ, LexisNexis, etc.) among personnel involved as prosecutors of the department, which may also impede the acquirement of relevant case laws.

There are many areas of opportunities to keep up or to enhance the current initiatives to curb forest crimes in the state. These include cooperation and initiatives involving communities at the international and local levels. These stakeholders provide support towards the efficient implementation of Sustainable Forest Management by contributing assistance in terms of ideas, finance and technical expertise. The compulsion of independent auditing on the ground forest operations for instances, has enormously been encouraging towards the progress of the SFM implementation. Political will and political stability are the most important preconditions for the realization of SFM that embraces the support from politicians and leaders of the state. This is entrenched in Sabah. The enhancements of technology and communications systems expedite the enforcement and transfer of information processes during operations at the ground level.

Some studies have identified influences that are associated with the number of occurrences of forest crimes. These include log production, number of active mills, direct employment in the forestry sector (Lintangah, 2007), size of forest area (Aishyah, 2010) and log pricing (Shanti, 1995; Rusli, 1999). These factors are related to the supply and demand of timber that determine the price of logs in the market place. The state of evidence that pose a threat to the alleviation of forest crimes includes political instability and political interference in the management of the forest that may influence and dictate sound management of the forest. The NCR claims by local communities in forest reserves are also articulated as a challenge in the fight against forest offences in some areas. The cynical attitude among some members of society of deliberately refusing to accept the importance of forests to livelihoods also poses a threat to the SFM concept and the mitigation of forest crimes. Finally, the lack of awareness may also hinder greater cooperation among the stakeholders to come up with mutual agreement to safeguard the forests for the benefit of current and future generations.

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Figure 1: Total Number of Cases Recorded (2001-2003).

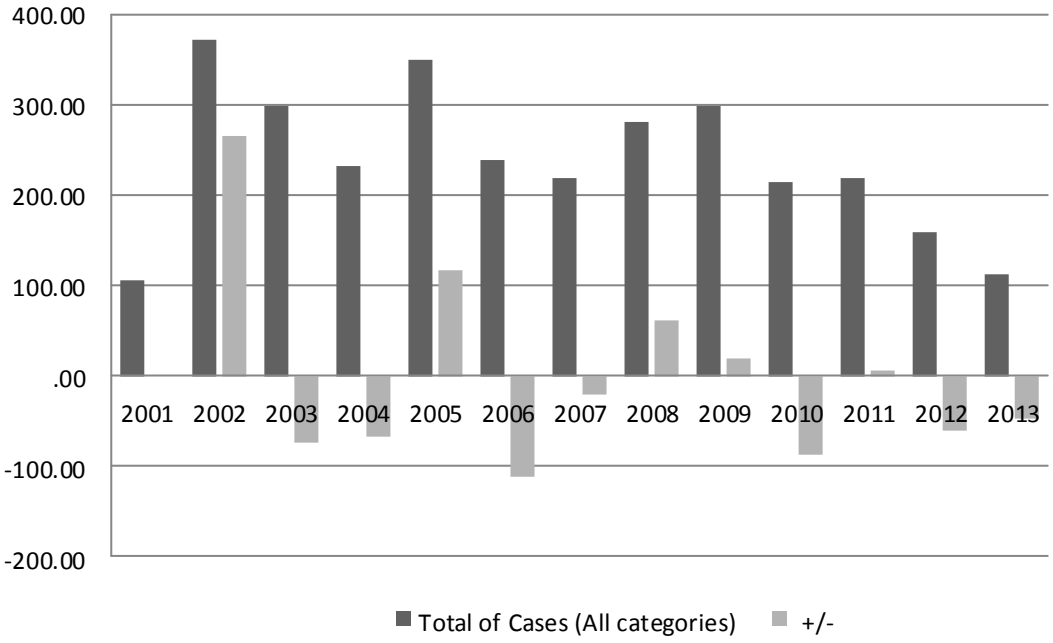
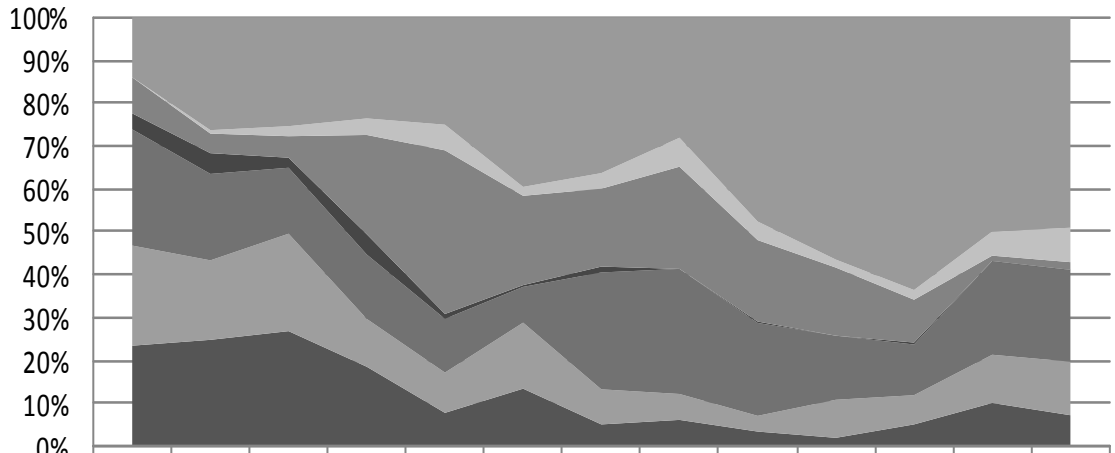
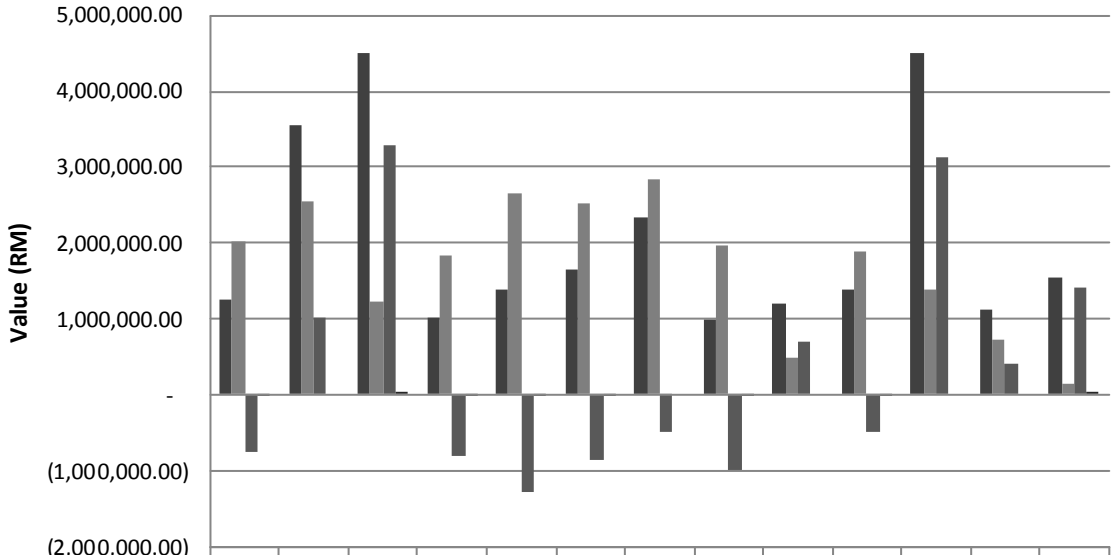


Figure 2: No of cases by category of forest offences (2001-2003).



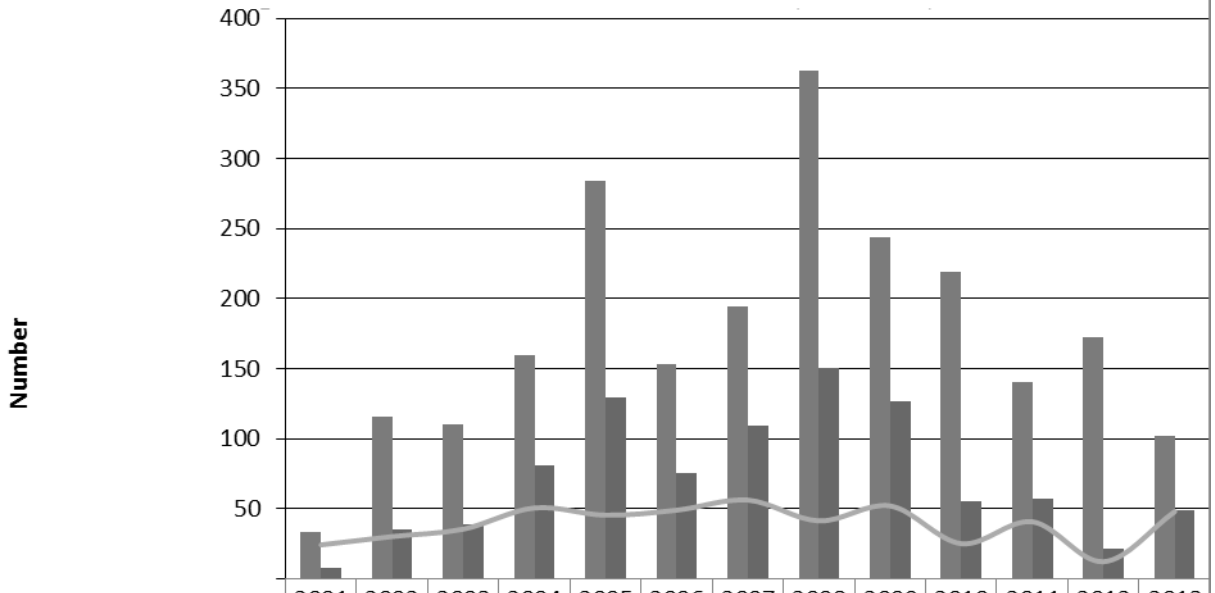
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Others	15.00	98.00	76.00	55.00	88.00	95.00	80.00	79.00	143.00	121.00	140.00	80.00	55.00
Sec201b3	.00	3.00	7.00	9.00	21.00	5.00	8.00	19.00	13.00	4.00	5.00	9.00	9.00
Sec 201c1	9.00	17.00	15.00	54.00	134.00	50.00	40.00	67.00	57.00	34.00	22.00	2.00	2.00
Sec 30Ab	4.00	18.00	7.00	11.00	4.00	1.00	3.00	.00	1.00	.00	1.00	.00	.00
Sec 30ig	29.00	75.00	46.00	35.00	44.00	20.00	60.00	82.00	65.00	32.00	26.00	35.00	24.00
Sec 23	25.00	69.00	68.00	26.00	33.00	37.00	18.00	17.00	11.00	19.00	15.00	18.00	14.00
Sec 20	25.00	92.00	80.00	43.00	27.00	32.00	11.00	17.00	10.00	4.00	11.00	16.00	8.00

Figure 3: Total fines & penalties vs value of confiscated logs.



	2,001	2,002	2,003	2,004	2,005	2,006	2,007	2,008	2,009	2,010	2,011	2,012	2,013
Total of Fines & Penalties Collected (RM)	1,262,1	3,562,9	4,515,3	1,015,5	1,375,1	1,655,3	2,347,9	981,986	1,205,1	1,376,7	4,516,4	1,126,7	1,556,2
Value (RM)	2,029,0	2,545,2	1,229,2	1,832,1	2,663,5	2,525,4	2,836,6	1,963,4	493,575	1,875,8	1,378,7	729,514	137,118
+/- (Total fines & Penalties - Value)	(766,86	1,017,6	3,286,0	(816,57	(1,288,	(870,10	(488,70	(981,51	711,572	(499,08	3,137,6	397,221	1,419,1
% (Penalties & Fines : Values)	(0.38)	0.40	2.67	(0.45)	(0.48)	(0.34)	(0.17)	(0.50)	1.44	(0.27)	2.28	0.54	10.35

Figure 4: Number of seizure and forfeiture (2001-2003).



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Seized	33	116	110	160	284	153	194	363	244	219	140	172	102
Forfeited	8	35	39	81	129	75	109	150	127	55	57	21	49
% (Forfeited/Seized)	24.24	30.17	35.45	50.63	45.42	49.02	56.19	41.32	52.05	25.11	40.71	12.21	48.04

Figure 5: Number of people arrested, charge and convicted by the court (2001-2003).

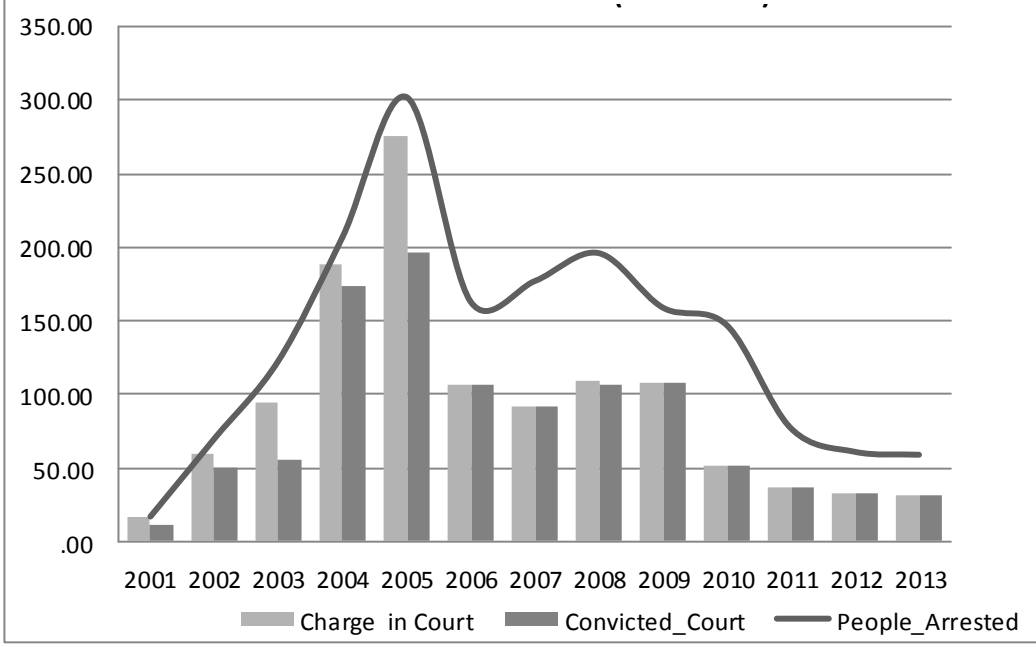
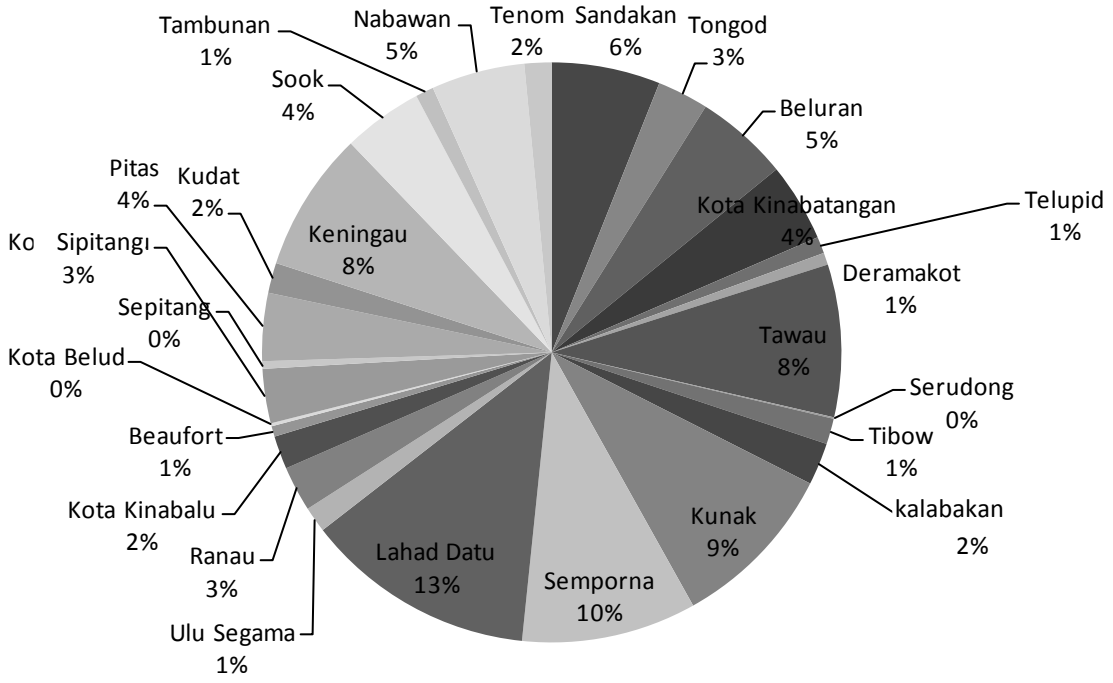


Figure 6: Cases of forest offences by forestry district (2001-2003).



PAPER 2: 2

KEPENTINGAN DAN SUMBANGAN PELAKSANAAN PENSIJILAN PENGURUSAN HUTAN MENGGUNAKAN STANDARD KRITERIA & PETUNJUK MALAYSIA [MC&I (HUTAN ASLI)] UNTUK AMALAN PENGURUSAN HUTAN SECARA BERKEKALAN (PHSB) DI SEMENANJUNG MALAYSIA

Nor Akhirrudin Mahmud | Mohd Radhi Chu Abdullah | Asiah Yaacob | Muhammad Umar Abdullah
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ABSTRAK

Hutan merupakan salah satu komponen terpenting di dalam sistem biofizikal di negara ini. Selain daripada membekalkan kayu dan hasil hutan yang lain, hutan juga memainkan peranan yang penting dalam mewujudkan alam sekitar yang berkualiti terutamanya perlindungan sumber air, pencegahan hakisan tanah dan nutrien, penstabilan iklim serta pemeliharaan sumber biologi. Justeru itu, sumber hutan negara perlu dirancang, diurus, dipelihara dan dibangunkan secara profesional, sistematik dan berkesan supaya pelbagai hasil dan perkhidmatan dapat dinikmati secara berterusan. Perkembangan pesat dalam sektor perhutanan kebelakangan ini telah menarik perhatian banyak pihak di peringkat tempatan dan antarabangsa. Kesedaran orang ramai terhadap kepentingan hutan telah meningkat, sementara kaitannya dengan pemeliharaan alam sekitar telah menyebabkan banyak pihak yang begitu prihatin supaya sumber hutan perlu terus dikekal, dipelihara dan diurus bagi kesejahteraan masyarakat. Oleh itu, pensijilan pengurusan hutan memainkan peranan yang penting dalam melaksanakan pengurusan hutan secara berkekalan. Pensijilan pengurusan hutan ialah sistem penilaian bebas untuk mengesahkan bahawa amalan-amalan pengurusan hutan bagi sesuatu unit pengurusan hutan [*Forest Management Unit* (FMU)] memenuhi keperluan standard yang meliputi aspek ekonomi, alam sekitar dan sosial. Sijil yang dikeluarkan memberi jaminan bahawa Hutan Simpan Kekal dalam FMU berkenaan diuruskan secara berkekalan berasaskan kepada keperluan kriteria dan petunjuk tertentu dan kayu balak diusahahasilkan dengan cara yang sah (mengikut kehendak perundangan). Justeru itu, kriteria dan petunjuk sebagai standard pengukur untuk pengurusan hutan secara berkekalan telah mula dilaksanakan di Semenanjung Malaysia pada tahun 1994 berdasarkan *ITTO Criteria and Indicators For Sustainable Forest Management* yang diterbitkan pada tahun 1992. Setelah melalui beberapa proses, satu dokumen yang dikenali sebagai Kriteria dan Petunjuk Malaysia untuk pensijilan pengurusan hutan MC&I (Hutan Asli) telah dihasilkan dan mula dilaksanakan pada tahun 2013 di Semenanjung Malaysia. Bagaimanapun, dalam pelaksanaan pensijilan pengurusan hutan MC&I (Hutan Asli) pelbagai isu dan cabaran telah dihadapi dalam memastikan pencapaian pematuhan standard MC&I (Hutan Asli) di Semenanjung Malaysia dan kertas kerja ini menghuraikannya secara terperinci dan kepentingannya kepada masa depan pelaksanaan sepenuhnya amalan PHSB di Semenanjung Malaysia.

1.0 LATARBELAKANG

1.1 Hutan merupakan salah satu komponen terpenting di dalam sistem biofizikal di negara ini. Selain daripada membekalkan kayu dan hasil hutan yang lain, hutan juga memainkan peranan yang penting dalam mewujudkan alam sekitar yang berkualiti terutamanya perlindungan sumber air, pencegahan hakisan tanah dan nutrien, penstabilan iklim serta pemeliharaan sumber biologi. Justeru itu, sumber hutan negara perlu dirancang, diurus, dipelihara dan dibangunkan secara profesional, sistematik dan berkesan supaya pelbagai hasil dan perkhidmatan dapat dinikmati secara berterusan.

1.2 Pada tahun 1992, ITTO telah mendefinisikan Pengurusan Hutan Secara Berkekalan sebagai *satu proses dalam mengurus kawasan tanah hutan untuk mencapai satu atau lebih objektif pengurusan bagi keperluan barangan dan perkhidmatan secara berterusan yang telah ditentukan dengan jelas, tanpa mengurangkan nilai dan produtivitinya serta tanpa mendatangkan kesan yang tidak diingini ke atas persekitaran sosial dan fizikal*. Berdasarkan takrifan di atas, adalah jelas bahawa pengurusan hutan secara berkekalan semestinya sesuatu pengurusan dan pembangunan hutan yang mesra alam dimana faedah dan manfaat hutan dari segi pengekalan alam sekitar/ekologi, sumbangan sosial dan ekonomi dapat direalisasikan untuk masa kini dan juga masa hadapan tanpa menjejaskan alam sekeliling dan keupayaan sumber itu sendiri.

1.3 Perkembangan pesat dalam sektor perhutanan kebelakangan ini telah menarik perhatian banyak pihak di peringkat tempatan dan antarabangsa. Kesedaran orang ramai terhadap kepentingan hutan telah meningkat, sementara kaitannya dengan pemeliharaan alam sekitar telah menyebabkan banyak pihak yang begitu prihatin supaya sumber hutan perlu terus dikekal, dipelihara dan diurus bagi kesejahteraan masyarakat.

1.4 Kemuncak kepada isu-isu alam sekitar dan perhutanan yang timbul sejak awal tahun 1990-an apabila isu pembangunan berkekalan menjadi satu *trend* dalam mana-mana perbincangan yang diadakan sama ada di peringkat tempatan atau antarabangsa. Antara isu-isu yang dibincangkan ialah:

1.4.1 Kemusnahan Hutan
1.4.2 Penurunan Kualiti Hutan (*Forest Degradation*)
1.4.3 Pemuliharaan Kepelbagaian Biologi
1.4.4 Perubahan Iklim Bumi

2.0 INISIATIF DAN KETETAPAN ANTARABANGSA TERHADAP PENGURUSAN HUTAN SECARA BERKEKALAN

Perkembangan dan kebimbangan masyarakat dunia terhadap isu-isu berkaitan dengan hutan dan alam sekitar telah mendorong kepada beberapa inisiatif dan ketetapan yang diambil di peringkat antarabangsa. Antaranya ialah Persidangan Bangsa-Bangsa Bersatu Mengenai Alam Sekitar dan Pembangunan di Rio de Janeiro, Brazil. Dokumen-dokumen penting yang dihasilkan di persidangan tersebut adalah seperti berikut:

2.1 Deklarasi Rio

Deklarasi ini mengandungi 27 prinsip bagi mengenal pasti hak dan tanggungjawab semua negara di bawah naungan PBB sebagai asas untuk mengadakan kerjasama antarabangsa di antara negara maju dengan negara sedang membangun berdasarkan kepentingan dan keperluan bersama bagi menjamin masa depan planet bumi. Deklarasi Rio juga menyatakan bahawa hanya terdapat satu halacara sahaja untuk meneruskan kesinambungan Ekonomi Jangka Panjang Dunia secara berterusan iaitu dengan mengaitkannya dengan pemuliharaan alam sekitar. Hasrat ini juga hanya akan dicapai sekiranya setiap negara menubuhkan struktur baru dengan pendekatan yang lebih global dan universal merangkumi sektor kerajaan, rakyat serta sektor sosial. Persetujuan yang lebih global pada peringkat antarabangsa mestilah dicapai untuk menjamin integrasi sistem pembangunan dan alam sekitar.

2.2 Kenyataan Prinsip-prinsip mengenai Hutan

Kenyataan Prinsip-prinsip mengenai Hutan iaitu *Non-legally Binding Authoritative Statement of Principles for a Global Consensus on Management, Conservation and Sustainable Development of all types of Forests* adalah merupakan satu persetujuan global terulung mengenai perhutanan yang mana Malaysia juga telah turut memberi persetujuannya. Kenyataan ini antara lain menuntut semua negara supaya dapat mempertingkatkan keberkesanan pengurusan, pemeliharaan dan pembangunan sumber hutan negara masing-masing secara berkekalan.

2.3 Agenda 21

Agenda ini adalah merupakan satu pelan tindakan yang lengkap bagi melaksanakan segala persetujuan dan perjanjian yang dibuat di Rio de Janeiro.Ia mengandungi 39 bab dan 115 program untuk dilaksanakan bagi tempoh 1993 - 2000 dan dua bab yang berkaitan terus dengan perhutanan ialah Bab 11 - "*Combating Deforestation*" dan Bab 15 - *Conservation of Biological Diversity*. Dalam hubungan ini, Malaysia juga komited untuk melaksanakan kesemua program yang tergaris di bawah kedua-dua bab ini.

2.4 Konvensyen mengenai Kepelbagaian Biologi

2.4.1 Hutan Hujan Tropika walaupun mempunyai kepelbagaian biologi yang tinggi, juga mempunyai ekosistem yang rapuh dan amat sukar untuk dipulihkan sekiranya ekosistem hutan tersebut diganggu terutama sekali gangguan yang berterusan berbanding dengan hutan-hutan jenis lain. Pada masa yang sama hutan tropika ini mempunyai nilai yang amat tinggi terutama sekali jumlah bilangan flora dan fauna yang terdapat di dalamnya. Gangguan yang berterusan akan menyebabkan nilai-nilai yang terdapat di dalamnya akan tergugat serta berkemungkinan menghadapi ancaman kepupusan.

2.4.2 Kenyataan yang dicapai semasa sidang ini adalah supaya semua negara dapat memainkan peranan yang lebih positif bagi memastikan sumber flora dan fauna yang sememangnya kaya dalam hutan tropika ini dapat terus dipelihara. Malaysia juga telah menandatangani konvensyen ini di Rio de Janeiro semasa UNCED pada 5 Jun 1992. Konvensyen ini telah pun berkuatkuasa di Malaysia pada 22 September 1994.

3.0 INISIATIF-INISIATIF LAIN

Inisiatif-inisiatif lain berhubung dengan keperluan pengurusan dan pemeliharaan sumber alam secara berkekalan juga telah dibentuk di peringkat antarabangsa. Di antaranya adalah seperti berikut:

3.1 Kerangka Konvensyen mengenai Perubahan Iklim

3.2 Konvensyen Perdagangan Spesies Terancam di Peringkat Antarabangsa [(*Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES*)]

3.3 Konvensyen Ramsar mengenai Tanah Lembab (*Ramsar Convention on Wetlands*)

4.0 INISIATIF DI PERINGKAT GLOBAL YANG MEMBERI KESAN TERHADAP PEMBENTUKAN KRITERIA DAN PETUNJUK KE ARAH PENGURUSAN HUTAN SECARA BERKEKALAN DI MALAYSIA

Pelbagai inisiatif di peringkat antarabangsa telah diwujudkan bagi memasti, melindungi dan mengawal sumber hutan daripada kekurangan atau kepupusan dengan mengadakan garis panduan bagi pengurusan hutan secara berkekalan dan bagi Negara Malaysia inisiatif Objektif ITTO tahun 2000 merupakan permulaan menghasilkan satu set Kriteria dan Petunjuknya bagi mengukur pengurusan hutan secara berkekalan. Pertubuhan Kayu-Kayan Tropika Antarabangsa atau *International Tropical Timber Organization* (ITTO) telah mengambil inisiatif dengan menentukan tahun 2000 sebagai tahun sasaran bagi mencapai pengurusan hutan tropika secara berkekalan. Inisiatif ini dikenali sebagai objektif ITTO Tahun 2000 atau *ITTO Year 2000 Objective*. Dalam hubungan ini, ITTO telah menyediakan beberapa garis panduan seperti Garis Panduan mengenai Pengurusan Hutan Asli Tropika secara Berkekalan (*Guidelines for Sustainable Management of Natural Tropical Forests*) dan garis panduan Kriteria dan Petunjuk bagi Pengurusan Hutan Asli Tropika secara Berkekalan (*Criteria and Indicators for the Sustainable Management of Natural Tropical Forests*).

5.0 PENGURUSAN SUMBER HUTAN

Pada masa ini litupan hutan di Malaysia adalah seluas 18.49 juta ha atau 56.4% berbanding dengan keluasan tanah negara. Daripada jumlah ini, seluas 5.86 juta ha adalah terletak di Semenanjung Malaysia, 4.40 juta ha di Sabah dan 8.23 juta ha di Sarawak. Seluas 14.62 juta ha (79%) adalah di dalam Hutan Simpanan Kekal(HSK) yang mana diurus di bawah Pengurusan Hutan Secara Berkekalan. Daripada 14.62 juta ha dalam HSK ini, 11.38 juta ha adalah dalam hutan pengeluaran yang berperanan membekal sumber kayu secara berterusan dan seluas 3.24 juta ha adalah hutan perlindungan yang berfungsi dalam menjaga kestabilan iklim dan keadaan fizikal negara, mengawal sumber air, mengekal kesuburan tanah, mengawal kualiti alam sekitar dan memelihara kepelbagaian biologi.

6.0 PENSIJILAN PENGURUSAN HUTAN

6.1 Pensijilan didefinisikan oleh Pertubuhan Standard Antarabangsa (ISO) sebagai satu prosedur pembuktian terhadap produk, proses atau perkhidmatan yang memenuhi standard tertentu. Manakala Pensijilan Pengurusan Hutan pula didefinisikan sebagai satu prosedur verifikasi yang telah diiktiraf dengan menghasilkan satu set Kriteria dan Petunjuk yang berkaitan dengan kualiti pengurusan hutan yang dinilai oleh auditan pihak ketiga. Set Kriteria dan Petunjuk ini biasanya ada kaitan dengan pengurusan hutan secara berkekalan yang mana ianya telah dipersetujui di peringkat antarabangsa. Pensijilan Pengurusan Hutan timbul hasil daripada desakan pihak Badan Bukan Kerajaan Alam Sekitar (ENGO) kepada kerajaan dan pengguna agar membeli produk dari hutan yang diurus secara berkekalan. Bagi ENGO proses Pensijilan Pengurusan Hutan akan mendatangkan faedah kepada mereka bagi mengekalkan kebergantungan kepada hutan.

6.2 Setakat ini, seluas 408.38 juta hektar (ha) telah berjaya disijilkan dan ianya mewakili 10% daripada jumlah keluasan kawasan hutan komersial di dunia. Daripada jumlah ini, seluas 237.65 juta ha disijilkan di bawah skim PEFC termasuklah Skim MTCS di Malaysia(4.65 juta ha atau 1.14%), 169.32 juta ha (41.46%) di bawah Skim FSC dan 1.40 juta ha (0.34%) di bawah Lembaga Ekolabel Indonesia (LEI). Skim pensijilan lain di bawah PEFC ialah 44.26 juta ha (CSA), 92.57 juta ha di bawah SFI dan ATFS, 10.10 juta ha (AFS), 1.89 juta ha (CERTFOR) dan 1.22 juta ha di bawah BPFC(Laporan Tahunan 2012,MTCC).

7.0 PEMBANGUNAN DAN PELAKSANAAN KRITERIA DAN PETUNJUK PENGURUSAN HUTAN DI SEMENANJUNG MALAYSIA

7.1 Usaha perumusan Kriteria dan Petunjuk sebagai standard pengukur untuk pengurusan hutan secara berkekalan telah mula dilaksanakan di Semenanjung Malaysia pada tahun 1994 berdasarkan *ITTO Criteria and Indicators For Sustainable Forest Management* yang diterbitkan pada tahun 1992. Lanjutan daripada itu, satu dokumen yang dikenali sebagai Kriteria, Petunjuk, Aktiviti dan Spesifikasi Pengurusan untuk Pensijilan Pengurusan Hutan Di Semenanjung Malaysia telah dihasilkan.

7.2 Standard ini telah diuji pemakaiannya di negeri Pahang, Selangor dan Terengganu menerusi satu projek perintis kerjasama Malaysia – The Netherlands pada pertengahan tahun 1996. Hasil kajian projek perintis ini telah dibincangkan dalam beberapa forum yang diadakan pada tahun 1998 dan 1999.Beberapa faktor, pandangan atau perkembangan penting terhadap kriteria dan petunjuk telah diambilkira. Di antaranya termasuklah:

- Penerimapakaian *Dutch Minimum Standards* oleh pihak The Netherlands sebagai standard pengurusan hutan yang baik;
- Penerimapakaian *ITTO Criteria and Indicators for Sustainable Forest Management of Natural Tropical Forests, 1998* di Malaysia; dan
- Hasil sesi-sesi rundingan di peringkat wilayah(region) dan national pada tahun 1999 untuk merumuskan satu standard bagi Pensijilan Pengurusan Hutan.

7.2 Output daripada perbincangan di forum-forum ini adalah penghasilan dokumen bertajuk *Malaysian, Criteria, Indicators, Actitivies and Standards of Performance (MC&I) for Forest Management Certification (Forest Management Unit Level), Peninsular Malaysia* bertarikh 23 Disember 1999. Dokumen Standard ini lebih dikenali sebagai MC&I (2001). Secara ringkasnya, standard yang dibangunkan tersebut adalah seperti berikut:

KRITERIA	INDIKATOR	AKTIVITI	PRESTASI STANDARDS
6	29	87	247

7.3 Standard MC&I (2001) yang dilaksanakan di lapan (8) buah negeri iaitu Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor dan Terengganu telah menerima beberapa kritikan khususnya daripada Badan-Badan Bukan Kerajaan yang berpendapat bahawa standard ini masih perlu diperlengkapkan lagi bagi memberi pertimbangan yang lebih munasabah dan menyeluruh kepada kehendak perlindungan alam sekitar, ekologi, sosial dan kepelbagaian biologi.

7.4 Menyedari hakikat ini, *Malaysian Timber Certification Council (MTCC)* telah bekerjasama dengan *Forest Stewardship Council (FSC)* pada tahun 1999 untuk membangunkan satu standard baru yang berdasarkan Prinsip dan Kriteria FSC. Di bawah kerjasama itu, Bengkel Pensijilan Hutan telah diadakan pada bulan Disember 2000, membolehkan pembentukan pelbagai pihak berkepentingan *National Steering Committee (NSC)* yang telah diberi mandat untuk membuat keputusan mengenai terma dan syarat-syarat untuk kerjasama MTCC-FSC serta untuk menyemak semula standard pengurusan hutan yang sedia ada supaya bersesuaian dengan keperluan FSC. Di samping itu, kajian kerjasama MTCC-FSC untuk membandingkan standard pengurusan hutan yang sedia ada dengan Prinsip dan Kriteria FSC (P&C) telah dijalankan oleh dua perunding bebas dan laporan akhir telah diserahkan kepada MTCC dan FSC pada September 2001.

7.5 Deraf awal MC&I (2002) ini telah dikaji semula dan penambahbaikan telah dibuat dengan mengambilkira perbezaan tiga wilayah di Malaysia iaitu perbezaan ekonomi, alam sekitar dan keadaan sosial. Hasil daripada perundingan dan perbincangan secara bersama telah bersetuju menerimapakai dokumen bertajuk *Malaysian Criteria and Indicators for Forest Management Certification [MC&I (2002)]*sebagai Standard untuk penilaian dan Pensijilan Pengurusan Hutan pada tahun 2004. Secara ringkasnya, Prinsip, Kriteria dan Indikator dan juga Verifier di bawah standard MC&I (2002) untuk Semenanjung Malaysia adalah seperti berikut:

PRINSIP	KRITERIA	INDIKATOR	VERIFIERS
9	47	96	233

7.6 Selaras dengan amalan antarabangsa dan proses penetapan standard untuk pembangunan standard pensijilan yang diterima pakai di bawah MTCS, di mana ianya memerlukan supaya kajian semula dijalankan sekurang-kurangnya setiap lima (5) tahun sekali untuk memastikan penambahbaikan dibuat secara berterusan. Untuk tujuan ini, *Standards Review Committee (SRC)* yang merupakan forum pelbagai pihak berkepentingan yang ditugaskan untuk mengkaji semula MC&I (2002) serta untuk membangunkan standard yang disemak semula telah ditubuhkan.MTCC bertindak sebagai Sekretariat kepada SRC dan memainkan peranan bagi memudahkan pembentukan SRC itu.

7.7 Setelah dibuat perubahan dan penambahbaikan, Standard MC&I (Hutan Asli) dapat dirumuskan seperti berikut:

PRINSIP	KRITERIA	INDIKATOR	VERIFIERS
9	47	97	307

7.9 Semenjak Februari 2012, lapan (8) FMU di Semenanjung Malaysia iaitu FMU Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor dan Terengganu yang melibatkan sejumlah 4.59 juta hektar Hutan Simpanan Kekal telah berjaya dikekalkan dengan Sijil Pengurusan Hutan mengikut Standard MC&I (Hutan Asli) oleh Badan Pensijilan Bebas iaitu SIRIM QAS International Sdn Bhd dan SGS (Malaysia) Sdn Bhd di bawah Malaysian Timber Certification Scheme (MTCS).

8.0 ISU DAN CABARAN DALAM PERLAKSANAAN PENSIJILAN PENGURUSAN HUTAN DI SEMENANJUNG MALAYSIA

Semenjak perlaksanaan pensijilan pengurusan hutan di Semenanjung Malaysia pada tahun 2000 sehingga kini pelbagai isu dan cabaran telah dihadapi. Antaranya adalah:-

8.1 Kos yang tinggi dan masa yang panjang

Proses Pensijilan Pengurusan Hutan melibatkan kos yang tinggi, masa dan tenaga yang banyak untuk mencapai tahap sentiasa diamalkan, ketelusan kedudukan standardnya dan proses auditan. Semenjak perlaksanaannya, pelbagai penambahbaikan perlu dilakukan bagi memenuhi standard MC&I. Ianya memerlukan kos yang tinggi dan masa yang panjang terutama bagi melaksanakan kehendak verifier yang pada masa ini yang mengandungi sebanyak 307 verifier kesemuanya. Setiap lima (5) tahun, standard ini akan dinilai dan dikaji semula mengikut standard antarabangsa yang mana akan memasukkan prosedur serta undang-undang baru mengikut perubahan semasa sama ada di peringkat antarabangsa dan tempatan. Disamping itu ia memerlukan persediaan terhadap apa-apa perubahan yang sentiasa berlaku yang melibatkan proses perbincangan antara *stakeholde*r sama ada di peringkat tempatan dan antarabangsa semata-mata bagi memenuhi kehendak polisi negara-negara tertentu yang sentiasa didesak oleh pihak ENGO atau kepentingan pihak yang mengawal pasaran berbanding dengan perlaksanaan SFM itu sendiri. Di samping itu kos-kos lain yang terlibat adalah melatih kakitangan, pemantauan yang berterusan dan promosi produk oleh pihak Malaysian Timber Council (MTC) di serata dunia. Kadang-kadang kos untuk promosi produk melebihi perbelanjaan berbanding menjaga kepentingan hutan secara berkekalan. Sebagai contohnya wang levi yang dikutip oleh pihak MTC lebih banyak digunakan untuk menaik taraf pihak industri sahaja sedangkan agensi yang melaksanakan SFM iaitu pihak JPSM dan Jabatan Perhutanan Negeri hanya diberi peruntukan yang terhad.

8.2 Konflik antara *stakeholder*

Pensijilan Pengurusan Hutan melibatkan pelbagai *stakeholder* yang mempunyai kepentingan tertentu yang memerlukan proses perlaksanaan yang panjang. Standard Pensijilan pula tidak akan diiktiraf sekiranya tidak ada sokongan daripada organisasi yang dipercayai oleh orang ramai seperti NGO. Bagi ENGO ianya akan mempengaruhi dari segi pengurusan hutan yang akan mengambilkira pemeliharaan biodiversiti, bagi social NGO pula akan mengambilkira aspek perkongsian serta tanggungjawab bersama dengan penduduk tempatan, bagi pihak industri ia lebih kepada tanggungjawab korporatnya. Bagi pembeli dan pengguna ianya lebih mementingkan maklumat penerangan terhadap produk yang dibeli. Bagi pemilik hutan ia merupakan alat kepada promosi barangannya manakala bagi pihak kerajaan pula ianya merupakan satu *soft policy* untuk mempromosikan SFM. Pada masa yang sama juga pihak yang melaksanakan SFM iaitu JPSM berada di bawah Kementerian Sumber Asli dan Alam Sekitar (NRE) yang lebih menekankan kepada pemeliharaan alam sekitar manakala Kementerian Perladangan, Industri dan Komoditi (MPIC) pula lebih menumpukan kepada perkembangan industri, promosi serta mencari pasaran di peringkat antarabangsa.

8.3 Kurang komitmen dan keberkesanan komunikasi

Perlaksanaan Pensijilan Pengurusan Hutan memerlukan komitmen yang tinggi daripada pihak atasan sehingga pihak pelaksana terutama di lapangan. Perlaksanaan ini bukan suatu perkara yang mudah bagi memenuhi standard MC&I. Ianya memerlukan pengorbanan masa dan tenaga bagi memastikan standard ini dapat dicapai sepenuhnya. Tanggungjawab yang dipikul bermula daripada peringat Kementerian NRE, Jabatan Perhutanan Semenanjung Malaysia di peringkat Persekutuan dan di sebelas(11) Jabatan Perhutanan Negeri dan satu di peringkat Wilayah Persekutuan. Segala komunikasi maklumat dan tindakan perlu diselaraskan di semua peringkat. Cabaran ini bukan hanya dipikul oleh seorang Ketua Pengarah Perhutanan sahaja tetapi semua pihak pelaksana bagi memenuhi kehendak Pensijilan Pengurusan Hutan. Kesan daripada kekurangan tersebut akan menyebabkan timbulnya *Corrective Action Request (CAR)* yang berulang-ulang bagi setiap Kriteria dan Petunjuk MC&I.

8.4 Pekerja Hutan yang kurang mahir

Pengetahuan terhadap standard MC&I walaupun dilaksanakan lebih sepuluh (10) tahun di Semenanjung Malaysia namun kefahaman kakitangan jabatan dan pihak swasta masih di tahap yang rendah. Ianya bukan sahaja di peringkat Pengurus Hutan tetapi juga di peringkat kakitangan di lapangan dan pekerja pembalakan. Bagi kakitangan jabatan, standard MC&I bukan mudah untuk difahami sepenuhnya memandangkan tahap pendidikan yang berbeza-beza. Bagi pekerja pembalakan pula ianya amat memerlukan pengetahuan dan kemahiran yang tinggi memandangkan pekerjaan

pembalakan sekarang ini telah berubah dari tanah pamah kepada tanah bukit yang lebih curam kedudukan yang memerlukan pengetahuan teknikal terutama dalam perlaksanaan RIL disamping menjaga kestabilan alam sekitar. Disamping itu kekurangan kakitangan jabatan yang telah berpencen yang tidak berganti juga merupakan faktor utama. Manakala pada masa yang sama kakitangan baru termasuklah Pengurus Hutan perlu mengambil masa yang lama untuk dilatih menjadi mahir dalam perlaksanaan Pensijilan Pengurusan Hutan. Kesannya adalah pematuhan prosedur kerja di lapangan tidak konsisten.

8.5 Pemantauan yang kurang berkesan

Tugas seorang Pengurus Hutan pada masa ini seperti penguatkuasaan undang-undang, mengawal pencerobohan hutan, penjagaan kawasan rekreasi dan pelancongan, kawasan tadahan air, kawasan HCVF, menyediakan maklumbalas terhadap laporan media dan orang awam, rawatan silvikultur, nurseri dan lain-lain tugas amat berat untuk dipikul. Tambahan pula dengan peralatan kelengkapan yang semakin uzur terutama kenderaan dan kawasan operasi pengusahasilan yang semakin jauh menyebabkan pemantauan dan tindakan awalan "*precaution action*" kurang berkesan. Kesannya adalah terdapat ketakakuran CAR bagi Kriteria dan Petunjuk MC&I yang sama dan berulang-ulang.

8.6 Pertindihan undang-undang serta kemasukan undang-undang antarabangsa yang tidak diiktiraf oleh pihak Kerajaan Malaysia

8.6.1 Undang-undang yang dijadikan *verifier* dalam Pensijilan Pengurusan Hutan adalah undang-undang antarabangsa dan tempatan. Antara undang-undang yang bertindih adalah Akta Perlindungan Hidupan Liar, 2010 seksyen 9 membenarkan pemburuan dalam Hutan Simpanan Kekal, manakala Akta Perhutanan Negara, 1984 di bawah seksyen 81 melarang sama sekali aktiviti memburu dalam Hutan Simpanan Kekal. Begitu juga Akta Orang Asli 1954 [Akta 134] telah digubal bagi tujuan untuk mengadakan perlindungan, kesejahteraan dan kemajuan orang asli di Semenanjung Malaysia.Seksyen 7(1) Akta 134 menyatakan -

(1) Pihak Berkuasa Negeri boleh, melalui pemberitahuan dalam Warta, mengisytiharkan mana-mana kawasan yang diduduki hanya oleh orang asli sebagai suatu rizab orang asli:

Dengan syarat—

(i) jika didapati tidak mungkin orang asli akan tinggal kekal di tempat itu, tempat itu tidak boleh diisytiharkan sebagai rizab orang asli tetapi hendaklah menjadi sebahagian daripada kawasan orang asli; dan

(ii) suatu rizab orang asli boleh diadakan di dalam sesuatu kawasan orang asli.

8.6.2 Pemasalahan yang timbul pula adalah masyarakat orang asli menuntut kawasan rayau juga menjadi haknya. Sedangkan kawasan rayaunya termasuklah kawasan tadahan air, kawasan pemeliharaan biodiversiti, kawasan konsesi pembalakan dan lain-lain lagi.

8.6.3 Di peringkat antarabangsa pula ILO Convention 87 dan 111 tidak diiktiraf oleh pihak Kerajaan Malaysia tetapi dimasukkan sebagai verifier atas syarat pihak PEFC yang menekankan kepada ILO Convention perlu dimasukkan sebagai syarat dalam mengiktiraf MC&I. Dalam pada masa yang sama pihak FMU juga perlu melaksanakan undang-undang yang bukan di bawah bidang kuasanya seperti Akta Perikanan 1985, Akta Suruhanjaya Hak Asasi Manusia Malaysia, 1999, Akta Kumpulan Wang Simpanan Pekerja, 1991, Akta Keselamatan Sosial Pekerja, 1969 dan lain-lain lagi.

8.7 Kurang kefahaman, kerjasama serta komitmen daripada pembalak terhadap perlaksanaan Pensijilan Pengurusan Hutan.

Sebahagian pembalak kurang kefahaman, kerjasama dan komitmen terhadap perlaksanaan MC&I terutama perlaksanaan di lapangan memandangkan tiadanya insentif daripada kerajaan dan hanya mengharapkan *green premium* semata-mata yang tidak menentu atau tiada langsung di pasaran antarabangsa. Pada masa yang sama juga pihak pembalak yang memperolehi kawasan yang tidak luas dan tidak tetap serta jangka masa yang pendek akan menilai semula dari segi kos pelaburannya berbanding dengan perlaksanaan MC&I. Antara kesalahan yang dilakukan yang menyebabkan ketakakuran CAR ialah tidak mengamalkan teknik tebangan berarah, pemandu bulldozer tidak mengikut aliran jalan yang telah ditanda serta melanggar arahan Keselamatan dan Kesihatan Pekerja dalam Operasi Pembalakan dan lain-lain lagi.Keadaan ini agak sukar dikawal.

8.8 Penilaian dan CAR yang dikenakan terhadap FMU semasa auditan pihak ketiga tidak konsisten

Di Semenanjung Malaysia sebanyak lapan (8) FMU telah dibuat penilaian oleh dua (2) badan pensijilan iaitu SGS(Malaysia) Sdn.Bhd dan SIRIM QAS (International) Sdn.Bhd yang mana hanya dua (2) syarikat ini sahaja yang di akreditasi oleh Jabatan Standard Malaysia. Empat (4) FMU iaitu Pahang, Johor, Selangor dan Terengganu dinilai oleh SGS(Malaysia) Sdn.Bhd. manakala empat (4) FMU lagi iaitu Perak, Kelantan, Negeri Sembilan dan Kedah dinilai oleh SIRIM QAS (International) Sdn.Bhd. Kebanyakan CAR yang dikenakan oleh kedua-dua syarikat ini tidak konsisten ke atas Kriteria dan Petunjuk MC&I yang sama menyebabkan pihak FMU agak keliru untuk membuat pembetulan berdasarkan keputusan CAR yang berbeza-beza. Oleh itu "Kempen Zero CAR" yang dilancarkan oleh Ketua Pengarah Perhutanan Semenanjung Malaysia sejak tahun 2012 untuk dicapai oleh lapan (8) FMU, hanya dua (2) FMU sahaja yang berjaya dicapai iaitu FMU Selangor dan Negeri Sembilan.

9.0 LANGKAH-LANGKAH UNTUK MENCAPAI PENSIJILAN PENGURUSAN HUTAN

Oleh itu, beberapa langkah telah dikenalpasti bagi menentukan kejayaan perlaksanaan Pensijilan Pengurusan Hutan terutama di lapangan antaranya adalah seperti berikut:-

9.1 Komitmen yang tinggi daripada pihak atasan.

Bagi menentukan kejayaan perlaksanaan Pensijilan Pengurusan Hutan komitmen daripada pihak atasan adalah amat penting. Di Semenanjung Malaysia komitmen ini telah ditunjukkan oleh Timbalan Ketua Setiausaha di peringkat Kementerian NRE dengan menjadikan *Key Performance Indicator (KPI)* terhadap pencapaian Pensijilan Pengurusan Hutan.Kemudian diikuti oleh Ketua Pengarah Perhutanan Semenanjung Malaysia dan Pengarah-Pengarah Perhutanan Negeri.

9.2 Penubuhan mekanisma ke arah pencapaian Pensijilan Pengurusan Hutan.

Jabatan Perhutanan Semenanjung Malaysia telah mengambil langkah dengan menubuhkan beberapa mekanisma bagi mencapai kejayaan Pensijilan Pengurusan Hutan. Antaranya ialah dengan menubuhkan Jawatankuasa Pemantauan Pensijilan Pengurusan Hutan MC&I di peringkat Ibu Pejabat yang dipengerusikan oleh Ketua Pengarah Perhutanan Semenanjung Malaysia dan ahlinya terdiri daripada Pengarah- Pengarah Bahagian dan Pengarah-Pengarah Perhutanan Negeri bagi membincangkan apa jua isu-isu berkaitan dengan Pensijilan Pengurusan Hutan serta mencari jalan penyelesaiannya. Manakala diperingkat negeri pula ditubuhkan Jawatankuasa Pemantauan Pensijilan Pengurusan Hutan MC&I yang dipengerusikan oleh Pengarah Perhutanan Negeri dan ahlinya pula terdiri daripada semua pegawai-pegawai perhutanan negeri bagi mengambil langkah tindakan pembetulan terhadap ketidakakuran CARs yang telah dikenakan semasa auditan oleh pihak ketiga atau oleh pihak Audit Dalaman. Dalam pada itu juga pihak Ibu Pejabat Perhutanan Semenanjung Malaysia telah melantik pegawai perhubungan berkaitan MC&I di negeri-negeri bagi menyebar dan menyampaikan apa jua maklumat yang berkaitan dengan langkah-langkah penyelesaian terhadap ketakakuran CARs dan membuat persediaan di pejabat dan di lapangan sebelum audit dilaksanakan oleh pihak ketiga.

9.3 Pemantauan yang berterusan melalui penubuhan Pasukan Audit Dalam serta mewujudkan Seksyen Pensijilan Perhutanan di Ibu Pejabat Jabatan Perhutanan Semenanjung Malaysia.

Bagi menentukan kejayaan pencapaian Pensijilan Pengurusan Hutan di Semenanjung Malaysia, Jabatan Perhutanan Semenanjung Malaysia telah mewujudkan seksyen baru di Ibu Pejabat iaitu Seksyen Pensijilan Hutan bagi memantau secara keseluruhan perlaksanaan Pensijilan Pengurusan Hutan di Semenanjung Malaysia. Seksyen ini telah berfungsi dengan jayanya dengan menyelaras mekanisma-mekanisma yang ada serta memantau perjalanan proses pensijilan di negeri-negeri. Seksyen ini juga telah menubuhkan pasukan Audit Dalam yang terdiri daripada pegawai-pegawai jabatan hutan yang senior bagi memantau perlaksanaan Pengurusan Hutan Secara Berkekalan dan secara tidak langsung perlaksanaan Pensijilan Pengurusan Hutan di negeri-negeri dan melapur terus di Mesyuarat Pemantauan Pensijilan Pengurusan Hutan yang dipengerusikan oleh Ketua Pengarah Perhutanan Semenanjung Malaysia.

9.4 Latihan yang berterusan bagi meningkatkan kemahiran bagi mencapai Pensijilan Pengurusan Hutan.

Jabatan Perhutanan Negeri dengan kerjasama Jabatan Perhutanan Semenanjung Malaysia telah melaksanakan apa jua kursus yang berkaitan dengan perlaksanaan Pensijilan Pengurusan Hutan sekurang-kurangnya dua (2) kali setahun kepada Pegawai kanan dan kakitangan berpakaian seragam dan kontraktor pembalakan terutama latihan yang berkaitan:-

i. Garis Panduan Jalan Hutan 2010;
ii. Garis Panduan untuk Pembalakan Kurang Impak (RIL) di Semenanjung Malaysia, 2003;
iii. Kriteria dan Petunjuk untuk Pensijilan Pengurusan Hutan di Malaysia [MC&I(Natural Forest)] ;
iv. Dendrologi;
v. Keselamatan dan Kesihatan Pekerja dalam sektor perhutanan;
vi. Mensurasi Hutan;
vii. Tebangan berarah; dan
viii. Tatacara di Balai Pemeriksaan Jabatan Hutan (BPJH).

9.5 Melaksanakan konsultasi antara *stakeholder*.

Oleh kerana adanya konflik antara *stakeholder* perlu adanya satu proses iaitu konsultasi antara *stakeholder* bagi memberi penerangan berkaitan dengan perlaksanaan Pensijilan Pengurusan Hutan. Sebagai contohnya mengadakan perjumpaan dengan Persatuan Pembalak yang dilaksanakan di peringkat FMU untuk memberi penerangan betapa pentingnya Pensijilan Pengurusan Hutan demi mencapai pengurusan hutan secara berkekalan. Kerjasama antara Jabatan PERHILITAN dan Jabatan Perhutanan Negeri dalam hal-hal yang berkaitan dengan hidupan liar, kerjasama antara JPSM dan JPN dengan JAKOA dalam menyelesaikan konflik orang asli dan kerjasama antara Kementerian NRE dan Kementerian MPIC bagi menyeimbangkan antara pemeliharaan alam sekitar dan pemasaran di peringkat antarabangsa.

9.6 Memperkukuhkan serta membuat penambahbaikan terhadap prosedur-prosedur, polisi dan Akta Perhutanan Negara, 1984.

Jabatan Perhutanan Semenanjung Malaysia sentiasa melakukan perubahan termasuklah perubahan teknikal dengan lahirnya beberapa panduan-panduan baru berdasarkan perubahan semasa dan pemasalahan yang berlaku di lapangan. Pada masa yang sama juga JPSM telah memperkukuhkan semula Polisi Perhutanan dan Akta Perhutanan Negara,1984 bagi memantapkan lagi pengurusan hutan secara berkekalan di negara kita.

10.0 IMPAK DARIPADA PELAKSANAAN PENSIJILAN PENGURUSAN HUTAN MENGGUNAKAN STANDARD MC&I (HUTAN ASLI)

Impak daripada aktiviti Pensijilan Pengurusan Hutan terhadap pengurusan hutan secara berkekalan secara keseluruhannya adalah seperti berikut:

10.1 Meningkatkan penglibatan pihak pengguna dan pihak-pihak lain yang berkepentingan ke arah pengurusan hutan secara berkekalan di mana kehendak dan kepentingan mereka diambil kira dalam pengusahasilan hutan dan perkhidmatan-perkhidmatan yang lain;

10.2 Meningkatkan usaha pengemaskinian perundangan bagi memperkukuhkan lagi polisi kerajaan dalam menjamin keluaran hasil hutan secara berterusan;

10.3 Mewujudkan satu sistem institusi perbincangan di antara kerajaan dan pihak-pihak yang terlibat secara langsung dengan pengurusan hutan ke arah menghasilkan satu kefahaman bagi keperluan pengurusan hutan serta usaha menangani isu-isu perhutanan masa kini;

10.4 Meningkatkan kecekapan pengawalan dan pemantauan amalan pengurusan hutan secara berperingkat dengan membekalkan maklumat yang tepat dan kemaskini;

10.5 Memastikan kewujudan serta keutuhan keluasan kawasan Hutan Simpanan Kekal (HSK) bagi tujuan pelaksanaan amalan pengurusan hutan secara berkekalan;

10.6 Menjamin penyeragaman data-data pengurusan hutan ke arah mencapai satu piawaian antarabangsa;

10.7 Menjamin pemantauan dan penilaian pelbagai keluaran dan perkhidmatan hutan termasuk keluaran bukan kayu secara lebih berkesan dan cekap;

10.8 Meningkatkan tahap kesedaran terhadap kepentingan biodiversiti terutama kepada pekerja hutan dan orang awam;

10.9 Mengenalpasti penyelidikan yang sesuai dan masih berkurangan dengan lebih tepat supaya pengagihan sumber penyelidikan dapat dilakukan secara berkesan bagi memenuhi keperluan pengurusan hutan; dan

10.10 Mewujudkan satu sistem laporan awam yang lebih mantap terhadap status, keadaan dan keupayaan hutan yang diurus secara berkekalan.

11.0 RUMUSAN

Antara beberapa rumusan boleh dibuat bagi menjayakan perlaksanaan Pensijilan Pengurusan Hutan sebagai alat pengukur bagi mencapai pengurusan hutan secara berkekalan adalah seperti berikut:

11.1 Perlaksanaan Pensijilan Pengurusan Hutan memerlukan Institutional Framework yang kemas, teratur dan mantap;

11.2 Perlaksanaan Pensijilan Pengurusan Hutan memerlukan kos yang tinggi serta mengambil masa yang panjang;

11.3 Perlaksanaan Pensijilan Pengurusan Hutan memerlukan perubahan sikap dan minda yang drastik sama ada di peringkat jabatan dan swasta;

11.4 Perlaksanaan Pensijilan Pengurusan Hutan memerlukan komitmen yang tinggi daripada pihak atasan hingga pekerja hutan sama ada di peringkat jabatan atau swasta;

11.5 Perlaksanaan Pensijilan Pengurusan Hutan memerlukan pengurus dan pekerja hutan yang kompeten serta mempunyai kepakaran teknikal yang tinggi;

11.6 Perlaksanaan Pensijilan Pengurusan Hutan memerlukan kepakaran baru iaitu “negotiator” yang cemerlang; dan

11.7 Perlaksanaan Pensijilan Pengurusan Hutan memerlukan tahap integriti yang tinggi.

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PAPER 2: 3

KEBERKESANAN TINJAUAN UDARA DAN OPERASI BERSAMA DENGAN AGENSI PENGUATKUASAAN YANG LAIN DALAM PENGUATKUASAAN HUTAN DI SARAWAK

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ABSTRAK

Jabatan Hutan Sarawak mengambil alih semula tugas dan tanggungjawab penguatkuasaan *Forests Ordinance (Cap. 126), National Parks & Nature Reserves, 1998 dan Wild Life Protection Ordinance, 1998* berkuatkuasa pada 13 Februari 2012. Pada tahun 2013, sebanyak 131 kertas siasatan telah dibuka yang mana 116 adalah berhubung kesalahan hutan, 7 berhubung perlindungan hidupan liar dan 8 melibatkan taman negara. Kaedah tinjauan udara menggunakan helikopter dan operasi bersama dengan agensi penguatkuasaan lain seperti Agensi Penguatkuasaan Maritim Malaysia (APMM), Pasukan Gerakan Am (PGA), Polis Marin, Suruhanjaya Pencegah Rasuah Malaysia (SPRM), Kastam Diraja Malaysia dan Polis Diraja Malaysia (PDRM) telah menunjukkan keberkesanan serta pencapaian yang lebih memberansangkan pada tahun 2014. Kertas kerja ini menghuraikan pencapaian penguatkuasaan hutan, mengenalpasti kekuatan menggunakan dua kaedah tersebut dan cadangan penambahbaikan yang perlu dilaksanakan.

PAPER 2: 4

IMPLEMENTATION OF FLEGT - TIMBER LEGALITY ASSURANCE SYSTEM IN SABAH: ISSUES, CHALLENGES AND RECOMMENDED STRATEGIES

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ABSTRACT

The Sabah Forestry Department manages the forest reserves of Sabah to achieve the greatest combination of benefits in the form of forest production and other uses that can be sustained over time. The department is well geared towards reaffirming the State's commitment in the realization of sustainable forest management in this millennium. The year 2013 marked the latest progress of "Sabah International Auditing of Sustainable Forest Management License Agreement/Long Term License Agreement" and the project has successfully achieved its objective of developing and field-testing a model for independent auditing system for the State's Sustainable Forest Management License Agreement/Long Term License Agreement sector. This includes establishing the platform for the assessment of Timber Legality Assurance System and regulatory compliance of the Sustainable Forest Management, capacity building and the development of relevant thematic areas such as Environmental Impact Assessment and Health/Safety issues with the legality collaboration. This paper highlights the issues and challenges encountered during the establishment and implementation of the Timber Legality Assurance System which is the central part of the Forest Law Enforcement, Governance and Trade Strategy and outlines the recommended strategies that need to be implemented.

1.0 Background

The Sabah Forestry Department (SFD) is committed in its compliance with the international agreements with the European Union (EU) related to the implementation of the Tcimber Legality Assurance System (TLAS) which is the central part of the Forest Law Enforcement, Governance and Trade (FLEGT) mechanism within licensed forest areas of Sabah, in accordance with European Union Timber Trade Regulations (EUTR), which is based on existing laws and regulations governing forest harvesting, mill operations and timber trade.

2.0 Timber Legality Assurance System of Sabah

The TLAS consists of:

*****Definition of the legal timber based on an agreed set of Principles and Criteria that refer to relevant laws, regulations and operation procedures; and

*****Control procedures for verifying compliance to legality of timber covering forest harvesting, transportation, mill operation, import and export.

Commenced in May 2009, the implementation of TLAS was partially backed by GTZ of Germany and the Government of the Netherlands. In the beginning, Global Forestry Services (M) Sdn. Bhd. (GFS), a third party auditor, was appointed to conduct field assessments. Subsequently, GFS supported and facilitated the development of the field verification standard for legal compliance based on Sabah Forestry regulations and the Sustainable Forest Management License Agreement (SFMLA).

The key objective of the project was to develop and implement a field verification system for legal compliance to fulfill Principles 1 to 4 of the Sabah Legality Standard of Forestry under the FLEGT/VPA (Voluntary Partnership Agreement) process. The verification process is based on continuous monitoring of 24 long-term forest management units and the licensing of harvest areas in compliance to the *Sabah Legality Standard*. Consequently, the current field legality standard for forestry in Sabah was developed under the FLEGT program. It has been in operation since its inception and has undergone six stakeholder reviews as part of continuous development.

From the collaboration with GFS, the SFD has outlined and revised the checklist for Principles 1-4 of the Sabah TLAS standard and regulated according to the current auditing system. The checklist comprises four Principles, *viz*. Principle 1: Right to Harvest; Principle 2: Forest Operation; Principle 3: Statutory Charges and Principle 4: Other Users' Right. They are provisioned into 30 criteria, 12 of these criteria are critical criteria that must be in full compliance, if applicable, to the SMFLA/Long Term License Agreement (LTL) holder while the remaining 18 are considered non-critical. Essentially, law related criteria are considered critical while performance-based criteria are categorized as non-critical. The critical criteria are weighted for two levels of compliance namely Compliance and Non-Compliance, whereas the non-critical criteria are segregated under Compliance, Partial Compliance and Non-Compliance. For each criterion, the score is 1.0 for full compliance, 0.5 for partial compliance and 0 for non-compliance. Each indicator is considered a compliance if the score achieved is more than 80%, whereas the scores for partial compliance is between 50% - 80% and scores less than 50% are marked as non-compliance. For legal compliance, the SFMLA/LTL holders should achieve a minimum overall scores of 70% for all applicable criteria.

3.0 Objectives and Scope of Audit

The objectives of the independent auditing are:

- To ensure continuous compliance of SFMLA/LTL holders with the terms and conditions of SFMLA/LTL as well as legal compliance with Malaysian laws and in accordance with the requirements of the EU-FLEGT of TLAS;
- To improve the performance of the SFMLA/LTL holders with systematic monitoring on the ground;
- To upgrade the skills and capacity of the SFD's Officers in carrying out auditing works;
- To instill transparency and professionalism amongst forest managers.
- To evaluate the corrective action taken by SFMLA/LTL holders to address non-conformance issues raised in previous audits.

The scope of the audit covers all aspects of forest operations within the SFMLA/LTL affected areas including observation of license status, Forest Management Plan (FMP), Annual Work Plan (AWP) and scrutinizing of respective laws and regulations as stated in the TLAS requirements.

4.0 Field Evaluation

In 2013, GFS carried out two TLAS assessments per month under the existing Reduced Impact Logging (RIL) project that requires a total of 180 man-days per month, covering a total of 26 SFMLA affected areas. The expansion of the scope of TLAS assessments includes both increase of periodic reporting and extension of areas under assessment. At present, the GFS allocates two (2) man-days per area and two man-days for reporting. The assessment work was scheduled and monitored by SFD whereas the responsibilities of the GFS are to conduct field assessments and submission of audit results to the Director of Forestry.

5.0 Key Output of FLEGT

- As a third party auditor, GFS provides assessment reports regarding each standard indicated under the Sabah Forestry Legality Standard and Sabah TLAS Checklist for each area assessed.
- Identify and categorize gaps in compliance and recommend corrective measures for addressing the gaps.
- Assess the adequacy of the Guidelines and Checklists provided and propose improvements where appropriate to support the implementation of the Sabah TLAS and FLEGT Licensing Scheme.

The auditing covered two rounds of field auditing on twenty (20) SFMLA/LTL holders. The field auditing conducted by the third party, GFS, continued in 2013 with funding from the RIL Project. In the recent audit, a total of twenty six (26) SFMLA/LTL holders were involved. It marked the fifth round of auditing of ten (10) SFMLA/LTL holders (see **Table 1**) and a third round audit for five (5) SFMLA/LTL holders (see **Table 2**). Notably, one (1) SFMLA/LTL area that is FMU17B (Area C), under the management of Maxland Sdn. Bhd., was being audited for the first time.

6.0 Achievement for the year 2013

Similar to the previous round of audits, all criteria related to compliance with legal requirements were strictly followed. In addition, auditors also evaluated the corrective actions taken to address the GAPs issues from previous audit.

In this sixth round of audit, the average compliance score of the SFMLA/LTL holders audited was 93.56%, an increase of 4.93% from the 5th round. Eight (8) SFMLA/LTL holder were high achievers with a perfect 100% score, eleven (11) SFMLA/LTL scored above 90%, five (5) SFMLA/LTL scored between 80% to 89.9% and two (2) SFMLA/LTL scored within the range of 70% to 79.9%.

The high achievers with 100% score are:

1. Maxland Sdn. Bhd. (SFMLA 01/07) FMU17A
2. Maxland Sdn. Bhd. (SFMLA 01/07) FMU17B
3. Maxland Sdn. Bhd. (SFMLA 01/07) FMU17B(Area C)
4. Lebihasil Sdn. Bhd. (SFMLA01/05) FMU17A
5. Lebihasil Sdn. Bhd. (SFMLA01/05) FMU17B
6. KTS Plantation Sdn. Bhd. [JP(SLK)125/93(CO)]
7. KM Hybrid Plantation Sdn. Bhd. (SFMLA01/04) FMU 11
8. Top Quantum Sdn. Bhd. (SFMLA01/09) FMU 25

Holders which did not pass the audit in 2013 due to non-compliance by attaining one or more applicable Critical Criteria are:

1. Sapulut Forest Development Sdn. Bhd. (SFMLA 04/97) FMU14
2. Bornion Timber Sdn. Bhd. (SFMLA 03/97) FMU11
3. Rakyat Berjaya Sdn. Bhd. (SFMLA 09/97) FMU16
4. Rakyat Berjaya Sdn. Bhd. (SFMLA 09/97) FMU 23
5. Rakyat Berjaya Sdn. Bhd. (SFMLA 09/97) FMU24
6. Anika Desiran Sdn. Bhd. (SFMLA 10/97) FMU5
7. Timberwell Sdn. Bhd. (SFMLA06/97) FMU3
8. Makmuran Sdn. Bhd.(COKG2/91)
9. Lagenda Aktif Sdn. Bhd. (SFMLA 02/2012) FMU11
10. First Greenworld Sdn. Bhd. (SFMLA 02/09) FMU25

*(Please refer to Table 1 and Chart 1).

7.0 Overall Assessment

Evaluation based on the aforementioned Principles demonstrates that the SFMLA/LTL achieved the highest mark for Principle 3 (Statutory charges) with a mark of 92.86%, followed by Principle 2 (Forest operation) with 90.50%, Principle 1 (Right to harvest) with 90.45% and finally Principle (Other user's right) with 82.69% (Table 2). The lowest mark recorded, which was Principle 4, was due to the inability of SFMLA/LTL to comply with Criterion 12.2. However, the latest performance under Principle 4 shows an improvement of 7.69%, an increase from 75% to 82.69% based on the results of 2012.

Several of the criteria are proven to be difficult to fulfill, listed here in order of difficulty:-

- Criterion 1.4 (69.23); inadequate system to protect license area from illegal exploitation;
- Criterion 3.2 (75%); mostly due to lack of inventory result to define forest condition in the FMP;
- Criterion 4.4 (76.92%); inadequate planning for road access and protection against fire especially in establishment of FMP;
- Criterion 2.2 (77.27%); implementation of Environmental Impact Assessment (EIA) mitigation measure; and
- Criterion 12.2 (78.5%); unable to adequately define third-party claims, lack of discussions with communities involved and poor record of discussions held with villagers.

Comparisons of the results of 2012 and 2013 show that the SFMLA/LTL have maintained their performance for Principle 1 with a negligible difference of 0.35%, for Principle 2, an increase of 5.55% from 84.95% in 2012 to 90.50% in 2013, and for Principle 3 a decline to 7.14% from 100% in 2012 to 92.86% in 2013 (Chart 2). Further analysis proved that this was due to the incapability of SFMLA/LTL to fulfill a specific criterion, which is Criterion 1.4 which was inadequate system to protect the license area from illegal exploitation, Criterion 2.2 whereby there was no implementation of EIA mitigation measure, Criterion 3.2 due to lack of inventory result to define forest condition in the FMP and Criterion 4.4 owing to the inadequate planning for road access and protection against fire especially in the formulation of FMP.

8.0 Issues and challenges affecting the implementation of Sabah TLAS

Apart from the difficulties in fulfillment of all the criteria listed in the checklists by the stakeholders ,SFD has also encountered several issues and challenges during the implementation of Sabah TLAS which must be given serious consideration towards finding a resolution. Below are the issues and challenges encountered:

8.1 Participation of stakeholders and commitment

The biggest challenge for the SFD in the effort of implementing the TLAS is to gain the full confidence of the various stakeholders in Sabah. At present, stakeholder participation and consultation activities are not at an encouraging level. This is due to the reluctance of certain stakeholders e.g. government, private sectors and the civil societies in taking part in the FLEGT-TLAS. Having been on going for over several years, it is acknowledged that mobilization efforts to increase stakeholders participation in the negotiation process is a complicated job and evidently previous SFD's effort to encourage them has not yet brought about desired results. The typical reaction is often to blame the system rather than to look at the conditions under which it is operating.

8.2 Inter-department coordination and collaboration

In order to fully implement TLAS to its full capacity, all relevant quarters in the government including the various departments are required to cooperate efficiently. Inter-department coordination and collaboration is highly important in ensuring well organized inter-department mobilizations and negotiations, as the verification of legalities is under the jurisdiction of a number of different government departments. In practice, inter-department collaboration is a complex matter, especially when the initiative of negotiating of FLEGT-TLAS involves several government departments, some of which may only have nominal responsibility and task in the said projects.

8.3 Capacity building

Since its early involvement in the FLEGT-TLAS negotiation process, capacity building has always been a crucial issue for the SFD. Numerous setbacks were encountered during the preliminary phase of the FLEGT-TLAS negotiations and throughout the documentation preparation of the guidelines provided by the EU. This is because of the fact that the parties, including the stakeholders and SFD's officers involved in the negotiations and the subsequent follow-up actions, basically do not possess the required skills and knowledge in handling the needs of capacity building.

8.4 Imported timber and legality of resource

Overall, it is vital that all relevant authorities verify and ensure the legality of timbers being imported into the country. Such imperative matters largely affect the status of the domestic timber industry and the overall credibility of the system. SFD is fully aware of the state of affairs and the need for a pragmatic mechanism to resolve the issue. Negotiations with the EU are currently still ongoing regarding this issue. At present imports must comply with Malaysia's import requirements.

8.5 Lack of financial resources

Funding and financial resources will constantly be a significant matter in the implementation of TLAS. Regardless, only minimal funding has been allocated for the implementation of the system.

8.6 Finality of FLEGT-VPA negotiations

To date, the Federal Cabinet has still not reached finality on the Malaysia and EU negotiations on the Forest Legal Enforcement Governance and Trade Voluntary Partnership Agreement (FLEGT - VPA). The process involves the preparation of cabinet papers in order for the cabinet to make the final decision on the matter.

8.7 Pressure for "Green Lane"

The Malaysian government has opted to implement the FLEGT - VPA, in order to recognize Malaysian timber exports to the EU as being on the "green lane". This stipulates that since the implementation of the said law in the EU beginning last year (2013), all timbers exports to the EU must have proof of its legality. In the effort towards the "green lane", Sabah timber producers have expressed a sensible level of apprehension in this new direction the industry is moving. Conversely, the slow and prolonged negotiation and discussions on the matter of TLAS documentation, which has been on going for six years since its introduction in 2009, could unfavorably present the SFD as being inept and incapable of implementing the system. Furthermore, it could dampen the stakeholders and timber players' confidence of the SFD's capabilities in implementing TLAS in the State of Sabah.

9.0 Recommended Strategies

The implementation of any endeavors, especially an extensive and complex program such as TLAS, will require sound strategies and adaptive measures to resolve the issues at hand. Additionally, implementing these strategies will guarantee an efficient structure and mechanism capable of operating the FLEGT-TLAS initiative to its full extent. While several strategies are apparent and self evident practices, a few will require attentive administering and constant focus in their proper executions.

Listed below are the recommendation sections established for the purpose of the issues:

Section 1 : Mobilization, Cooperation and Commitment

1.1 Organized structure, proper designation and established representation

- Identify typology of stakeholders using existing platforms as a basis in order to ascertain the various positions and contributions of stakeholders.
- Establish formal and elective representations of various stakeholders to enable smooth flow of information and instructions.

1.2 Information-sharing mechanism

- Create official website disclosing all information and up to date status regarding the States implementation of FLEGT-TLAS. This ensures accessibility and receptivity, essential to bolster stakeholder participation. It also helps to further facilitate traceability.
- Coordinate regular dialogues to engage stakeholders and relevant parties. This is vital in early stages to circularize conception and comprehension of the system across all participating individuals.

1.3 Inter-departments joint efforts

- Constant communication and collaboration between the SFD and other departments will inevitably, although gradually, develop the symbiotic and reciprocal inter-department relationship, enhancing efficiency over every contact.

1.4 Appropriate training and exercise

- Provide workshops and seminars engaging relevant parties, including hands-on SFD officers as well as timber industry players, regarding various aspects in the implementation of FLEGT-TLAS. This is especially necessary for the more demanding aspects of the system such as capacity building and technical skills. This is further discussed in Section 2.1.

1.5 Country exchange mission

- Conduct country exchange mission with VPA-implementing countries to obtain a more direct exposure and understanding of the expectations and consequences of the VPA process. Additionally, this would also allow us to reflect on avoiding mistakes and oversights encountered by the VPA-implementing countries.

Section 2 : External and foreign assistance

2.1 In the pursuit of the FLEGT-VPA, various international organizations are functioning to assist affiliating countries, both VPA and non-VPA countries. These organizations provide support ranging from direct funding and call for proposals, to logical and technical support such as capacity building and thematic training, as well as professional consulting. It is recommended that we fully utilize the assistances provided by these organizations accordingly to our needs and shortcomings in implementing FLEGT-TLAS:-

- Organizations providing funding support:
  (i) ITTO's (International Tropical Timber Organizations) Tropical Forest Law Enforcement & Trade (TFLET) Thematic Programme.
  (ii) Asia-Pacific Network for Sustainable Forest Management (APFNet).

- Organizations providing technical support:
  (i) European Forest Institute's EU FLEGT Facility.

- EU-FAO (Food and Agriculture Organization) FLEGT provides both financial and technical support as well as information services to increase the availability of FLEGT-related information and knowledge and to promote experience sharing among local stakeholder groups.

- The United Nations Office on Drugs and Crime (UNODC) provides support focusing mainly on technical assistance and capacity building in deterrent efforts against criminal practices including illegal logging and other forest-related crimes such as the illegal movements of wood-based products. The UNODC cooperates with agencies such as the Police, Customs, Attorney General Offices, Anti-Corruption Commission, Financial Investigation Units and key line ministries from the Forestry sector.

Section 3 : Segregation of timber imports

3.1 All timber imports are recommended to be segregated upon receipt based on the legality status of the point of origin.

3.2 SFD has come up with a proposal on mechanism to handle segregation of timber from Sarawak and other countries. SFD and STIA should work jointly to find out which companies are importing from Sarawak and other countries and further to provide them with the necessary guidance on implementation mechanism, including what are the procedures and only companies involved should be subjected to such audit (Abi A., Kugan F. & Wong B., pers. comm. 2014).

3.3 Any implementation should only begin after training is completed and segregation is only temporary until Sarawak ends their phased approach on joining FLEGT VPA (Abi A., Kugan F. & Wong B., pers. comm. 2014).

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3.4 Although Sabah is not yet a VPA party, it is assumed that TLAS is implemented locally and further conducts and timber related trades are to be dictated by the system.

Section 4 : Resolutions and authoritativeness

5.1 It is necessary that all quarters involved with negotiations and decision-making processes to be professionally prompt and to avoid delays as much as possible. A greater part of the negotiation process of implementing FLEGT-TLAS in this country has been wasted on delays and adjournments, especially in the higher levels of authority. But it is understood no matter how timely and efficient we aspire to be, some matters and decisions are inevitable and require more time to be decided. Nevertheless, it is encouraged that the SFD, from all levels of position, swiftly resolve or avoid bottleneck situations, and at the same time be persistent and firm against delays caused by other associated organizations.

10.0 Conclusions

Since negotiations between Malaysia and the EU started in 2006, the FLEGT-VPA has yet to reach finality, and desirably the implementation phase. Nevertheless, the SFD will persist and make headway to administer the TLAS at the local level. The objective of the initiative is to combat and eradicate illegal timber trade, and ultimately illegal logging, at the domestic and international scale. This is in line with the mission and purpose of the SFD. The implementation of the system will significantly elevate the level of traceability and ensure that only legal timbers are traded in the market. This will also indirectly decrease the crime volume of illegal logging. When the demands stop, the supply stops as well. Various setbacks and obstacles have been identified in the negotiation stage of the FLEGT-TLAS, and the appropriate solutions and good practices have been outlined in this report. It is hoped that with these observations and recommendations, the SFD will be more capable and efficient in implementing TLAS and coping with any future issues in this system.

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Annex I

Table 1: Sabah Independent Auditing of SFMLA Projects: Summary Results for 6th Audit 2013.

No.	SFMLA Holders	FMU	License No.	%C	C	P	NC	NA	Total Criteria	Total Applicable Criteria
1.	Lebihasil Sdn Bhd	17A	SFMLA 01/05	100	22	0	0	8	30	22
2.	Maxland Sdn Bhd	17A	SFMLA 01/07	100	21	0	0	9	30	21
3.	Lebihasil Sdn Bhd	17B	SFMLA 01/05	100	22	0	0	8	30	22
4.	Maxland Sdn Bhd	17B	SFMLA 01/07	100	21	0	0	9	30	21
5.	Maxland Sdn Bhd	17B (Area C)	SFMLA 01/07	100	21	0	0	9	30	21
6.	KTS Plantation Sdn Bhd		JP(SLK)125/96 (CO)	100	26	0	0	4	30	26
7.	KM Hybrid Plantation Sdn Bhd	11	SFMLA 01/04	100	16	0	0	14	30	16
8	Top Quantum Sdn Bhd	25	SFMLA 01/09	100	16	0	0	14	30	16
9.	Sabah Forest Industries Sdn Bhd	7	JP(KSG)107/96(CO) & JP(KSG)108/96(CO)	98	24	0.5	0	5	30	25
10.	TH-Usia Jatimas Sdn Bhd	18	SFMLA 12/97	97.9	23	0.5	0	6	30	24
11.	Jayakuik Sdn Bhd	1	SFMLA 01/08	97.5	19	0.5	0	10	30	20
12.	Rakyat Berjaya Sdn Bhd	15	SFMLA 07/97	96.7	28	1	0	0	30	30
13.	Bornion Timber Sdn Bhd	11	SFMLA03/97	96.2	25	0	1	2	30	26
14.	Begaraya Sdn Bhd		TPFMA	95.8	22	1	0	6	30	24
15.	First Greenworld Sdn Bhd	25	SFMLA 02/2009	94.4	17	0	1	12	30	18
16.	TSH Resources Berhad	4	SFMLA 07/97	94.4	24	1.5	0	3	30	27
17.	Rakyat Berjaya Sdn Bhd	16	SFMLA 07/97	93.1	26	1	1	0	30	29

18.	Rakyat Berjaya Sdn Bhd	24	SFMLA 07/97	92.9	10	0.5	1	9	30	21
19.	Sapulut Forest Development Sdn Bhd	14	SFMLA14/ 97	91.1	25	1	2	2	30	28
20.	TH-Bonggaya Sdn Bhd	18	SFMLA 11/97	89.6	19	2.5	0	6	30	24
21.	Eco-Plantation Sdn Bhd	2	SFMLA05/ 97	88.1	16	2.5	0	9	30	21
22.	Rakyat Berjaya Sdn Bhd	23	SFMLA 07/97	87.5	19	2	1	6	30	24
23.	Timberwell Berhad	3	SFMLA 06/97	84	20	1	3	5	30	25
24.	Makmuran Sdn Bhd		COKG 2/91	81.6	15	0.5	3	11	30	19
25.	Lagenda Aktif Sdn Bhd	11	SFMLA 02/2012	78.8	20	0.5	5	4	30	26
26.	Anika Desiran Sdn Bhd	5	SFMLA 10/97	75	15	3	3	6	30	24

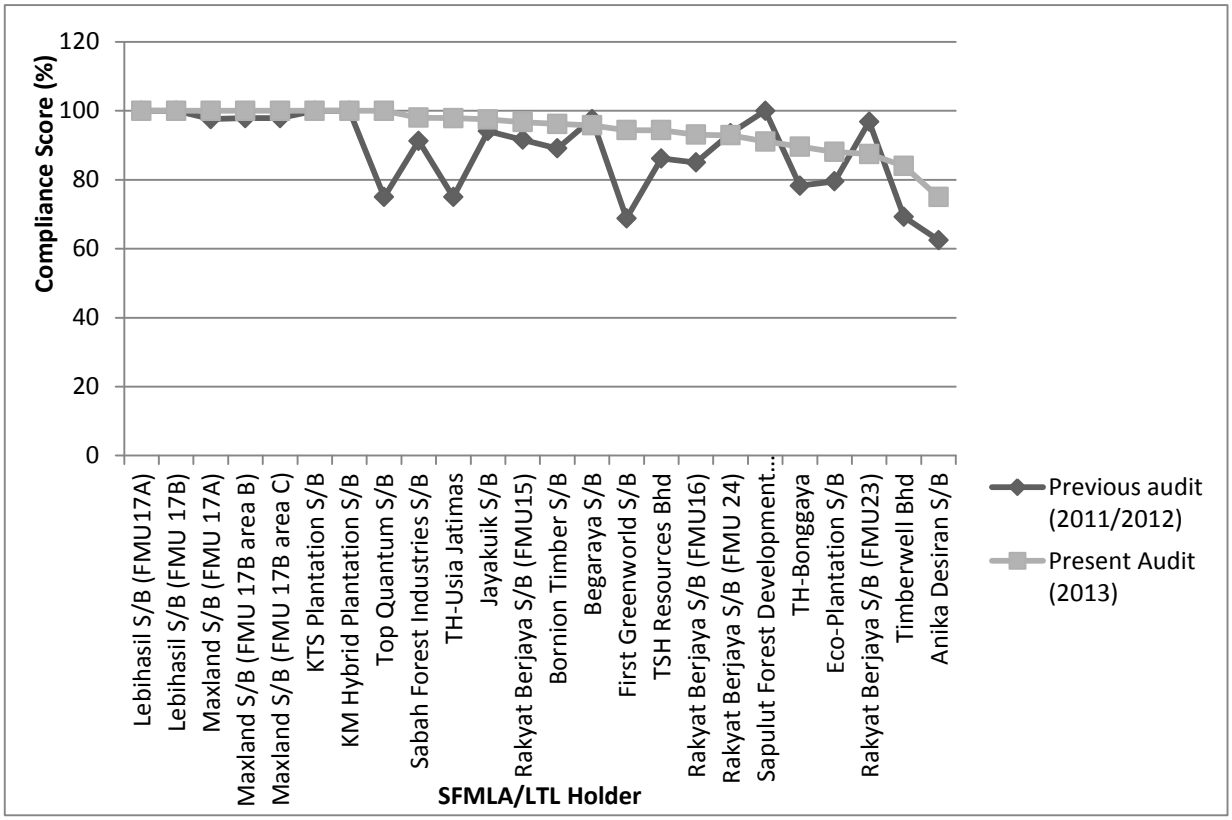
LEGEND:

% C : Percentage compliance
C : No. of full compliance criteria - no gap in performance on elements of the standard that are not applicable.
P : No. of partial compliance criteria - with minor gaps in compliance.
NC : No. of non-compliant criteria - inadequate compliance to the criteria.
NA : No. of not applicable criteria.

*Note : Even though the licensee has achieved 80% compliance, it is still considered failed due to non-compliance by attaining one or more applicable critical criteria.

Annex II

Chart 1: Graph showing the percentage of compliance in previous audit (2011/2012) and 2013 audit.



Weighting Procedure

Critical Criteria: Compliance must achieve 80 % and above of the total criteria.

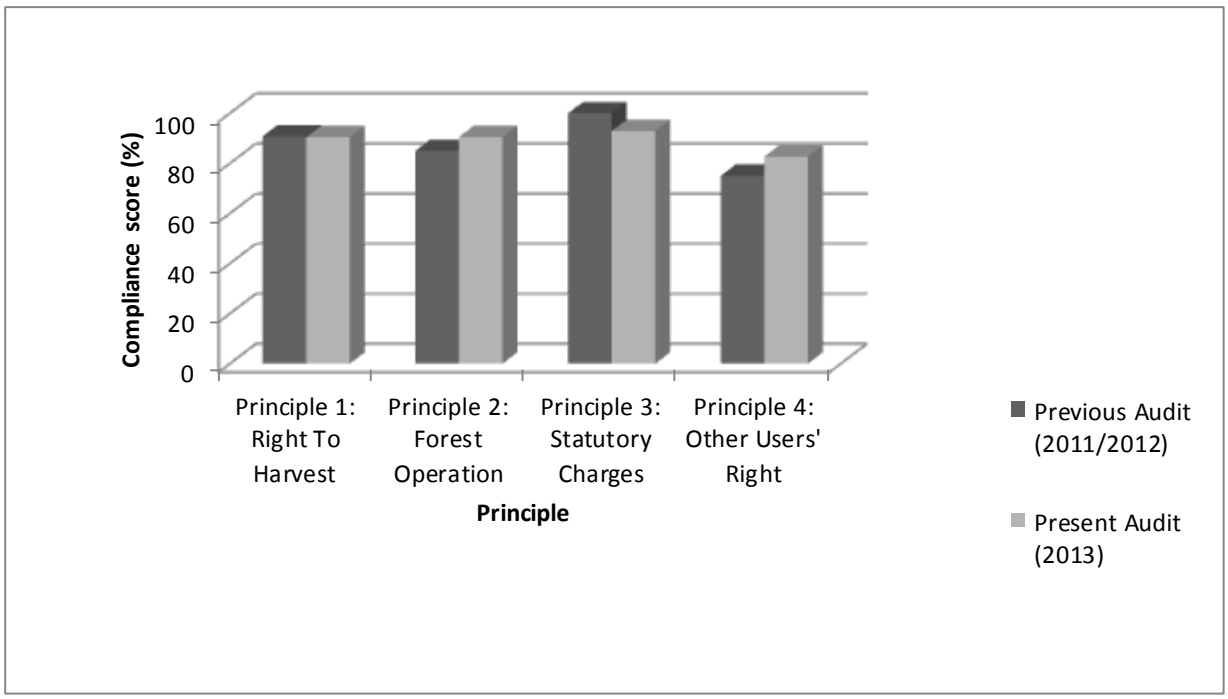
Non Critical Criteria: Full Compliance must achieve at least 80 % compliance of the total criteria, whereas Partial Compliance is at 50 % to 80 % compliance of the total criteria. Anything below 50 % would be considered Non Compliance.

Annex III

Table 2: Overall average compliance for applicable criteria within each principle.

Principle:	Criterion	Total indicators	Compliance % (2013)
1. Right to harvest	1.1 - 3.8	14	90.45
2. Forest operation	4.1 - 10.2	12	90.50
3. Statutory changes	11.1	1	92.86
4. Other user's right	12.1 - 12.3	3	82.69
Overall average compliance			**89.13**

Chart 2: Comparison of compliance for each Principle between previous audit (2011/2012) and 2013 audit.



PAPER 2: 5

EMERGING INTERNATIONAL FOREST AND FOREST RELATED ISSUES: CHALLENGES TO FORESTERS FOR FUTURE FORESTRY SECTOR DEVELOPMENT IN MALAYSIA

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ABSTRACT

The issues of environment and forest get the world's attention since the Forestry Conference of the United Nations (UN) on the Environment and Man in Stockholm, Sweden in 1972. It became more pronounced and was warmly debated during the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992. It was the beginning of an era in which forestry issues were discussed at a global arena in a comprehensive and integrated manner. Issues in forestry matters are cross-cutting and are discussed at many international processes as well as at regional and national levels. Malaysia is a party to various international conventions on forests and environmental related agreements. These international processes either directly or indirectly touch on forestry issues that are related to sustainable forest management, biodiversity conservation, environmental protection and lately trade. To add to complication, NGOs have established their own platforms and mechanisms to discuss similar forestry matters. Furthermore, in an increasing liberalized and borderless world where trans-boundary and global environmental impacts of forest and forest-related activities are also the concern of other nations. This paper attempts to highlight the challenges confronting foresters in addressing forest and forest-related issues in formulating future strategies for forest sector development in Malaysia.

1. INTRODUCTION

1.1 Forest and forest related issues are discussed at many international and regional fora not just by natural resource stakeholders and managers but by public at large. The world community as well as the public changing values and priorities on the roles of forest such as in the regulation of climatic and physical conditions, the safeguarding of water catchment areas, regulating soil fertility, providing aesthetic and recreational amenities, as well as the conservation of biological diversity. With the advancement of globalization some of the most important effects on forests and forestry in many countries in the region are the result of international and regional developments.

1.2 Many, significant changes have taken place in the forestry sector since the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil from 3 - 14 June, 1992. These changes occur both within and outside the sector with some of them having specific impact on individual countries while many of the important changes are global in nature.

1.3 International issues related to forest among others include sustainable forest management, illegal logging, trading of legally source timber and timber products, climate change and biodiversity conservation. Forestry matters have become cross-cutting issues at many international processes and included in the environmental agenda.

1.4 In the early years the debate on environmental issues, Malaysia had participated actively in the debate of forest and forest-related matters at the first United Nations Conference on Environment and Development (UNCED) and currently United Nations Forum on Forest (UNFF). Malaysia is a party to a number of Convention such as RAMSAR Convention on Wetlands, the Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC), International Tropical Timber Agreement (ITTA), and Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES).

1.5 The enormous diversity in economic, social, political and institutional conditions among the countries of the world makes it extremely difficult to provide a generalized description of change in forest and forestry. The change in forests and forestry will be much influences by changes outside the sector, rather than actions within the sector itself. Plus awareness about worldwide environmental issues which relates to forestry has grown substantially during the past decade.

1.6 This paper aims to elaborate some emerging international forest and forest related issues in the context of Malaysia's future forestry sector development in Malaysia towards the year 2020 and beyond.

2.0 INTERNATIONAL FOREST AND FOREST RELATED INSTRUMENTS

2.1 The current international forest and forest related instruments aims at regulating certain forest activities. Internationally, these instruments are categorized into two categories that is legally binding and non-legally binding. Legally binding instruments are agreements and conventions which members of the participating country is a signatory to it. While non-legally binding instruments have no legal implication on the participating countries. These instruments appear in agreements, conventions, conferences, forums, meetings and workshops.

2.2 The instruments are further classified into bilateral, regional and multilateral. Some of the bilateral instruments such as Malaysia-Japan Free Trade Agreement, Malaysia-European Union Partnership Cooperation Agreement, Malaysia- European Union Voluntary Partnership Agreement. While some of the regional instruments amongst others ASEAN Ministers On Agriculture And Forestry (AMAF), ASEAN Senior Officials On Forestry (ASOF), ASEAN Economic Cooperation and ASEAN- Free Trade Agreement. The well known multilateral instruments signed by Malaysia are United Nations Framework Convention on Climate Change (UNFCCC), Convention on Biological Diversity (CBD), Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), and RAMSAR Convention on Wetland.

2.3 Forests and forestry related issues were documented under the various instruments and discussed cross-cuttingly in agreements, conventions, conferences, forums, meetings, workshops and also seminars. The forest and forest related instruments that Malaysia's dealt with as listed in Annex I.

3.0 EMERGING FOREST AND FOREST RELATED ISSUES

3.1 Sustainability Of Natural Tropical Forest Resources

3.1.1 Sustainable Forest Management and Certification

3.1.1.1 Sustainability of the forest resource is about the functions and services provided by forest, and about meeting the concerns and expectations of civil society, as well as equity. In general term it implies that the invaluable forest resource has to be managed to ensure a continuous flow of goods and services in perpetuity for the benefit of the people, and which is compatible with the need to preserve the forest ecosystem and the environment.

3.1.1.2 In 1992, ITTO defined Sustainable Forest Management as "The process of managing permanent forest land to achieved one or more clearly specified objectives of management with regard to the production of continuous flow of desired forest products and services without undue reduction in its inherent values and future productivity and without undue undesirable effects on the physical and social environment''. This has been the practice in Malaysia of selective harvesting of the natural inland forests to ensure that the larger remaining trees would reach commercial sizes in 25 to 55 years for a second rotation of harvesting.

3.1.1.3 Forest management certification has emerged as as an innovative market instrument to promote sustainable forest management. It is an instrument used to confirm the achievement of certain predetermined performance standards of forest management in a given forest area. The current acceptance of timber certification by over 30 countries worldwide which are working on or have completed national certification standards or schemes may have more to do with their desire to maintain existing market share or increase market access of their forest products. However, the efficiency of this instrument to promote sustainable forest management is still subject to considerable debates at the international level.

3.1.1.4 Currently, Malaysia has her own standards of Criteria and Indicators for Forest Management Certification. The Criteria and Indicators is elaborated based on the ITTO's *Criteria for the Measurement of Sustainable Tropical Forest Management*.

3.1.1.5 International Tropical Timber Organisation, in 2013 had proposed a revised version of guidelines for sustainable forest management under the title "The Revised International Tropical Timber Organisation (ITTO) Guidelines For The Sustainable Management Of Natural Tropical Forests 2013". Malaysia is one of the member country that summited a lengthy and comprehensive comments, suggestion and intervention to this revised guideline.

3.1.1.6 Among the latest intervention by Malaysia read as follows:

(a) The proposed Guidelines are more than over-ambitious. When ITTO commenced operational activities, a study was undertaken to assess the status of forest management in its producer member countries. The findings were published in "No Timber Without Trees: Sustainability in the Tropical Forest" in 1989 which reported only about one million hectares could be considered to be under sustainable management. In a follow-up study released by the ITTO in 2011, it was reported that the area under Sustainable Forest Management (SFM) has increased to 30.6 million hectares out of which 17 million hectares had been certified for sustainability based on existing Guidelines. This assessment covered some 1.4 billion hectares of tropical forests in ITTO member countries. Although the situation has since improved, these statistics clearly demonstrate the enormity of the challenges producer countries face in implementing SFM even using current guidelines. Strong efforts are always being exercised to use existing guidelines to expand the area of tropical forests managed sustainably and certified rather than adopt new guidelines.

(b) The implementation of SFM requires strong institutions and resources, both human and financial, which are still a significant constraint to the nation. The proposed Guidelines are so stringent and complicated, that are beyond the requirements of certification for sustainability and legality verification. The proposed Guidelines have 16 Principles instead of the existing 10 including 2 Principles dealing with climate change and carbon stocks. These two new Principles are so complicated in nature that require a very sound scientific research input and should not be included in the guidelines.

3.1.2 Conservation Of Forest Resources

3.1.2.1 Malaysia had various national strategies and programmes to curb illegal deforestation such as enhancement of forest law, strong enforcement and governance, application of technology as well as forest certification initiative. In 2012, Malaysia had about 69% of gazetted forest area which include totally protected areas. At the international level, the involvement of Malaysia in the Asia Pacific Economic Corporation - Expert Group on Illegal Logging And Associated Trade (APEC-EGILAT) is very crucial as the foundation of instrument of the group was lead by Malaysia as the first chairmanship. The chairmanship was accorded to YBhg. Dato' Prof. Dr. Hj. Abd. Rahman bin Hj. Abd. Rahim, Director General Forestry Peninsular Malaysia who is a very dedicated forester.

3.1.2.2 At the 38th Session the FAO Conference adopted the Report of the 14th Regular Session of the Commission on Genetic Resources for Food and Agriculture and adopted the Global Plan of Action for the Conservation, Sustainable Use and Development of Forest Genetic Resources. Malaysia also welcomes FAO to support the effective implementation of the Global Plan of Action (GPA) and initiate appropriate support to address the strategic priorities for GPA.

3.1.2.3 Malaysia acknowledges the importance of conserving forest resources as Malaysia is one of the 12 mega-diverse countries and her rich biological heritage has a huge potential to be explored for new wealth creation and to enhance the development of the nation in line with the National Policy on Biological Diversity (1998) and the National Biotechnology Policy (2005). The Convention on Biological Diversity gives the recognition that biological diversity is the sovereign right of a nation opposed to the view that biological resources are the common heritage of mankind.

3.1.2.4 At the tenth meeting of the Conference of the Parties, held in Nagoya, Aichi Prefecture, Japan, adopted a revised and updated Strategic Plan for Biodiversity. Some examples of the Aichi Biodiversity Targets which relates to forestry are:

- ✓ At least halve and, where feasible, bring close to zero the rate of loss of natural habitats, including forests.
- ✓ Establish a conservation target of 17% of terrestrial and inland water areas and 10% of marine and coastal areas.
- ✓ Restore at least 15% of degraded areas through conservation and restoration activities.

3.1.2.5 As a nation subscribing to international instruments, foresters must be familiar with the details contents of those related instruments domestically and internationally.

3.1.3 Forest Ecosystem Management Approach

3.1.3.1 Forest ecosystem approach emphasizes the ecological integration of forest ecosystem into other neighbouring ecosystems and encompasses more than just the forest aspect. In addition, sustainable forest management sets specific targets of action to assess progress towards the achievement of sustainable management of a given forest management unit, while the ecosystem approach does not contain targets, but advocates the starting point for action in managing the ecosystem through adaptive management to deal with the complex and dynamic nature of ecosystems in understanding their function.

3.1.3.2 The application of the ecosystem approach is to consider all the twelve guiding principles in Decision V/6 of the CBD as a package taking into account local conditions. As such, the application of an ecosystem approach which is best applied at the landscape level has given rise to an apparent paradox in using the ecosystem approach in managing forest resources at the local level or at the level of forest management units, especially those that are subject to forest management certification in the overall context of timber labelling and certification that is currently demanded by the environmentally sensitive markets in Europe and the United States of America.

3.1.3.3 This is in view that managing forest resources at this level would not be able to embrace and address simultaneously in a holistic and integrated manner all the ecological goods and services provided by forest equitably as the unit of management may be too small to permit the management of all ecological processes. However, the aggregation of each individual management unit which is being managed for the production of a single or few forest goods and services based on an ecosystem approach, when treated as a whole at the landscape level, would be identical to managing the forest resources through an ecosystem approach as envisioned in the CBD.

3.1.3.4 It should also be noted that the application of the ecosystem approach as guided by the twelve principles are not specifically related to forests, for example, the call to reduce market distortion and perverse incentives in Principle 4, as well as the negative externalities that impair forestry are often found beyond the sphere of influence of the forestry sector itself. Hence, if an ecosystem approach is to be applied in managing forest resources, then it should be based on certain specific interpretations of the ecosystem approach and not the general formulations of the twelve guiding principles of the ecosystem approach which are hardly operational as yet.

3.1.3.5 If forest is to be truly managed through an ecosystem approach then it is pertinent to have analytical tools to evaluate the trade-offs between short-term benefits and long-term goals of the various goods and services provided by forest; forecasting models to assess the social, cultural and environmental consequences of management action that take into account the ecological tolerances and resilience of the forest ecosystem; cost-effective methodologies to conduct inventory that encompasses the full range of ecological, biological and social diversity of forest; environmental impact assessments that cover all the components of biological diversity, as well as the potential off-site impacts on adjacent and other ecosystems, including social impact assessment; knowledge and sciences required to define the ecological rotations of the various goods and services provided by forest, and the "desired forest future"; and the full economic valuation of forest goods and services that would enable the internalization of costs and benefits of the forest ecosystem.

3.1.3.6 The concepts of ecosystem approach and sustainable forest management put people at the centre of management, as well as the need for transparent stakeholders participation involving a combination of bottom-up and top-down approaches, although the ecosystem approach of the CBD seems to place greater emphasis on the content and comprehensiveness of the principles, rather than what precisely needs to be achieved and how that achievement could be demonstrated through management. Nevertheless, the long-term goals of sustainable forest management in the overall context of sustainable development should be viewed as identical to the vision of managing forest resources through an ecosystem approach.

3.2 Environmental Issues

3.2.1 In pursue for sustainable development the uptrend awareness and sensitivity among the general public on the use of forest goods and environmental services. The environmental issues are discussed at local, national, regional and global level. A great deal of Malaysian have a strong environmental bonding rooted in their livelihood in the context of social aspect and cultural beliefs. Local communities commonly raised local environmental issues with regard to conservation of forests and related natural resources. This lead the government for a more systematic efforts to assess the impact of development activities on the livelihoods of the local communities. There had been initiated to introduce a public hearings for a more broad participation among local communities in decisions making that have environmental implications.

3.2.2 In addressing national level environmental issues such as forest fire and landslide the response is triggered by the government. This has lead the government to improve guideline in managing the forests. Domestically, there are active organizations in driving the environmental agenda comprises of several non-governmental organizations including civil society. In response to local and national environmental issues an environmental court had come into force. The nation is also in the process reviewing the national forest policy as well as strengthening forest legislation.

3.2.3 The regional and global environmental issues such as transboundary smoke haze, wildlife enforcement networks and shared ecological corridors, present challenges to the country. Managing shared forest boundaries, forest ecosystem and forest water resources had been initiated in an attempt to coordinate joint management of forestry resources for mutual benefits. One of this joint management is the Heart of Borneo Initiative between ASEAN Member States of Brunei, Indonesia and Malaysia.

3.2.4 Increasingly, global environmental issues are influencing resource-use decisions. This largely stems from the fact that many environmental problems are global in nature, affecting all human beings, and need to be addressed through collective global action. Climate change is one of the most important of these and, not surprisingly, international initiatives are becoming a major driver of climate change mitigation and adaptation efforts.

3.3 International Legal Framework On Forests

3.3.1 The call for a legal framework on forests to enhance the conservation and sustainable management of all types of forests was rigorously debated at UNCED and has been on the international agenda especially UNFF. At the early stage of discussion, both the Intergovernmental Panel on Forests (IPF) and the Intergovernmental Forum on Forests (IFF) could not reach consensus to initiate the negotiation for a legally binding instrument on forests, although Malaysia together with a total of 30 other countries supported it.

3.3.2 Currently, there is still no single legally-binding international instrument that deals exclusively with forests. The intension of some countries for the creation of a legally-binding instrument (LBI) on forests at UNCED and in the post-Rio process was to establish a framework covering the various issues of the fragmented or scattered international forest regime. However, there are a number of legally-binding conventions or agreements that have effect on the management of forest resources and trade of forest and forest related products. Amongst others such as CDB, CITES, UNCCD, UNFCC, United States of America Lacey Act, European Union Forest Law Enforcement, Governance And Trade (FLEGT) and Australia Illegal Logging Prohibition Bill.

3.3.3 The period between 2013 and 2015 will shape the future of the global development agenda and related institutional modalities as the international community is engaged in operationalizing the outcome of the United Nations Conference on Sustainable Development and designing the post-2015 United Nations development agenda. This period will also be decisive for the future of the international arrangement on forests, because the Forum should take a decision on this matter at its eleventh session. These major issues are closely interlinked and will have an impact on each other. Substantive preparatory work on the international arrangement on forests and a comprehensive assessment of the implications of the United Nations Conference on Sustainable Development and the post-2015 United Nations development agenda are elements necessary to enable the Forum at its eleventh session to fulfil its mandate to review the effectiveness of the international arrangement on forests and decide on the future global policy architecture on forests.

3.3.4 Nevertheless, this conference may recommend a specific platform or forum to consult Malaysian foresters and related stakeholders on their views and responses on a legally-binding international instrument that deals exclusively with forests.

3.4 Timber Legality And Trade

3.4.1 Emerging Legality Restrictions

3.4.1.1 Most of the exports from the wood-based industry in Malaysia in future would be wood-based panel products, especially furniture, and laminated scantlings (lamscants) for the production of windows and doors, including oriented strand boards, and other higher-valued products to cater for niche markets. Most of this product is subjected to legal requirement when entering United States of America, European Union and Australian markets.

3.4.1.2 In the Star newspaper dated 7 July 2014, Martin Khor Executive Director of South Centre discussed on the Trans Pacific Partnership Agreement (TPPA) on the possible trade restrictions on timber related product in TPPA. He mentioned there are chapters on labour and environment standards that are of a standard acceptable to US administration, Congress and constituency groups. He correlates chapters on labour and environment standards that may cause deforestation or pollution.

3.4.1.3 Malaysia also recognizes many ongoing international initiatives on forest law enforcement and legally harvested timber such as FLEGT, US Lacey Act and Australian Illegal Logging Prohibition Act. However, to enable Malaysia to comply with all the requirement of import markets, the financial burden for managing forest sustainably should be compensated with fair price through green premium.

3.4.2 United States of America Lacey Act, European Union Forest Law Enforcement, Governance And Trade (FLEGT) and Australia Illegal Logging Prohibition Act

3.4.2.1 The World Bank reports, illegal logging costs developing countries over $10 billion in lost assets and revenues every year. With a significant proportion of global wood trade estimated to be illegal, illegal logging also undermines the legitimate forestry sector by creating unfair competition with undervalued products.

3.4.2.2 In 2008 the US Congress amended the Lacey Act making it, illegal to import, export, transport, sell, receive, acquire or purchase in interstate or foreign commerce, any plant taken or traded in violation of the laws of US, a US State, relevant foreign laws.

3.4.2.3 The European Union imposed that business outlet whose place timber products on the market to undertake due diligence and makes it an offence to place illegal forest products on the EU markets. The Forest Law Enforcement, Governance and Trade recognizes the role of both producers and consumers in curbing illegal timber trade.

3.4.2.4 As for Australia Illegal Logging Prohibition Bill prohibit the importation into Australia and domestic processing of illegally logged timber and timber products. Australian timber importers are subject to make a declaration that they had taken the required due diligence.

3.5 Forests And Climate Change

3.5.1 Increasingly, global environmental issues are influencing resource-use decisions. This largely stems from the fact that many environmental problems are global in nature, affecting all human beings, and need to be addressed through collective global action. Climate change is one of the most important of these and, not surprisingly, international initiatives are becoming a major driver of climate change mitigation and adaptation efforts. Following UNCED there have been a number of international conventions relating to various aspects of the environment – for example, the Convention on Biological Diversity (CDB), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC). Several other agreements and conventions precede UNCED, for example, the Convention in International Trade in Endangered Species (CITES) and the Convention on Wetlands of International Importance (Ramsar Convention). Most international environment conventions and agreements are backed by various implementation mechanisms, providing technical and financial assistance to facilitate country level action. Many countries have developed national strategies and action plans for aspects such as biodiversity conservation, control of desertification and climate change mitigation and adaptation, taking advantage of the various conventions. However, implementation often lags behind policy development on account of resource and institutional constraints.

3.5.2 With regard to Copenhagen Accord 2009 - United Nations Climate Change Conference 2009 in Copenhagen there is a Forest-specific text which occurs in two sections. They are as follows:

(a) **Section 6:** We recognize the crucial role of reducing emission from deforestation and forest degradation and the need to enhance removals of greenhouse gas emission by forests and agree on the need to provide positive incentives to such actions through the immediate establishment of a mechanism including REDD-plus, to enable the mobilization of financial resources from developed countries.

(b) **Section 8:** Scaled up, new and additional, predictable and adequate funding as well as improved access shall be provided to developing countries, in accordance with the relevant provisions of the Convention, to enable and support enhanced action on mitigation, including substantial finance to reduce emissions from deforestation and forest degradation (REDD-plus), adaptation, technology development and transfer and capacity-building, for enhanced implementation of the Convention. The collective commitment by developed countries is to provide new and additional resources, **including forestry and investments through international institutions, approaching USD 30 billion for the period 2010 - 2012** with balanced allocation between adaptation and mitigation. Funding for adaptation will be prioritized for the most vulnerable developing countries, such as the least developed countries, small island developing States and Africa. In the context of meaningful mitigation actions and transparency on implementation, **developed countries commit to a goal of mobilizing jointly USD 100 billion dollars a year by 2020 to address the needs of developing countries**. This funding will come from a wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance. New multilateral funding for adaptation will be delivered through effective and efficient fund arrangements, with a governance structure providing for equal representation of developed and developing countries. A significant portion of such funding should flow through the Copenhagen Green Climate Fund.

3.6 Gender And Local Community In Forest Management

3.6.1 The social dimension in sustainable forest management deals with a wide variety of aspects that include gender and indigenous peoples rights to health and safety issues in the local employment. The Malaysian forestry sector recognizes the importance of gender equality in forest management and policy decision making. There are continuous effort in identifying challenges and opportunities for improving gender equality in forestry. The country as a whole is still in the process of closing the gender gaps by strengthening the capacity and providing technical support for gender mainstreaming and the collection of gender-disaggregated data in the forest sector.

3.6.2 Forests were regarded as very mean to sustaining daily lives by the rural poor, through the use of wood materials and a variety of non-wood forest products. In the common practice by the locals used of wood materials and a variety of non-wood forest products were for individual household purposes. However, recent information reveals a rise in such products in the informal sector market, for additional cash income.

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3.6.4 Employment opportunities provided by forests were equally emphasized. Opportunities in forestry-based jobs as well as the direct contribution of forests to food security were considered critical to the livelihoods of the rural poor. The decentralized nature of the forest sector was underlined, referring to the fact that, for communities living on fringes of forests and often in such remote areas, forests provide the only possible source of employment, shelter, food and medicine.

3.6.5 This conference may wish to consider further work on gender equality and provide relevant recommendations for the conference. As for the local community, the conference may wish to relate to existing domestic policies already is existence the contribution of local community in SFM practices.

3.7 Access And Benefit-sharing (ABS)

3.7.1 Malaysia views that the access to, and fair and equitable sharing of benefit arising from the utilization of biological and genetic resources and traditional knowledge are currently inadequately regulated and thus urgent need to protect them from bio-privacy or illegal, unreported and unauthorized bio-prospecting and exploitation. Therefore, it is hoped that Malaysia and the G77 and China countries should endeavor to implement the provisions of the Convention on Biological Diversity (CBD) on the global recognition of the sovereignty of states over their resources and traditional knowledge.

3.7.2 The Conference of the Parties to the CBD, Malaysia in February 2004, had adopted a decision to mandate its *Ad hoc* Open-ended Working Group on Access and Benefit-sharing to elaborate and negotiate an international regime on access to genetic resources, and the sharing in a fair and equitable way the results of research and development, as well as the benefits arising from the commercial and other utilization of genetic resources, including forests, on mutually agreed terms between contracting parties.

3.7.3 Access and Benefit-sharing to elaborate and negotiate on the nature, scope, and elements of the international regime on access and benefit-sharing, including an analysis of existing legal and other instruments at national, regional and international levels relating to access and benefit-sharing, as well as access contracts, compliance and enforcement mechanisms.

3.7.4 Malaysia is in the process of drafting Access and Benefit Sharing Law. The objective of this Bill is to implement the objectives under the Convention on Biological Diversity specifically on access to biological resources and the sharing of benefits arising from their utilization.

3.8 Forest Financing

3.8.1 Forest financing is heavily dependent on domestic funding. It is generally derived from government revenue and revenues generated from state owned forests. Finance has remained a critical challenge for a proper and consistent management regime on forests. Forests are long-term endeavours which require continued investment for their maintenance, whereas decision-makers with financial resources (both public and private) are generally guided by short-term considerations. As many forest products and services are still not compensated for attracting sufficient finance for sustainable forest management has remained a major challenge in the country and also most parts of the world, and a constant issue of discussion at international policy fora, including at UNFF.

3.8.2 Financing for Sustainable Forest Management activities is very crucial for developing countries since the economic contribution from forestry sector is still the mainstream for sustainable development agenda. Malaysia as a member of G77 countries plus China's reiterated at UNFF10 in support for the establishment of the voluntary Global Forest Fund for Sustainable Forest Management.

3.9 Valuation Of Forest Resources

3.9.1 Forest resources especially timber is value based on direct market transactions. The conventional valuation of forest resources does not taking into account the ecology, aesthetics and socio-economics role of the forests. A good economic valuation of the different goods and services provided by a forest is a complicated and complex task. The valuation exercise requires foresters to work closely with economics expert and expert from other related disciplines to provide a comprehensive report. The challenge to the forester is to produce the valuation report that shall be used by authorities in the process of decision-making for an effective and efficient management of the forest resources.

3.9.2 The emphasis on forests seen as only for timber production ought to be chained in view of environmental sensitive global community in this borderless world of information technology. Among the services of the forest that is widely discussed at national, regional and international level is, it's ability to sequestrate carbon. Forest for carbon sequestration is seen more important at global than at national or local levels. Valuation can contribute to setting levels of possible compensation to a country or to a local community that is obliged to conserve forests beyond its own needs or to refrain from using its forests' full production potential.

3.9.3 Forest Department Peninsular Malaysia (FDPM) had convinced a National Conference on Forest Economic Valuation on the 3 to 5 September 2014. The paper presented by YBhg. Dato' Prof. Dr. Hj. Abd. Rahman bin Hj. Abd. Rahim with the title "Contribution Of The Forestry Sector In Peninsular Malaysia Towards Malaysia's High Income Economy Status". Among the pertinent recommendation in his paper:

- ✓ Underlying and implementing forestry strategies to enhance effective future economic contribution of forestry to community livelihood in the Country.
- ✓ The establishment "**Centre for Forest Resource Accounting and Valuation**".

3.9.4 In this regard, the conference is urged to consider forest valuation as the nation major task in the near future in ensuring that sustainably use of the different goods and services from sustainable managed forests. The conference is also urged to support and reaffirm for The establishment "**Centre for Forest Resource Accounting and Valuation**" in-line with the resolution of National Conference on Forest Economic Valuation.

3.10 Payment for Ecosystem Services (PES)

3.10.1 Ecosystems provide the general society with a wide range of services from sustainable source of clean water to productive soil and carbon sequestration. Human kind relies on these services for raw material inputs, production processes, and climate stability.

3.10.2 To the best of this paper's knowledge, many of these ecosystem services are either undervalued or have no financial value tag to them. The decisions often focus on immediate financial returns in which many ecosystem landscape and functions are being ignored.

3.10.3 A Study conducted by Forest Trends, The Katoomba Group and The United Nations Environment Programme (2008) the Millennium Ecosystem Assessment, which included over 1,300 scientists from 95 countries found that over 60% of the environmental services studied are being degraded faster than they can recover. The study further reported that, in response to growing concerns, some formal and voluntary markets are emerging for ecosystem services in countries around the world. In addition, some business deals required investment in rehabilation and maintenance of particular ecological systems and the environmental services.

3.10.4 In Malaysia, PES is still a long way forward as the mechanism for it is still in infancy stage. Payment for Ecosystem Services offered tremendous potential in the field of capacity building, research and source of revenue.

3.11 Capacity-building And Technological Challenges

3.11.1 Capacity building and the transfer of technology remain a serious challenge for many developing countries, and efforts are being made to address those challenges internally as well as with cooperation from the outside. Technology transfers took different forms: multilateral projects, exchanges of experts and training that involved international organizations and donor countries. Frequently reported themes included mapping, monitoring and forest inventory systems, remote sensing technologies, projects on rehabilitation and afforestation, technologies in carbon stock enhancement, desertification and communal forestry/ participatory approaches.

3.11.2 Technological changes will be one of a significant challenges influencing forests and forestry sector. This due to the sector slow uptake and uncertain market demand and vague public policies towards the year 2020 and beyond. In this regard, direct investments by the government in capacity building and research plays the main role. This is to reduce dependent on technologies developed by other countries which may not meet local needs. Nevertheless, some technologies can be easily adopted and adapted while some require substantial modifications.

3.11.3 Technological innovation is much in demand to address emerging challenges of forest management such as efficient use of forest resources, forest environmental catastrophe, pests, diseases, and the demands of society, locally and internationally. Data gaps and continuous data resource monitoring and managing are among the challenges ahead. The need for sufficient and timely data on forest resources is crucial for management and decision-making.

4.0 CHALLENGES TO FORESTERS

4.1 Forest and forestry policies have been formulated to encompass the nation principles of sustainable forest management based on ITTO guideline on Sustainable Forest Management of tropical forest. The implementation of this guideline based on the country capabilities and differentiated responsibilities.

4.2 The complex task of sustaining the sustainability of natural tropical forest resources which is economically viable, socially accepted and environmentally sound is very much of challenge to foresters of today and beyond. The prospect of international financing and trade-related activities may offer prospects for new growth and directions in forestry to further promote sustainable forest management. The roles of civil society organizations, NGO's and the private sector through cooperation and collaborative approaches in forest related awareness programme is likely to be an uptrend pattern.

4.3 The task confronting foresters in addressing forest and forestry related issues are very complex in manner. Basically, foresters are trained on managing the forest and to deal issues on forest management. Since the era of UNCED that debated the issues on environment and forest then foresters were exposed to issues out of managing the forest only. In addressing international forest and forestry related issues, foresters need to know the instrument in which the issues are being raised. This is followed by understanding the issues in the instrument itself. The more complex task understands the terms or words used in text of the instrument. This is vital due to the implications on the use of the terms or words to the country.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Forest provides multiple goods and services not offered by any other forms of landscape. This will remain as a centre of discussion in international and regional initiatives. Sustainability of forest resources and environmental protection, as well as ecological stability are all an integral part of the overall global ecosystem. As agreed at UNCED, forest and forest related issues should be addressed in an integrated, holistic and balanced manner.

5.2 Malaysia is fully aware of the forest and forest related issues in which she is committed to a number of international conventions related to forest, environment and nature conservation. Being parties to the various conventions, Malaysia has to realize that international agreements has influences and will continuously influence the Malaysia's forest management practices and timber trade.

5.3 Forestry in the context of international community is more than just managing the forest. It has become more people centered, and public's perceptions on forests have undergone significant changes with increasing emphasis on the environmental and social values of forests. In this context, there will be an increase demand for stakeholders consultation and public participation including gender base and also local community as part of the decision-making process.

5.4 With the domestic and international community increasing demand and higher expectation from forestry sector, Malaysia's foresters have to redefine the roles and responsibilities in the year 2020 and beyond as by that time Malaysia will be declared as a developed nation. The home grown foresters are expected to have the ability and skills to manage the forest resource in meeting changing societal needs for both forest goods and services, and without unduly degrading the resource and the environment.

5.5 In view of the expanded roles of forest in meeting changing societal demands, future human resource development in Malaysia would place greater emphasis in enhancing knowledge and in the development and expansion of skills, such as in managing forests for bio-energy and in mitigating climate change; in the conservation of areas having high diversity and endemism and the effective management of watershed areas. On this point, there is an urgent need to provide training and exposure to the foresters so as to achieve multiple-resource forest management that involves the production of forest goods and services which is compatible with the need to conserve the forest ecosystem and protect the environment. There is also an urgent need for knowledgeable field professional forester involvement in the international negotiations so that practical limitations, workable practices, conservation importance and needs for sustainable economic and social development are always taken into account in agreeing to the decisions made. In this regard, there is need to provide continuous exposure to the foresters in international instruments with regard to agreement and negotiation as well as meeting.

5.6 Members of conference is urged to consider forest valuation as the nation major task in the near future in ensuring that sustainably use of the different goods and services from sustainable managed forests. The conference is also urged to support and reaffirm for The establishment "**Centre for Forest Resource Accounting and Valuation**" in-line with the resolution of National Conference on Forest Economic Valuation.

5.7 While forests are located within the boundaries of each states of Malaysia where each individual states have their absolute rights to manage and utilize them, it is recognized universally that many of the benefits derived from forests are of transboundary in nature. This is made even more crucial in an increasing liberalized and globalized borderless world where transboundary and global environmental impacts of forests and forest-related activities in individual states may affect other states and eventually other countries. Therefore, there is an urgent need to have a forester centred framework to assist in addressing the forest and forest related issues at the national, regional and global levels.

5.8 Significant challengers remain in many parts of the region and it is increasingly evident that countries cannot develop forestry policies in isolation – rights and responsibilities are increasingly spilling across sectors as populations increase, demands on resources heighten and economies integrate. Future forestry in Malaysia should focus not only on the improvement of sustainable forest management practices of natural forest for multiple use but also improvement in addressing international forest and forest related issues.

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PAPER 2: 6

PENGGUNAAN APLIKASI PAMIS (*PROTECTED AREA MANAGEMENT INFORMATION SYSTEM*) UNTUK MENAMBAHBAIK PENGURUSAN KAWASAN-KAWASAN TERLINDUNG SEPENUHNYA DI SARAWAK

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ABSTRAK

Kerajaan Sarawak telah mewartakan 44 buah 'Kawasan Terlindung Sepenuhnya' dengan keluasan 831,778.40 hektar. Ia terdiri daripada 31 Taman Negara, 9 Rizab Semulajadi and 4 Sanktuari Hidupan Liar. Usaha-usaha mengurus dan mengawal kawasan yang sebegitu luas adalah satu tugas yang amat mencabar. Maka, Sarawak Forestry telah mengguna-pakai satu aplikasi komputer, iaitu PAMIS, sejak tahun 2007 untuk menambahbaik sistem pengurusan dan pengawalan. Pengalaman menggunakan aplikasi PAMIS akan dibincangkan dalam kertas kerja ini.

1.0 PENGENALAN

Kerajaan Sarawak telah mewartakan 831,778.40 hektar sebagai Kawasan Terlindung Sepenuhnya. Kawasan-kawasan ini terdiri daripada 31 Taman Negara, 9 Rizab Semulajadi dan 4 Sanktuari Hidupan Liar dan kesemuanya merupakan aset-aset semulajadi yang penting di Sarawak dan ianya seharusnya diurus dengan mampan dan baik.

Untuk memastikan kawasan-kawasan tersebut diurus secara mampan, SARAWAK FORESTRY telah mengguna-pakai satu aplikasi komputer yang dikenali sebagai aplikasi PAMIS ataupun '*Protected Area Management Information System'.* Penggunaan aplikasi ini bertujuan untuk memastikan semua data *'geo-spatial'* yang dikumpul semasa menjalankan rondaan sempadan dapat dianalisis bagi tujuan perancangan dan pengurusan Taman Negara, Rizab Semulajadi mahupun Sanktuari Hidupan Liar. Semua data yang dikumpul akan dianalisa menggunakan aplikasi PAMIS dan disimpan secara digital di dalam Pelayan Utama (*Main server*).

Penggunaan PAMIS telah bermula secara berperingkat mulai tahun 2007 bagi mengantikan cara penyimpanan data-data secara konvensional dan 'manual'. SARAWAK FORESTRY telah mensasarkan lebih 10 Kawasan Terlindung Sepenuhnya untuk mengguna-pakai PAMIS bagi tujuan pengurusan, pengawalan dan pemantauan sempadan kawasan-kawasan tersebut.

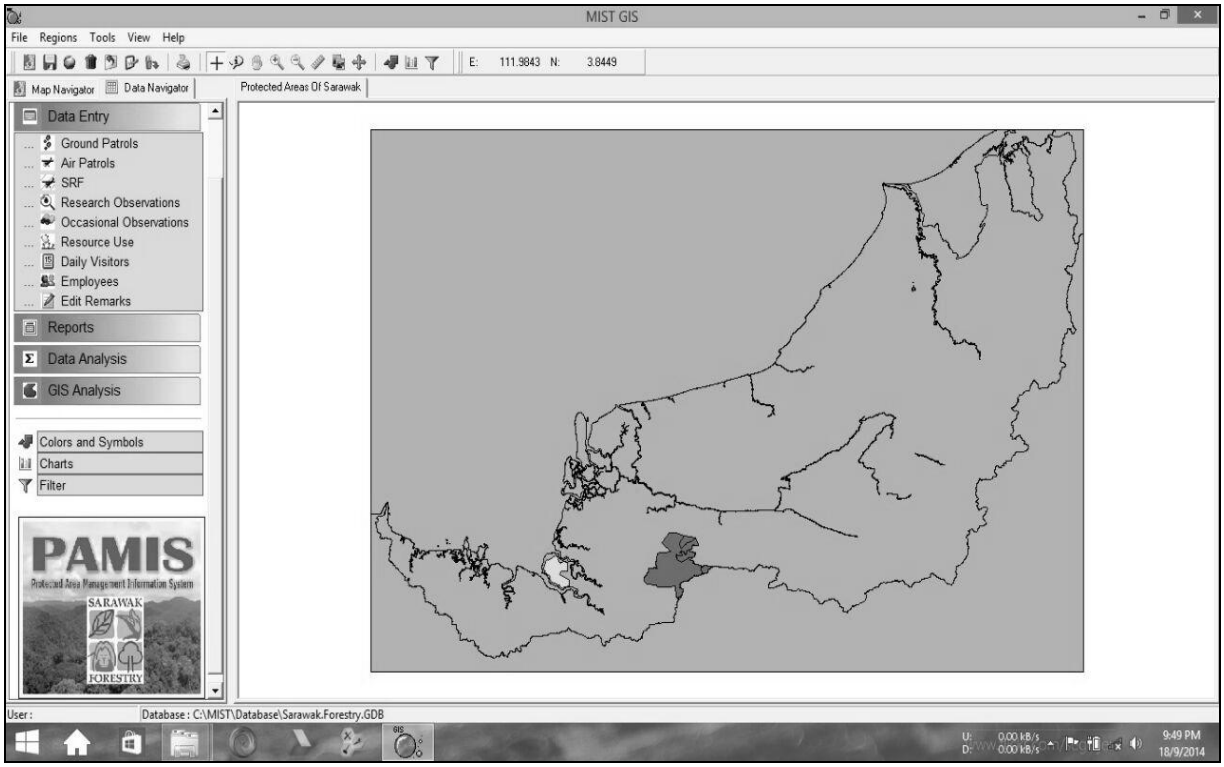
2.0 APLIKASI PAMIS

Aplikasi PAMIS ataupun terdahulu dikenali sebagai MIST merupakan salah satu aplikasi komputer yang telah lama diguna-pakai diseluruh dunia untuk mengurus, mengguna dan menyimpan data-data *'geo-spatial'* yang direkod semasa rondaan sempadan oleh renjer mahupun pekerja lapangan di kawasan-kawasan terlindung.

Ia mula diperkenalkan oleh Ecological Software Limited yang berpusat di Hungary dan diguna-pakai pada tahun 1999 di Uganda. Aplikasi yang mesra-pengguna ini memanipulasikan maklumat-maklumat yang dikumpul menggunakan GPS dan rekod bertulis untuk diintergrasikan menjadi satu maklumat yang lengkap dan tepat. Maklumat yang dihasilkan melalui aplikasi ini adalah berbentuk *'real-time'* dan amat berguna bagi memudahkan pihak pengurusan membuat keputusan dalam masa yang singkat. Aplikasi ini merupakan satu aplikasi komputer '*Open source*' yang mana ianya boleh dimuat-turun secara percuma daripada halaman sesawang *www.ecostats.com*. Aplikasi PAMIS amat mudah digunakan dan boleh diubahsuai untuk menepati keperluan pengguna.

Selain daripada penggunaan sistem berkomputer, aplikasi PAMIS juga memberi penekanan kepada prosedur pengumpulan data lapangan yang betul. Ini termasuklah prosedur dan aktiviti yang perlu dilaksanakan sebelum, semasa dan selepas rondaan sempadan dijalankan seperti taklimat sebelum rondaan, prinsip pengumpulan data yang betul dan taklimat selepas rondaan bagi berkongsi maklumat terkini kepada pihak pengurusan.

Gambarajah 1: Papan pemuka aplikasi PAMIS ataupun MIST 2.2.3.4.



Pengguna PAMIS boleh mengaksesnya di mana-mana lokasi yang mempunyai talian internet. Bagi memastikan keselamatan dan integriti maklumat yang disimpan di dalam Pelayan Utama, pengguna akan diberikan kata kunci yang mempunyai peringkat akses ke dalam PAMIS dan dihadkan penggunaan maklumat mengikut keperluan pengguna.

3.0 PENGGUNAAN APLIKASI PAMIS OLEH SARAWAK FORESTRY

Pada mulanya aplikasi PAMIS telah diperkenalkan oleh Wildlife Conservation Society-Malaysia (WCS) mulai tahun 2007 sebagai percubaan di Sanktuari Hidupan Liar Lanjak-Entimau selama dua tahun. Pada masa yang sama, beberapa siri latihan anjuran-bersama WCS dan Sarawak Forestry telah diadakan bagi melatih pegawai-pegawai SARAWAK FORESTRY agar dapat menggunakan aplikasi PAMIS. Sebilangan pegawai SARAWAK FORESTRY juga dihantar ke Taman Negara Endau Rompin untuk menyaksi sendiri cara PAMIS digunakan di Taman Negara tersebut.

Bermula pada tahun 2010, PAMIS telah memperkenalkan penggunaannya di Taman Negara Maludam dan Rizab Semulajadi Bukit Lima di Wilayah Sibu. Pada penghujung tahun 2011, Taman Negara dan Rizab Semulajadi tersebut telah menggunapakai aplikasi PAMIS secara menyeluruh bagi tugas-tugas rondaan dan pemantauan sempadan.

Hasil penggunaan aplikasi PAMIS di ketiga-tiga Kawasan Terlindung Sepenuhnya itu, menampakkan pengurusan taman yang lebih sistematik, cepat dan amat berguna untuk merancang tindakkan susulan bagi sesuatu pemerhatian yang direkod semasa rondaan sempadan. Pihak pengurusan taman juga boleh mengakses maklumat yang dikehendaki mengenai sesuatu kawasan dengan lebih cepat.

Pada tahun 2012, satu kertas kerja mengenai penggunaan aplikasi PAMIS di seluruh Taman Negara, Rizab Semulajadi dan Sanktuari Hidupan Liar telah disediakan dan seterusnya diluluskan oleh pihak pengurusan SARAWAK FORESTRY. Justeru itu latihan penggunaan aplikasi ini telah diperhebatkan dan diperluaskan ke seluruh Taman Negara, Rizab Semulajadi dan Sanktuari Hidupan Liar di Wilayah Miri, Bintulu dan juga Kuching.

Gambarajah 2: Contoh laporan lapangan PAMIS – Rangers Report bagi rondaan sempadan di Sanktuari Hidupan Liar Lanjak-Entimau.

SARAWAK FORESTRY

Rangers Report
Inclusive dates: 16/7/2014 : 22/7/2014
Report date: 26/8/2014

PAMIS

Number of Patrols	**2**	**Average Days on Patrol**	**1.00**
Patrol Days	**2**	**Average Nights on Patrol**	**0.00**
Patrol Nights	**0**	**Average Patrol Size**	**3**
Total Distance(km) Patrolled	**17.196434**	**Average Patrol Distance(km)**	**8.60**
Costs / km Patrolled	**0.00**		

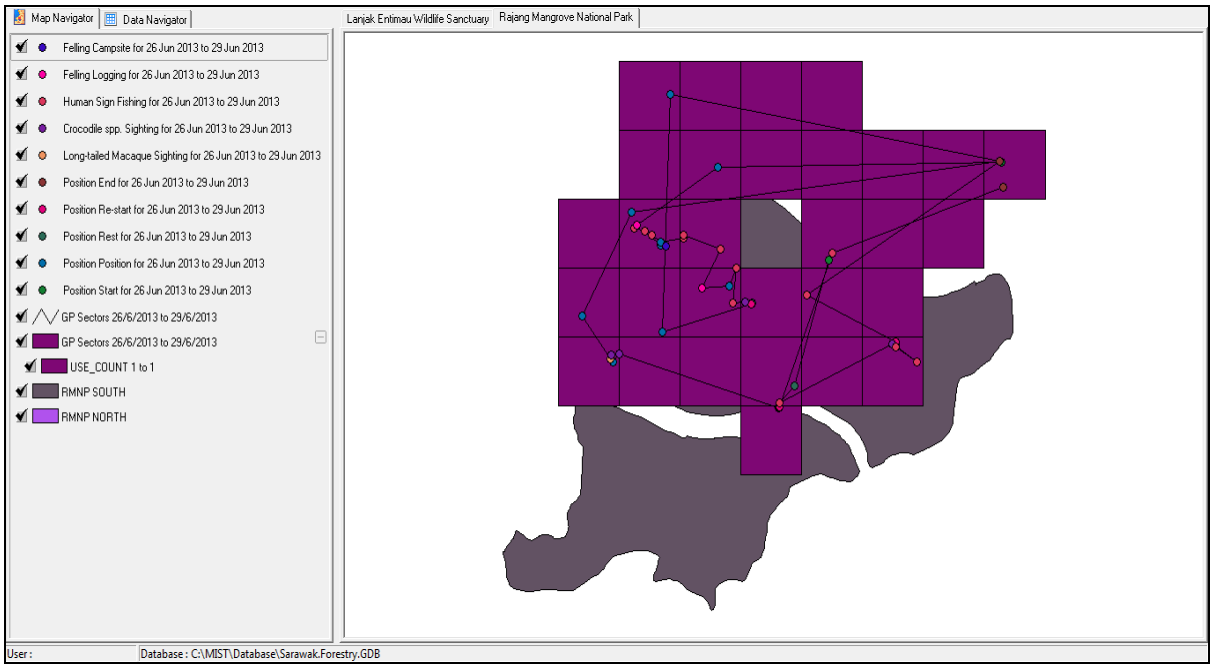
ID	Name	PATROLS	DAYS	NIGHTS	Distance (km)
SFCSB0533	Adau,Mujap	1	1	0	13.374068
SFCSB0532	Janting,Keroh	1	1	0	13.374068
SFCSB0707	Luta Sigie,Leslie Lincoln	1	1	0	13.374068
SFCSB0146	Pasang,Anding	1	1	0	13.374068
WCS02	Sidu,Now	1	1	0	13.374068
WCS03	Yii,Kimberly Jen Huey	1	1	0	13.374068
	count = 6	sum = 6	sum = 6	sum = 0	sum = 80.24

4.0 STATUS PENGGUNAAN DAN PENGIKTIRAFAN APLIKASI PAMIS

Pada tahun 2014 pula, PAMIS telah diguna-pakai sepenuhnya di Kawasan Terlindung Sepenuhnya di Wilayah Miri (7 lokasi), Bintulu (1 lokasi), Sibu (3 lokasi) manakala Wilayah Kuching masih lagi di peringkat percubaan di empat lokasi.

SARAWAK FORESTRY mendapat pengiktirafan sebagai organisasi yang telah fasih dalam pengunaan PAMIS apabila pada pertengahan tahun 2012 dilantik sebagai perunding proses penubuhan sistem PAMIS untuk Kementerian Pertanian dan Pembangunan Luar Bandar (MARD) Vietnam bersama German Agency for International Cooperation (GIZ). Khidmat pakar yang juga dihulur termasuk khidmat nasihat teknikal bagi mencadangkan konsep dan *'System Developer'* yang sesuai bagi projek di negara Vietnam. Para wakil dari negara Vietnam juga telah dibawa melawat ke beberapa buah Taman Negara di Sarawak bagi melihat sendiri penggunaan PAMIS oleh SARAWAK FORESTRY. Hasil daripada beberapa siri lawatan dua-hala di bawah naungan GIZ, pihak kerajaan Vietnam telah bercadang untuk mengguna-pakai aplikasi PAMIS dalam sistem pengurusan data dan maklumat perhutanan mereka.

Gambarajah 3: Contoh laporan lapangan PAMIS – Kawasan rondaan di Taman Negara Rajang Mangrove.



5.0 CABARAN IMPLIMENTASI APLIKASI PAMIS

Antara cabaran-cabaran yang dihadapi dalam memperkenalkan aplikasi PAMIS di Kawasan Terlindung Sepenuhnya di Sarawak adalah kekurangan peralatan lapangan yang sesuai seperti komputer, GPS, kamera, peta kawasan dan juga pengetahuan penggunaan komputer yang rendah di kalangan pekerja taman.

Menyedari kekurangan yang melibatkan perihal logistik dan peralatan lapangan di lokasi-lokasi yang mengguna-pakai aplikasi PAMIS, SARAWAK FORESTRY telah memperuntukkan sejumlah bajet untuk membeli peralatan komputer, GPS, kamera dan lain-lain lagi. Buat masa ini, hampir kesemua Kawasan Terlindung Sepenuhnya mempunyai infrastruktur dan peralatan yang minima bagi menggunakan aplikasi PAMIS.

Latihan juga telah dirancang dan diadakan bagi pihak pengurusan dan renjer taman yang mana latihan tersebut telah diberi oleh pegawai-pegawai SARAWAK FORESTRY yang telah mendapat latihan dalam penggunaan aplikasi PAMIS. Bagi memastikan pihak pengurusan dan renjer taman mendapat pemahaman yang tinggi terhadap pengendalian aplikasi PAMIS, penekanan terhadap latihan lapangan dan *'hands-on'* diberi keutamaan yang lebih. Setiap Taman Negara, Rizab Semulajadi dan juga Sanktuari Hidupan Liar akan didatangi oleh *'System Administrator'* wilayah secara berkala untuk memberi latihan dan tunjuk-ajar lanjut. Sebarang masalah berkenaan penggunaan aplikasi PAMIS bagi taman tersebut akan cuba dikenalpasti dan diselesaikan.

Pada masa ini, pemantauan dan juga penggunaan aplikasi PAMIS dijalankan dari pejabat korporat oleh Bahagian Kawasan Terlindung dan Pemuliharaan Biodiverisiti, SARAWAK FORESTRY. Tiada unit khas yang ditubuh bagi PAMIS. Penggunaan aplikasi ini hanya dipantau dan dikawalselia oleh dua orang pegawai SARAWAK FORESTRY dari Wilayah Sibu. Bagi memastikan kejayaan penggunaan aplikasi PAMIS ini, SARAWAK FORESTRY telah melantik beberapa orang *'System Administrator'* dari Wilayah Miri, Bintulu, Sibu dan Kuching. Tugas utama *'System Administrator'* ini bertujuan membantu pemantauan keberkesanan aplikasi PAMIS di wilayah mereka sendiri dan juga bertindak sebagai *'trouble-shooter'* bagi aplikasi ini. Mereka juga bertanggungjawab untuk melaporkan tahap kemajuan penggunaan aplikasi PAMIS di wilayah mereka setiap bulan.

6.0 KESIMPULAN

Penggunaan aplikasi PAMIS telah membantu SARAWAK FORESTRY menambahbaik sistem dan cara rondaan sempadan dengan lebih sistematik dan teratur. Dengan adanya aplikasi PAMIS, pihak pengurusan taman dapat memantau, mengikuti dan membuat perancangan yang lebih tepat dan berkesan berdasarkan analisis yang dibuat menggunakan aplikasi PAMIS. Penggunaan aplikasi PAMIS yang 'mesra pengguna' dan mudah juga telah memberi peluang kepada pegawai dan renjer SARAWAK FORESTRY untuk menambahbaik kebolehan dan kemampuan mereka di dalam pengurusan data secara berkomputer.

Secara kesimpulanya, langkah penggunaan aplikasi PAMIS yang diambil oleh SARAWAK FORESTRY bagi Kawasan Terlindung Sepenuhnya di Sarawak telah banyak memberi manfaat terhadap cara pengurusan dan penyimpanan data bagi taman-taman negara, rizab semulajadi dan sanktuari hidupan liar.

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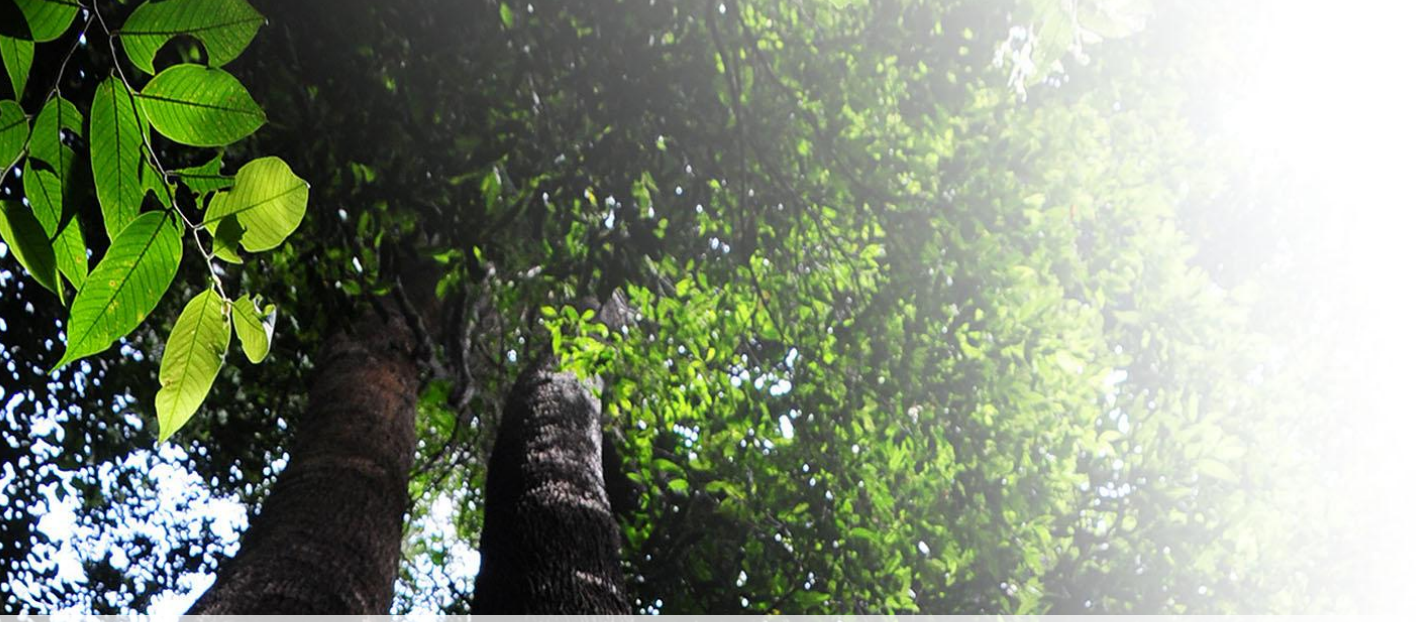
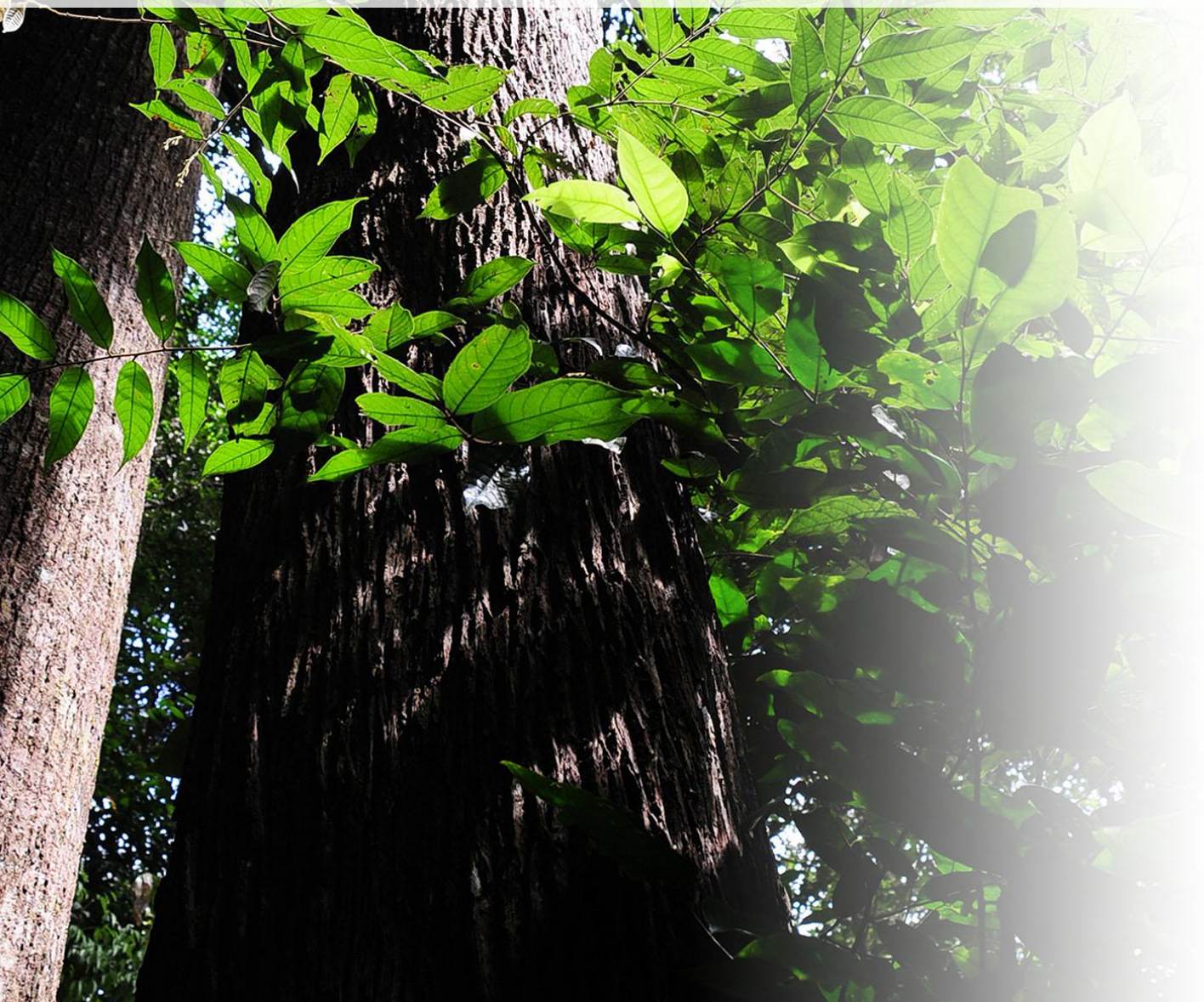


WORKSHOP SESSION III

FOREST BIODIVERSITY: RESTORATION, CONSERVATION AND PROTECTION



PAPER 3: 1

WILDLIFE MONITORING AND RESCUE OPERATION AT HYDRO ELECTRIC PROJECT: THE SARAWAK EXPERIENCE

Paschal ak Dagang| Connie Geri | Oswald Braken Tisen | Julia Sang
Sarawak Forestry Corporation

ABSTRACT

Sarawak Forestry's experiences in conducting wildlife monitoring and rescue operation (WiMOR) at Bakun and Murum Hydro Electric Projects (HEPs) are discussed. A great deal of planning and resolve are required to undertake the various activities and overcome the corresponding challenges. The lessons learnt from the Bakun and Murum WiMOR were most helpful in charting the directions and standard operation procedures for future WiMOR in the state.

1.0 INTRODUCTION

The Bakun and Murum HEP Projects are two of the twelve hydroelectric dam projects that have been earmarked for construction in Sarawak.

1.1 Bakun HEP

The Bakun Dam is an embankment dam located in Sarawak, Malaysia on the Balui River, a tributary of the Rajang River and situated some sixty kilometres west of Belaga. It is the second highest concrete-faced rockfill dam in the world and generates 2,400 megawatts (MW) of electricity.

More than 10,000 native residents (mainly Kayan/Kenyah) from 16 longhouses who lived in the flooded area have been relocated to a longhouse settlement named Sungai Asap in Bakun. Most of them were subsistence farmers.

1.2 Murum HEP

The Murum dam is the second hydroelectric project (HEP) to be developed by Sarawak Energy since Batang Ai HEP in the 1980s. The dam will generate 944 MW of electricity when completed. The Murum dam is a Roller-Capacity Concrete dam with a height of 141 m and a catchment area of 2,750 km. The size of the reservoir is 245 sq km.

Based on the Murum Social and Environmental Impact Assessment (SEIA) Study, a total of 1,302 Penan (335 households) and 113 Kenyah Badeng (18 households) in three areas – Plieran, Seping and Danum, were affected by the Murum HEP. (Source: http://www.sarawakenergy.com.my/index.php/hydroelectric-projects/about-hydropower).

Figure 1: List of the Existing and Proposed HEP Dams in Sarawak.

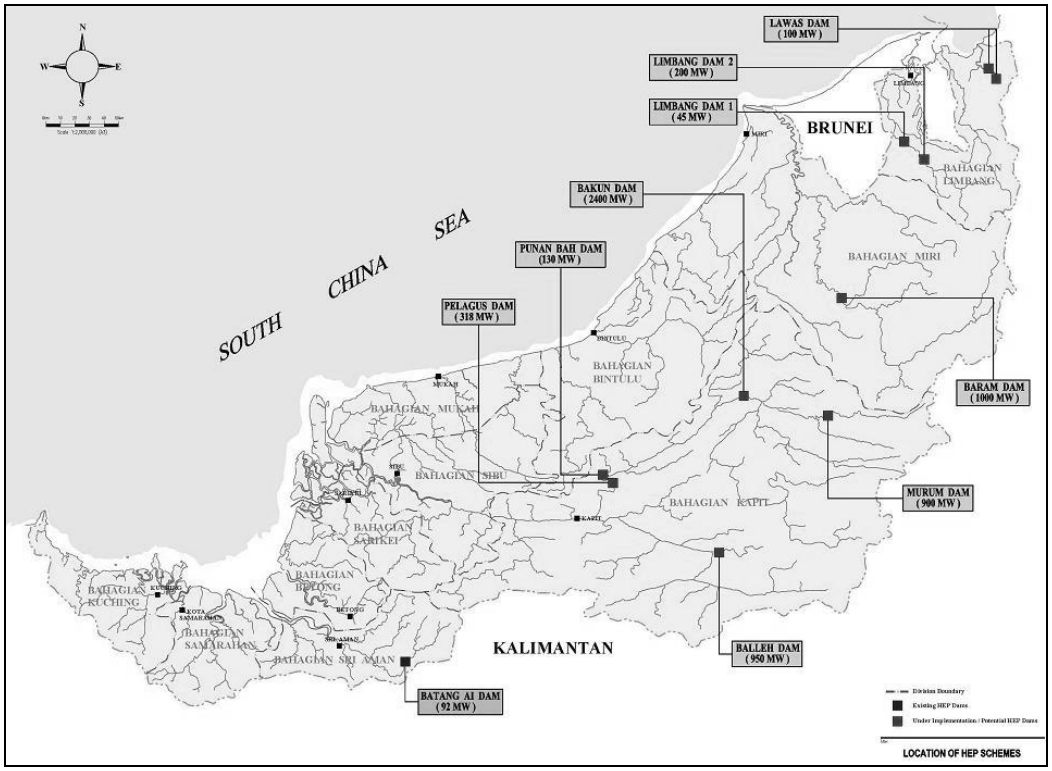
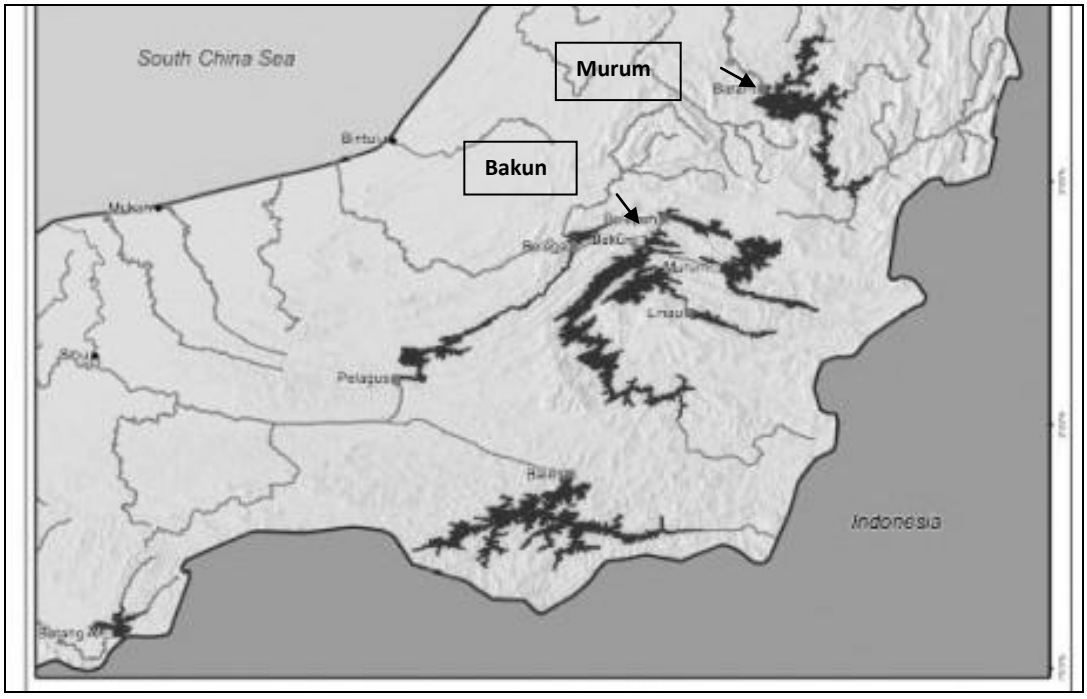


Figure 2: Reservoirs of Bakun HEP and Murum HEP.



2.0 WILDLIFE MONITORING AND RESCUE OPERATION (WiMOR)

Wildlife monitoring and rescue operations (WiMOR) were implemented at Bakun HEP and Murum HEP, in fulfilment of the requirement by Natural Resources and Environment Board (NREB) to safeguard and protect biological resources within the flooded areas. A Wildlife Rescue Plan was formulated by Sarawak Forestry Corporation (SFC) and endorsed by Natural Resources and Environment Board (NREB) prior to rescue operation. This plan involved three phases: pre-impoundment, during impoundment and after impoundment (monitoring).

This plan aims to prescribe pragmatic approaches and methodologies for the undertaking of:

(a) Animal monitoring and rescue operation
(b) Plant assessment, rescue and re-planting operation
(c) Monitoring and rescue of aquatic fauna (i.e. fish)*

**For wildlife monitoring and rescue operation in Bakun HEP, the fish component was not included.*

2.1 Pre-impoundment activities

Pre-impoundment activities mainly involved planning and included the following:

- Preliminary visit to the sites – to assess ground situation and for further planning purposes
- Health screening for all staff – only those that are healthy and physically fit can join the operations
- Insurance policy coverage – insurance policy for staff and casual labourers
- Purchase of equipment (rescue equipment, longboats, outboard engines and communication facilities)
- Build infrastructure (floating camps, floating store, office, nursery and sub-camp)
- Rapid wildlife assessment (wildlife inventory – to know the species of wildlife that can be found within the flooded zone)
- Habitat suitability assessment (to assess suitable sites for release of rescued wildlife)
- Training (use of rescue equipment)

2.2 During impoundment activities

Fauna component

- Monitor and rescue priority species in priority sites at various stages of rising water
- Rescue wildlife by trapping (passive rescue) and by capturing (active rescue) and
- Release the rescued wildlife at pre-determined release sites

Flora component

- Rescue and collect plant materials at various stages of rising water
- Raise and tend planting materials of the priority species at the nursery
- Carry out habitat assessment for replanting site above the flooded zone
- Construct permanent nursery for selected non-tree species

Aquatic fauna monitoring and rescue *(for Murum dam only)*

- Rescue selected aquatic fauna from the river below Murum Dam (between Dam site and power house) after impoundment
- Breed selected aquatic species for release after the impoundment
- Manage the holding facilities at the site (Murum) or other localities

2.3 After impoundment

Animal monitoring and rescue

- Survey and monitor the priority species marooned on the permanent islands
- Initiate trapping and relocation of some of the animal to reduce overpopulation and distress

Plant rescue and re-planting

- Re-planting of rescued plants
- Carry out regular monitoring and maintenance of planted plants above the flooded zone (at least within 1 year after planting)
- Plant and display rescued plants in the permanent nursery

Aquatic fauna monitoring and rescue *(for Murum Dam only)*

- Release aquatic fauna into selected section of the river
- Establish '*Tagang System*' with local communities along selected sections of the river between the main dam and the power house

3.0 RESULTS / ACHIEVEMENTS

WiMOR at Bakun HEP flooded zone started in May 2009 and completed in July 2011. A total of 1552 individuals comprising 48 mammal species, 15 bird species and 22 reptile species were rescued. For plants, 33,715 seedlings of tree species such as Ensurai, Tegelam, Meranti, Rengas, Resak, Engkabang, Binatoh, Luis and Urat Mata were successfully raised at the WiMOR nursery and transplanted above the flooded areas according to the planting plan. 851 individuals from 281 species of shrubs and herbs were also rescued.

WiMOR in Murum HEP flooded zone started in September 2013 and the operation is still on-going. For animal rescue a total of 1,760 individuals comprising 49 mammal species, 20 bird species and 29 reptile and amphibian species have been rescued so far and released at specific sites. For plant rescue, a total of 11,095 seedlings of tree species such as Ensurai, Meranti, Lun, Resak, Engkabang, and Selangan Batu were collected. In addition, a total of 4,129 individuals of shrub and herb were rescued and raised at the nursery in Murum. These seedlings will be transplanted to specific areas according to the planting plan.

4.0 EXPERIENCES, CHALLENGES AND LESSONS LEARNT

Bakun WiMOR was the first structured wildlife rescue and monitoring programme conducted in Sarawak. It was a learning experience for all parties taking adaptive technique depending on location and situation. Bakun WiMOR achieved its objectives successfully. The Borneo Post reported Bakun WiMOR as a "herculean task with tremendous success".

The experiences and lessons learnt are summarized below:

4.1 Training of Locals

4.1.1 Fauna component

The project engaged approximately 80 local people from the Bakun Resettlement Scheme areas (Sg Asap and longhouses downstream of Bakun Dam) and resettlement areas of Tagulang and Matalun (Murum HEP) as daily paid casual labourers. All of them underwent on-the-job training, especially on animal handling, so that they could execute their tasks confidently, efficiently and safely.

4.1.2 Flora component

SFC personnel trained all local labourers engaged in the plant rescue operation to carry out various tasks (plant collection, nursery practices and maintenance, planting techniques, post-planting maintenance, etc.) from time to time during the operation.

4.2 Time constraint

For both Bakun and Murum WiMOR, inadequate time was given for proper planning and implementation of pre-impoundment program resulting in curtailment of some of the activities. For example, the rapid wildlife assessment and habitat suitability assessment was not done.

4.3 Harsh conditions

The harsh conditions at the project areas were not to be taken lightly. During the impoundment process, changes in the environment caused the spread of diseases through air, water or soil. Safety precautions and wearing of protective gears such as hand gloves, mouth cover, and proper shoes must be made mandatory for all future such work.

4.4 Health issues

Persons participating in WiMOR should be fit and healthy, and should undergo health screening before and after fieldwork. The Management must be aware of each staff member's medical condition in order to safeguard his/her health. Staff involved with the operation must be forewarned on the existing health issues in the areas (e.g Bakun and Murum) to enable them to take the necessary precautions. The performance and progress of Bakun WiMOR was affected by postponements twice due to health issues. Below are examples of health issues or problems that affected our staff and local communities.

- Melioidosis and Leptospirosis during Bakun WiMOR
  - Two SFC staff and two casual labourers lost their lives during WiMOR in Bakun due infections from Melioidosis or Leptospirosis.
- Malaria during Murum WiMOR
  - One SFC staff was admitted to ICU due to malaria infection after returning from Murum.

4.5 Danger posed by logging operation

Rescue operations may only be conducted in areas where logging operations are not ongoing.

4.6 Insurance coverage for rescue workers

Compulsory insurance for staff and local people engaged by the project is an essential precaution.

4.7 Encroachment of planting sites

In the selection of sites for replanting of rescued plants, due consideration should be given to the likelihood of local communities encroaching onto such sites. Certain areas were cleared for agriculture farming by local communities after the seedlings have been planted at Bakun.

4.8 Rescued plants with commercial or medicinal values (Bakun)

Orchids, aroids, begonias and some ferns with commercial or medicinal values should not be left unguarded at the rescue site.

4.9 Uneven commitment

Support and assistance for the WiMOR projects from other relevant government agencies were uneven. The selection of team members from other agencies, where and when necessary, should be coordinated by the State Secretary's Office.

4.10 Local communities

4.10.1 Awareness

A comprehensive CEPA programme should be conducted to ensure that the local communities are aware of the importance and legal requirement for conservation of wildlife that is affected by the impoundment process.

4.10.2 Participation in rescue work

Since the rescue operations required participation of the local community, it was necessary to provide appropriate training, especially in the proper handling of animals.

4.10.3 Expertise and knowhow

The Bakun experiences and lessons learnt had provided SFC staff with the necessary expertise and knowhow to take on the Murum rescue with confidence. More than 50 staff members had been involved, half of whom had been trained to use *Telinjet* in animal rescue.

4.11 Project Risks

- Nature and environment: Unpredictable weather and habitats
- Financial: Delayed disbursement of funding and lengthy procurement process
- Manpower: Shortage of certain expertise and unpredictable work ethics of local labourers
- Timing: Time available for planning and execution could be constrained by factors such as bureaucracy, date of impoundment etc that are beyond the control of the WiMOR team
- Local belief: Traditional rituals as well as other spiritual considerations should be accorded proper attention
- Local opposition: Project execution could be hampered by local opposition such as the Penan blockade at the Murum HEP

5.0 CONCLUSIONS AND RECOMMENDATIONS

- Given adequate resources and commitment by the major stakeholders, it is possible to successfully undertake big wildlife rescue operations in a tropical rainforest as proven by the Bakun and Murum WiMOR projects.
- Adequate time and meticulous planning are required to address and overcome the inherent and numerous risks and challenges entailed in a WiMOR operation.
- To ensure the survival and long term well being of rescued wildlife, it is imperative that stakeholder consultation be held and concrete plans be formulated. In recognizing that the translocation of wildlife out of their original habitats is very stressful for them it is imperative that meticulous planning and preparation be carried out in consultation with relevant stakeholders.
- Although WiMOR is supposed to be about the rescue of plants and animals, the authorities involved in the implementation of the project have to take cognizance that the overbearing factor to be given due consideration is that concerning the management of humans.
- Participation of the locals in the WiMOR projects is very important in order to impart the sense of belonging and ownership and thus support to the projects.

ACKNOWLEDGEMENTS

The authors wish to thank all individuals especially SFC staff from various Regional Offices, Regional Manager Kuching, Sibu, Miri and Bintulu, Administration and Finance staff of SFC, Government agencies especially staff from NREB, District Office, Sarawak Hidro staff (Bakun HEP), Sarawak Energy staff (Murum HEP), and not forgetting the local people from Sg Asap, Tagulang and Matalun Resettlement areas who contributed to the success of the Wildlife Monitoring and Rescue Operation at Bakun & Murum HEP Flooded Zone.

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PAPER 3: 2

DIPTEROCARP IUCN RED LIST ASSESSMENT

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ABSTRACT

During the last few years, efforts have been made to collect bio-geographical and ecological data to produce an overall picture of Dipterocarp species diversity and population distribution within the different protected areas of Sabah, such as forest reserves, park areas, etc. The data generated has been used not just to produce Ecological Niche Models in population distribution and habitat loss studies, but it has also played a major role in the State's Forestry Department's ongoing efforts in carrying out IUCN Red List Conservation Assessment. The assessment studies the species' status, population trends and threats thus providing baseline information for conservation efforts at both the national and international levels. The paper provides a brief overview of the survey work performed to date: Dipterocarp diversity within the protected areas; and the ongoing IUCN Assessment conducted.

INTRODUCTION

During the last 4 years, numerous expeditions, surveys and studies in research plots have been conducted within the various forest reserves (FR) and park areas. The data generated from the studies have taken into account population density, ecological and altitudinal range distribution for the species being studied. In certain cases, seedlings within plots established were counted and were monitored regularly. The ecological data gathered were used to produce a picture of Dipterocarp species distribution across the State of Sabah. The work has stemmed from previous ecological studies in collaboration with the University of Aberdeen. To date, the collaboration is still ongoing and has now expanded to include Universiti Malaysia Sabah (UMS).

IUCN ASSESSMENTS

The numbers of plant species found within the State remains as a rough estimate of 10, 000 or more. Although an actual figure has yet to be provided for the number of Sabah endemics, current literature review and compilation work has provided a tentative estimate of approximately 1,000 species (Colin Maycock, *pers. com.*), and the list keeps expanding. As of today, up to 18% of Sabah's total land mass has been set aside as Totally Protected Areas (TPAs), comprising Forest Classes 1, 6 & 7, Wildlife Sanctuaries, Wildlife Conservation Areas and the Sabah Parks Areas. There is an urgency to assess what percentages of plant species are protected within these TPAs and their current conservation status. As an initial study, the Dipterocarpaceae family has been chosen as a model for the assessment. The Dipterocarp is the dominant tree family found within the State's FR. The state of Sabah has a total of 183 species of Dipterocarpaceae (Ashton, 2004), spanning over 9 genera: *Anisoptera*, *Cotylelobium*, *Dipterocarpus*, *Dryobalanops*, *Hopea*, *Parashorea*, *Shorea*, *Upuna* and *Vatica*. Of these 183 species, 96 species (52.5%) are endemic to Borneo (refer ***Chart 1***). From the 96 species, 6 species are known to be endemic to Sabah: *Dipterocarpus ochraceus*; *Hopea ovoidea*; *Shorea kudatensis*; *Shorea micans*; *Shorea symingtonii* and *Shorea waltonii.* Therefore, with such a high degree of island endemism and specific locality endemism, it is an interesting family to be used as a model in this work. Moreover, the Dipterocarpaceae family is a taxonomically and ecologically well studied group.

In the conservation status assessments, species are evaluated based on the following criteria listed in the IUCN Red List Assessment Criteria and Categories (version 3.1):

(1) Population reduction;
(2) Geographical range in the form of Extent of Occurrence (EOO) and Area of Occurrence (AOO);
(3) Small population size and decline;
(4) Very small or restricted population;
(5) Quantitative analysis.

The different criteria will be taken into consideration before assigning the species into the various categories such as Extinct (EX); Extinct in the wild (EW); Critically Endangered (CE); Endangered (EN); Vulnerable (VU); Near Threatened (NT); Least Concern (LC); Data Deficient (DD) or Not Evaluated (NE).

While calculating the estimated distribution range of particular species using EOO and AOO in criterion 2, there are certain limitations and downsides to it. There are possibilities that it might over estimate the area of occurrence or overlook certain areas of occurrence. Therefore, to complement the information obtained from AOO and EOO, maps of finer scale are used for each of the species. These maps are generated through Ecological Niche Modeling (ENM) where computer algorithm is used in predicting species distribution based on the species locality data and environmental information that have been previously entered into the system. The software that is currently utilized is MAXENT 3.3.1., where environmental data such as soil, altitude, rainfall, temperature and precipitation are entered into the program. The predicted distribution sites generated from ENM will be used as a means for ground truthing purposes.

The process of consolidating the various data from expeditions through herbarium specimen collections from e.g., the Heart of Borneo expeditions and ecological research plots are ongoing. ENMs for approximately 56 Dipterocarp species have been produced and the predicted locations are verified through expeditions and surveys. The current assessment work is much needed because for certain species, there is a marked difference in terms of conservation status assigned across geographical barriers. One marked example would be *Shorea leprosula* that is found to be distributed across Peninsular Thailand, Sumatra, Peninsular Malaysia and Borneo. At the Global IUCN Assessment level it was given a status as Endangered A1cd, but at the National IUCN Assessment level it was given a status as Least Concerned (Chua *et., al.,* 2010), as the species is widely distributed throughout West Malaysia, Sabah and Sarawak. Moreover; it flowers and fruits annually, and securing planting materials from this species is not a problem. Another example would be *Parashorea malaanonan* that is found in Borneo and the Philippines. At the Global level, it was assigned as Critically Endangered A1cd. From surveys conducted the species can be found in at least 12 TPAs within the state, where the species is known to flower and fruit annually.

Given such strong disparity in the assessment and conservation status assignment among the Global, the National and the State level, it is essential for the work to be carried out thus providing a better idea of which species that are highly threatened or critically endangered at the state level. Therefore, this study contributes to enhance conservation and protection efforts within the state, as such information would be crucial in Forest Management Plans (FMPs).

As of today, the total number of Dipterocarp species found within Sabah's TPAs is 136 species (Refer to ***Chart 2***). Out of the total, 69 species are Borneo endemics. This means that the State has at least 74% of the Dipterocarp species within the State's TPAs. The figures would be higher if the species listed included subspecies and varieties.

Ongoing efforts are undertaken to carry out IUCN Red List Conservation Assessment for the Dipterocarpaceae family. This is illustrated with the Sabah endemic, *Dipterocarpus ochraceus* that is found within the Sabah Parks area. The Area of Occurrence (AOO) for this species is calculated to be 16km^2, with a total of 68% habitat loss. At the Global Level it has not been assessed due to lack of information, while Peter Ashton (2004) considered it Endangered. Extensive survey performed has shown that currently there are only 3 populations that consist of not more than 60 individuals in the wild at the moment. Out of the 3 populations found, 1 is located on state land threatened by land development, whereas the other 2 populations are located within TPAs highly threatened by forest fire during drought. Taking all the information into account, this species has been assessed as Critically Endangered (unpublished data) at the State's level and steps were taken to conserve the remaining populations. Due to its irregular flowering pattern, the flowering and fruiting of this species is monitored regularly, and any mature fruits are harvested and raised within the Sabah Forestry Department's (SFD) nursery to be used in restoration projects. Through herbarium records and ENM generated, seedlings that are raised are replanted within suitable sites or sites where the species was previously reported but no longer exist. One such site would be the Bukit Hampuan Forest Reserve. Current genetic diversity studies are undertaken for this species in order to understand the population diversity and its dynamics.

Another example to which a different IUCN conservation status is assigned would be *Shorea kudatensis*, which is another Sabah endemic. At the Global Level it is assessed to be Critically Endangered A1cd C2a and Ashton (2004) considered it Endangered. Surveys conducted have shown that there are at least 3 healthy populations within the State's TPAs. Flowering and fruiting events are fairly regular and similar to *Dipterocarpus ochraceus,* seedlings raised in the SFD's nursery are sent to suitable sites for restoration efforts, and one such site is the Timimbang Forest Reserve.

CONCLUSIONS

In 2010, the Aichi Biodiversity Targets were listed, whereby Strategic Goal C of the plan states: "***To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity"*** and target 12 states: "***By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained***." (http://www.cbd.int/sp/targets/).

To achieve these mentioned targets within the time frame, there is a need to conduct assessments and assigning IUCN status to the plant species within the state. In addition, the Malaysian Plant Conservation Strategy has made a national commitment to have an assessment of the conservation status of all known plant species for Malaysia (Target 2). Therefore, such effort is essential for providing an up-to-date evaluation of the status of the 183 Dipterocarp species to improve the baseline data for Forest Management Planning and restoration efforts, especially in identifying areas of High Conservation Value Forests (HCVFs) that contain critically endangered plant species.

ACKNOWLEDGEMENTS

We would like to thank the Director of Sabah Forestry Department and also the Deputy Director of Research and Development, Dr Lee Ying Fah for their continued support in this project. Special thanks are extended to the District Forestry Officers for their continuous help in guiding and providing on the ground information on the areas surveyed, not to forget Sabah Parks for information sharing and permission for carrying out surveys within their areas. Heartfelt thanks is extended to Mohmad Jumri Abdul Hamid for his patience and effort in providing all the maps, GIS information and the much needed information in running the ENM. Last but not least, we thank all the Forest Research Centre staff for helping and conducting the ground truthing work: Postar Miun, Jeisin Jumian, Joel Dawat, Martin Tuyok, Brono Saludin and Junaidi Pokok.

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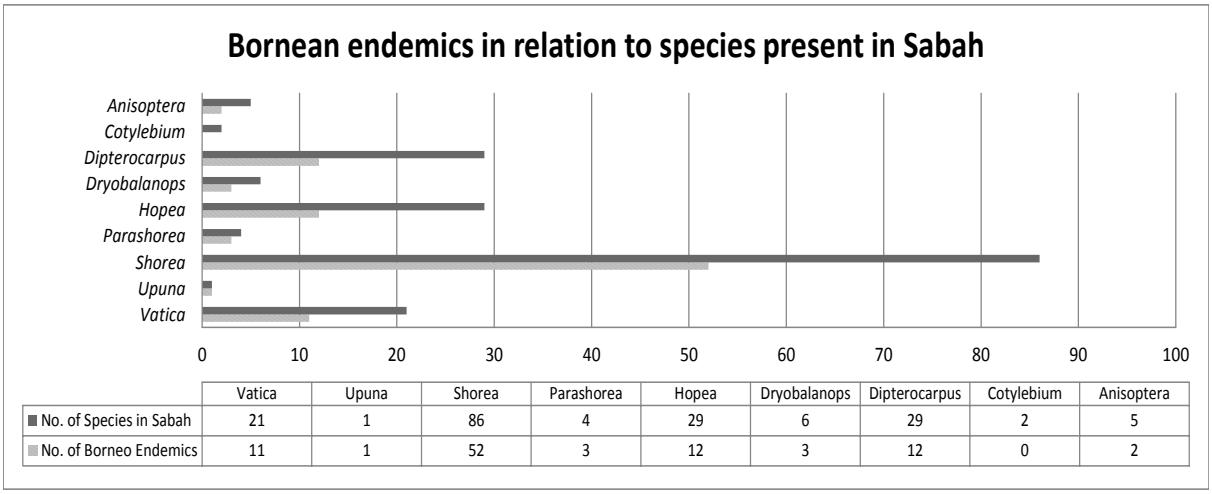

	Vatica	Upuna	Shorea	Parashorea	Hopea	Dryobalanops	Dipterocarpus	Cotylebium	Anisoptera
No. of Species in Sabah	21	1	86	4	29	6	29	2	5
No. of Borneo Endemics	11	1	52	3	12	3	12	0	2

Chart 1: Number of Bornean endemic Dipterocarps present in comparison to the total number of Dipterocarp species found in Sabah.

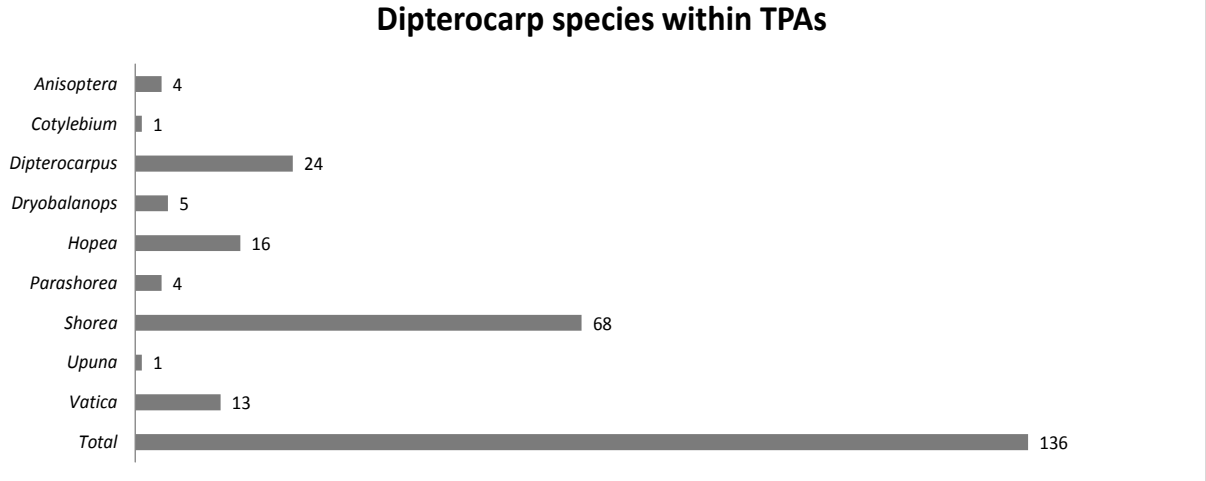

Chart 2: To date, a total of 136 Dipterocarp species spanning over 9 genera located within the TPAs in Sabah.

PAPER 3: 3

SUSTAINABLE SEED SUPPLY OF MALAYSIAN RAINFOREST TREE SPECIES TO SUPPORT CONSERVATION INITIATIVES IN PENINSULAR MALAYSIA

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ABSTRACT

Sustainable seed collection is one of the key components in forest conservation strategy. The Lentang Seed and Planting Material Procurement Center, Pahang was established by Forestry Department Peninsular Malaysia (FDPM) as a center to supply high quality seeds and planting materials from Seed Production Areas and Phenology Plots to support forest activities such as rehabilitation, reclamation and restoration (3R) in degraded and logged-over forest in order to enhance forest productivity. To achieve the procurement of high quality seeds and planting material, the Seed and Planting Material Procurement Team was set up to collect seeds and wildings throughout the year and especially during mass-flowering and fruiting seasons of dipterocarp and non-dipterorcarp species. The seeds and wildings collected would be processed and raised at the Nursery at Lentang Seed and Planting Material Procurement Center to meet the demand from various planting programs. The seedlings will be utilized by the State Forestry Departments for their 3R activities, awareness program and collaboration with NGOs, as well as the 26 Million Tree Planting Campaign launched in 2010. Therefore it will be a great challenge for FDPM to enhance seed viability and quality in fulfilling the future demand for high quality seedlings. As forests play an essential role as carbon sequester and enhancing carbon stocks, the ultimate goal of the conservation strategy is adaption and mitigation of climate change effects on mankind and the environment.

1.0 INTRODUCTION

Malaysia continues to highlight the importance of sustainable forest management despite the rich natural forest present in the country. There is always a major concern that logged-over forest, degraded forest areas, ex-mining areas, eroded coastal area and idle agricultural lands should be rehabilitated with indigenous tree species. Forest activities such as rehabilitation, reclamation and restoration (3R) thus are essential to enhance forest productivity and the supply of quality planting material is of great importance for it to succeed.

One of the major activities of Forestry Department Peninsular Malaysia (FDPM) is to supply sufficient and healthy seedlings for rehabilitation activities in poor and degraded Permanent Reserve Forest (PRF) and State Land Forest (SLF), forest plantation, agro-forestry and other planting activities such as the 26 million tree planting campaign launched in 2010. Request for quality planting material has been received from various government agencies and private sector in their greening activities, landscape and ornamental, urban forestry, educational activity and awareness campaigns that are related to forest conservation. In this endeavor, FDPM has continuously advocating the use of quality seeds in the preparation of planting stock. Generally, quality seedlings will produce quality timbers.

Production and supply of quality planting material involve four (4) major factors, namely: i) excellence source of seed supply (superior provenance); ii) high survival rate of seedlings and healthy wildings collection; iii) capacity in supplying sufficient and healthy seedlings; and iv) innovation of seedling propagation technique in nursery. Production of quality planting materials involve phenology observation activities, seed collection, seed handling and preparation of planting materials.

Production and supply of quality planting materials is one of the long term strategy towards producing excellent forest stand from superior provenance. The quality of planting materials will ensure the production of trees with high survival rate, resistent to disease outbreak, have excellence growth rate which enable to produce high quality timber.

2.0 CHARACTERISTIC OF INDIGENOUS SEEDS

Generally most of the seeds from the tropical trees are recalcitrant with high moisture content as opposed to the orthodox seeds, when shed from mother tree, seeds tend to germinate immediately. The recalcitrant seeds have short viability period, cannot tolerate very low temperature (below 10ºC) and high reduction in moisture content. These seeds are also easily damaged during the journey back to the nursery after their collection as

compare to the orthodox seeds. Recalcitrant seed should always be kept cool and damp in order to retain its viability.

The irregular and unpredictable cyclic mass fruiting of most indigenous species, usually between six to seven years, causes a sudden availability in large quantities of the precious seed over a short period. Only with a proper reporting, the correct timing can be estimated for quality seed collection. This requires close monitoring and phenological observation.

3.0 PLANTING MATERIAL PRODUCTION

Quality seed procurement and sustainable production of planting material at the Lentang Seed and Planting Material Procurement Center, Pahang is conducted as shown in Figure 1.

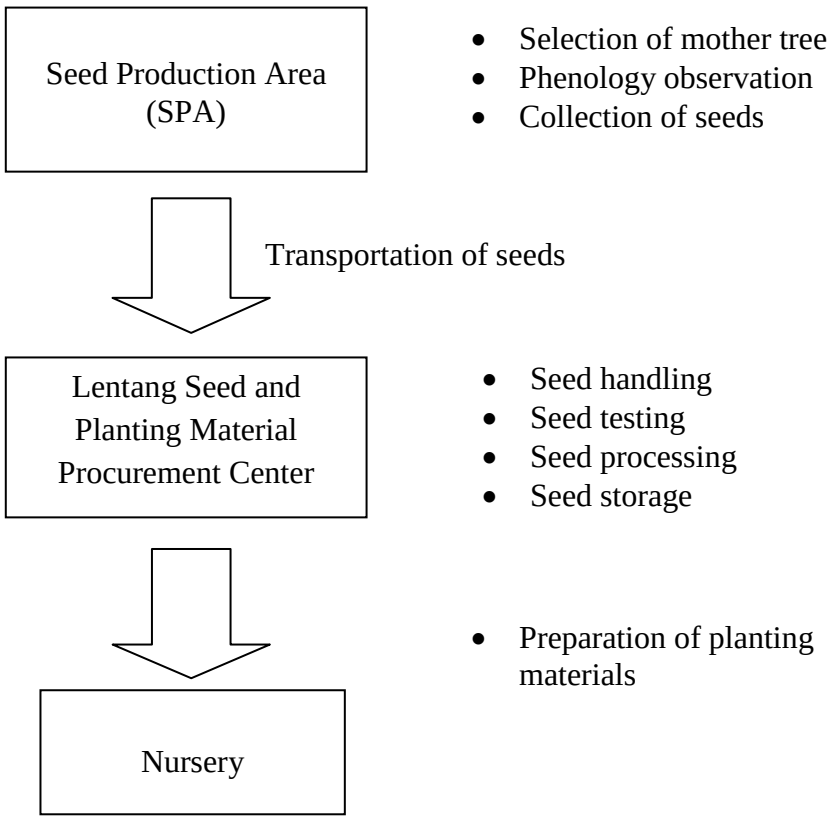

Figure 1: Seed procurement and production of planting materials.

Details of these activities are as follows :-

a) Seed Production Area (SPA) and Phenology plots

Seed Production Area (SPA) is defined as a "natural or planted stand or group of stands, set aside, periodically rouged and treated to stimulate seed production. The purpose of SPA is to provide, in quantity, seeds of known origin from the best phynotypes available. The establishment of seed production areas is a stop-gap measure, design to provide seed of the best possible quality, until the seed orchard begin to bear. The establishment of seed orchard is relatively more time consuming due to the requirement of going through progeny trial. Therefore, seeds are collected from SPA and phenology plots in PRF all over Peninsular Malaysia.

b) Phenology Observation

Phenology is the study of the timing of recurring biological events in the plants, the causes of the timing with regards to biotic and abiotic forces and the interrelation among phases of the same or different species. Phenology observations are periodically performed on mother trees in SPA and phenology plots to record the stages of flowering and fruiting. Observations are conducted by State Phenology Observation Team under coordination of Forest Plantation and Protection Division, FDPM Headquarters, Kuala Lumpur. Data obtained from the observations will be analysed using e-FORGRIS (Forest Genetic Resource Information System). The e-FORGRIS data can be accessed and updated from time to time and the information can be used for future planning and management purposes to determine the right timing for seed collection activities.

c) Seed Collection

Seed collection activities are carried out based on phenology observation. Changes on the fruit colour and seed maturity is a factor for the collection time. All changes to the observed flowers and fruits are monitored to determine suitable timing for the seed collection activity. Collection is suitable to be carried out when the seeds are still on the trees in order to avoid the incidences of insect and fungus attack when the seeds dropped. The collected seeds should be immediately sent to Lentang Seed and Planting Material Procurement Center to be processed.

FDPM has established Seed Procurement Team with total of 50 members who are actively involved in seed collection activity. The experienced team consist of 4-6 persons led by a Forest Ranger. These teams are provided with training which increase their knowledge and skills to optimize the timing of seed collection and to handling, transporting, storing and planting of these seeds.

Among the major activities of the team are to:

i) collect, handle and process mature quality seeds;
ii) produce planting materials;
iii) collect leaf and fruit specimens;
iv) maintenance of hazardous trees;
v) carry out tree climbing demonstration; and
vi) recruit and train new members of Seed Procurement Team.

d) Seed Handling

After collection, the seeds are isolated into two (2) categories of seeds which are recalcitrant and orthodox seeds. The recalcitrant seeds are less resistant and have a low survival rate. Hence, they need to be handled according to standard operating procedures, such as temperature control and short traveling time (distant). The orthodox seeds are very resistant and have high survival rate, as their water relative rate is very low (very dry) with quick drying method.

i. Labeling

Once collected, seeds must be stored in a ventilated container and kept in a shaded area. Seed batches must always be properly labelled both during transportation and subsequent storage. Always use two labels, one fixed to the ouside of the container or bag, and one inside together with the seeds. The labels and ink should be waterproof. Seeds must be transported to the Lentang Seed and Planting Material Procurement Center as quickly as possible.

ii. Seed Drying

Seeds with high moisture content are more prone to heat damage. Hence, direct sunlight should be avoided until the moisture content has reduced. Initial drying under shade is recommended. Fruits of species with recalcitrant seeds (e.g. *Dipterocarpus* spp.) should never be sun-dried.

iii. Seed Processing

This process involves impurity removal activity (pest) that exist with the seeds, remove wing and separating the seeds from their stalk. It is done manually or mechanically. Dipterocarp seeds need to be de-winged and this is usually done manually. Pods and cones can be left dried under the sun until they crack open. When a pod is hard to crack open, a knife may be used and individual seeds extracted. Fleshy fruits need to be de-pulped through a combination of soaking in water followed

by gentle abrasion. Once clean, the seeds can be pre-dried on mats or layers of old newspaper that absorb excess water. Frequent turning is important in this drying process so that the batches are dried evenly.

iv. Seed Cleaning

Some simple methods for seed cleaning are available which include sieving, water floatation, blowing and winnowing.

v. Seed Storage

After cleaning process, the seed purity is tested before the seeds are kept in cold storage. Important factors that need to be considered during the storage are temperature control and level of humidity. Recalcitrant seeds should be sown immediately after collection without storage because they cannot survive more than two weeks in an uncontrolled environment. Orthodox seeds, such as leguminous species can generally be stored for many years in normal room condition.

e) Seed Test

Seed testing is done to determine the seed survival rate. Seeds are tested randomly from every seed lot. The seeds need to be tested to determine their purity, bud force and other related features.

f) Preparation of planting material

Seeds obtained will be sown according to the procedures and nursery techniques accepted by FDPM standard. During the sowing, the seeds should be spaced out properly in order to avoid overlapping. The spacing will depends on the seed size. Generally, there are three (3) methods of sowing, which are scattered sowing, line sowing and sowing directly into the pot.

4.0 WAY FORWARD

a) More SPA and phenology plots need to be established and maintained to increase the volume of planting material production in order to meet future demand for quality planting material that constantly increasing. Monitoring and phenology observation need to be carried out periodically and the information need to be analysed using e-FORGRIS to produce detailed information for preparation of seeds collection schedule systematically in order to collect more and high quality seeds.

b) Production and supply of quality planting material need well managed and good nursery practices. Nursery which aims to produce quality planting materials need to have suitable standard. Skillful and commited staff will guarantee the production of quality planting materials and this can be achieved through building capacity activities including training, course, and workshop to involve the staff on nursery management; operation and seed storage; and also preparation and production of planting materials.

c) The establishment of specific teams, such as Seed Procurement Team will increase the FDPM ability in producing quality seeds and planting materials. The teams need to be enhanced in term of their knowledge, skill and experience in order to increase productivity of seed collection. High quality supporting equipment must be provided to the team sufficiently.

d) Quality planting material will produce more productive and high-value forest stand. In order to achieve the target, FDPM requires expertise in various fields, like arborist, pathologist, entomologist and tree improvement experts to carry out operational studies, provide technical advisory service, training, course and project future activity for sustainable quality seed production.

5.0 CONCLUSION

Production and supply of quality planting materials are essential to implement 3R activities (rehabilitation, reclamation and restoration), which are crucial to in achieving sustainable forest management. As forests play an essential role as carbon sequester and enhancing carbon stocks, the ultimate goal of the conservation strategy is adaption and mitigation of climate change effects on mankind and the environment.

PAPER 3: 4

A PRELIMINARY STUDY ON THE CONSERVATION OF *PAPHIOPEDILUM SANDERIANUM* (RCHB. F.) STEIN OF GUNUNG MULU NATIONAL PARK

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ABSTRACT

Paphiopedilum sanderianum (Rchb. F.) is endemic to Gunung Mulu National Park (GMNP), Sarawak and is listed as an endangered species in the Convention on International Trade in Endangered Species (CITES) Appendix I. Currently there are eight (8) species of slipper orchids found in Sarawak. Endemic to GMNP, *Paph. sanderianum* is one of the iconic species to the national park. As such, a study was initiated and carried out. This study was to survey the known sites of the species, collect data on individual plant numbers and monitor the phenology aspects of the species. Five locations, namely Green Cave, Paku Waterfall, Berar, Clearwater Cave and Bukit Susu were selected for the study based on Sarawak Herbarium records and information from local community and guides. Berar recorded the highest number of individuals while Paku Waterfall recorded the least number of individual plants. Total percentage of flowering is 32.35% for all five sites in which the flowering season was between July and August. The rate of seedpods production is about 73.36% from the number of flowers observed in the previous flowering season.

1.0 INTRODUCTION

Covering an area of 544 sq. km. (Hazebroek and Kashim, 2006), Gunung Mulu National Park (GMNP) is known for its unique geological features such as the famous pinnacles as well as the limestone formations. The areas are also covered with various types of forests which become natural habitats for rich biodiversity of flora and fauna.

Paphiopedilum sanderianum is among eight species of slipper orchids that are found in Sarawak. It is a rare species that is endemic to GMNP, Sarawak and is classified as an endangered species under CITES Appendix I (CITES, 2014). This species was first discovered in the year 1885 by J. Foerstermann and was thought to be extinct before it was rediscovered in 1978 in Sarawak by I. Nielson (Cribb, 1997).

Based on the Sarawak Herbarium records, this species has been found at elevations between 200 and 900 m in GMNP. It is commonly found growing among mosses and leaf litter with roots attached to vertical limestone cliffs that receive scattered morning sunlight (Beaman *et., al.,* 2001). *Paph. sanderianum* is a multifloral species and may take eight to ten years to flower for the first time (Tibbs, 2008).

Endemic to GMNP, *Paph. sanderianum* is one of the iconic species to the national park. As such, a conservation study was initiated and carried out. This study was to survey the known sites of the species, collect data on individual plants numbers and monitor the phenology aspects of the species.

2.0 SPECIES STUDIED

Leaves of this species are linear and obtusely bilobed at apex. The inflorescence consists of purple peduncle with short purple hairs, bract are purple with dark veins, sepals are yellow with maroon stripes, petals pale yellow with dotted purple in basal half while the upper parts are purple all over. Peduncles are 30 cm long with one to four flowers (Cribb, 1997).

Figure 1: Flowering plant of *Paph. sanderianum* (above).

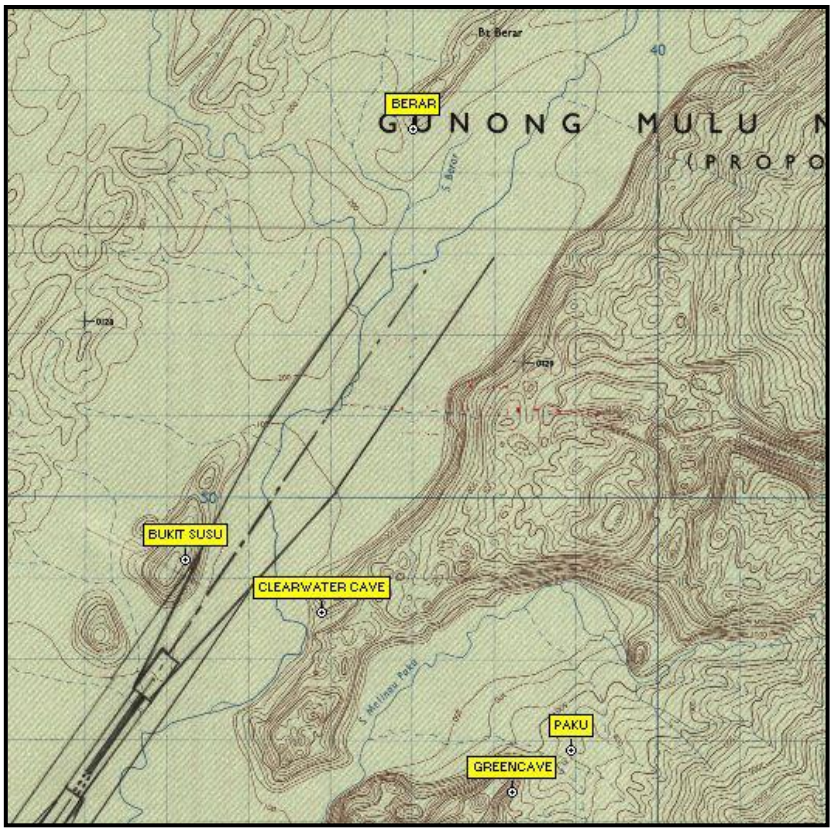

Figure 2: Study sites in Gunung Mulu National Park (right).

3.0 STUDY AREA

The study on the species was conducted in GMNP, targeting on limestone formations at 100 m a.s.l. For this study, five known sites were selected, namely Berar, Green Cave, Paku Waterfall, Bukit Susu and Clearwater Cave. The selections were based on information from the Sarawak Forest Department herbarium records, local community and the park guides. *Begonia* spp., *Thelasismicrantha* (Brongn.) J.J. Sm and *Burbidgea schizocheila* Hackettare are among common herbaceous species that are found in the areas.

4.0 METHODS

Survey activities were conducted in 2013 and 2014. All of the areas with *Paph. sanderianum* were marked with red and white flagging and GPS data were recorded. Individual plants were tagged with yellow tagging. Environmental data including temperature, humidity and light intensity were recorded. Data on the number of individual plants, number of flowers and seedpods were gathered from a series of monitoring activities conducted within the marked locations. Correlation value was generated from Minitab software (Minitab Release 12.1). Percentage of flowering plants and seedpod productions were calculated as shown below, as per modified from Murren and Ellison (1996):

$$\text{Percentage of flowering plants} = \frac{\text{No. of flowering plants}}{\text{Total no. of individual plants}} \times 100$$

$$\text{Percentage of seed pod production} = \frac{\text{No. of seed pods}}{\text{Total no. of individual flowers}} \times 100$$

5.0 RESULTS AND DISCUSSION

5.1 Distribution

Paph. sanderianum was found growing lytophytically on limestone formation from the altitude of 100 m to 500 m under shaded area of 10 to 20 klux. Average humidity of the studied sites is 72% and temperature between 24^{o}C to 30^{o}C. *Paph. sanderianum* was found in all five studied sites.
The most common occurrence of *Paph. sanderianum* was at Berar while the least at Paku Waterfall. The total number of individuals increased in the year 2014 (Table 1), suggesting that there are new growth of *Paph. sanderianum* within the study sites except for Clearwater Cave and Paku Waterfall.

Table 1: Number of plants recorded in 2013 and 2014.

Area	**2013**	**2014**
Berar	411	439
Green Cave	41	48
Bukit Susu	26	28
Clearwater Cave	12	12
Paku Waterfall	2	2
Total	492	529

Limestone formations of Berar and Green Cave are distant from tourist attractions and that may suggest fewer disturbances from any human activities. These areas also provide shades with light intensity of 10 to 13 klux which is within the optimum range for growth of *Paphiopedilum* spp. (McDonald, 1999). Thus, a high number of individual plants recorded in both sites.

Bukit Susu recorded fewer number of individual plants as compared to the two above-mentioned areas. This may be due to disturbance of the habitat by human activities as the area is not part of the park until gazetted in 2013. Light intensity recorded in this area was similar to Berar and Green Cave.
The *Paph. sanderianum* in Paku Waterfall and Clearwater Cave were observed to have the lowest number in individual counts. Based on observations, these areas received slightly higher light intensity of 20 klux. The slipper orchids that grow high on vertical cliffs are not shaded with tree canopies thus receiving direct exposure to sunlight throughout the day.

5.2 Phenology

Flowering season of *Paph. sanderianum* recorded in GMNP occurred around July and August. There were 120 plants (Table 2) flowering in August 2013 with an average of two flowers per peduncle. Percentage of flowering plants is 32.35%. This percentage may suggest that it is not a good flowering year for *Paph. sanderianum* as mentioned by Bodis and Molnar (2009).

Table 2: Flowering rate for each of the five sites with total rate of 0.32.

Sites	**No. of adult plants**	**No. of flowering plants**
Berar	260	66
Green Cave	71	44
Bukit Susu	26	3
Clearwater Cave	12	5
Paku Waterfall	2	2
Total	371	120

Various factors may have contributed to the flowering of the slipper orchid plant. Light intensity is one of the factors. Based on Brown (2001), *Paphiopedilum* orchid will not bloom if light levels are too low or too high. Maximum light intensities for *Paphiopedilum* spp. as suggested by Runkle (2008) are 16,145 lux. For Paku Waterfall which recorded highest light intensities of 20klux, flowering still occurs but it may take longer for plants to flower (Wellenstein & Wellenstein, 2000). Bukit Susu recorded high light intensities of maximum 19 klux which resulted in only 11.53% rate of flowering plants.

Green Cave showed high rate of flowering plants which is 62% while Berar recorded only 25.38% rate. Number of flowers produced in these two sites was higher due to the production of four flowers per peduncle. This may suggest that the environmental factors of Green Cave and Berar are suitable for growth and flowering of the species.

From 120 flowering plants, 81 produced seedpods with production rate of 73.36% (Table 3). All of the flowers in Bukit Susu developed into seedpods (Fig. 2). All the other sites showed more than 50% of flowers were fertilised except for Paku Waterfall where no seedpods were observed.

Table 3: A total of 179 seedpods were recorded from 81 producing plants.

Sites	No. of flowers	No. of seedpods
Green Cave	86	66
Berar	136	99
Bukit Susu	9	9
Clearwater Cave	9	5
Paku Waterfall	4	0
Total	244	179

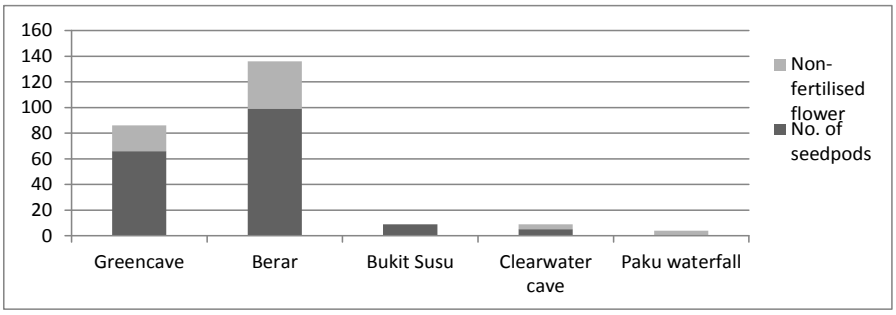

Figure 3: The number of sterile and fertile flowers per plant.

There is a significant correlation of flowers and seedpods with correlation value of 0.998 for the year 2013. Since there are so many factors involved in pollination of flowers (weather and the presence of pollinating insects), it is difficult to conclude whether production of seedpods is dependent on the number of flowers produced for this species. Long-term monitoring is required to observe such intriguing factors.

6.0 CONCLUSION

The distribution of the species is most common in Berar with a total number of 439 plants while the lowest number of plants was recorded in Paku Waterfall. There was no depletion in individual counts during surveys undertaken. There were 120 plants recorded flowering with total number of 244 flowers in 2013. A total of 179 seedpods were produced, giving a production rate of 73.36%. Seedpod production may suggest possibilities of the emergence of new individuals within the area.

Long-term monitoring is required to gather comprehensive data on the environmental factors affecting growth and distribution of *Paph. sanderianum*. Seasonal change in climate and pollination patterns could be further studied in order to gain more information which will be valuable for conservation purposes.

The presence of this species at Paku Waterfall and Clearwater Cave, which are presently among the famous tourist sites in GMNP, adds ecotourism values to attract more visitors. However, continuous monitoring of the habitat of this slipper orchid is recommended to ensure no illegal collection. It is also recommended that Bukit Susu trails should be upgraded to facilitate visitors to view the slipper orchids in their wild habitat.

ACKNOWLEDGEMENT

The Research, Development and Innovation Division (RDID) would like to express gratitude to the Heart of Borneo Initiative (HoB) for providing funds for the project. Our thanks also go to Tuan. Haji Abang Mohammad Mohtar Abang Pawozan for his guidance and support. In addition, this fieldwork would not be a success without the assistance of Gunung Mulu National Park management team both from Sarawak Forestry Corporations and Borsar Mulu. We would also like to extend our gratitude to Miss Jenny and Mr Katong and last but not least, the locals who had provided great assistance during the fieldwork.

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PAPER 3: 5

PLANT DIVERSITY STUDY IN FOREST RESERVES WITH ULTRAMAFIC HABITATS IN SABAH, MALAYSIA

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ABSTRACT

A study on the plant diversity was conducted for 10 Forest Reserves with ultramafic habitats in Sabah, namely Bidu-Bidu FR, Bukit Hampuan FR, Bukit Tawai FR, Danum Valley FR (Mt. Nicola), Gunung Tinkar FR, Sakar Island FR, Sapagaya FR (Mt. Silam), Sempilor Malawali FR, Sg Imbak FR and Ulu Tungud FR (Meliau Range). The data was gathered from recent and past botanical expeditions and surveys. Ultramafic forest develops on soil which is derived from ultramafic rocks. Ultramafic rocks are widespread and extensive in Sabah (Malaysia) covering an area of approximately 3500 km^2. Ultramafic soils are generally deficient in the essential macronutrients, phosphorus and potassium, have high magnesium/calcium ratios and high concentrations of potentially phytotoxic nickel. This is one of the factors often cited as defining for the structure and species composition in ultramafic forests. Of the estimated 8000 species of vascular plants in Sabah, 4252 species are recorded on ultramafic outcrops. The total number of plant species recorded from the ten forest reserves is 2673 with 653 endemic to Borneo including 145 Sabah endemics.

1.0 INTRODUCTION

Plant diversity refers to the variety of plants that exist in the world. Plants compete with other plants and organisms to survive in an ecosystem. Over time, they develop various characteristics which help them survive, which leads to plant diversity. In Sabah, however, the exact figure of total number of plant species occurring in the state is still unknown.

Sabah is very rich in plant species, with an estimated 8000 higher plants occurring within the state (Wong 1992, Van der Ent *et al*. 2014b). 12,000–15,000 species of flowering plants are estimated to occur in Borneo (Soepadmo, 1995). Of this figure, 4252 species are recorded on ultramafic outcrops (Van der Ent *et al*. 2014a, 2014b).

High plant diversity in Sabah is attributed to many factors, including the edaphic factor. The floristic composition of forests is most markedly differentiated where the soils are limiting to plant growth and survival, by adverse water conditions or low nutrients. The combination of sharply defined topography, extraordinarily diverse rock substrates, and generally shallow, soils with low nutrient content has led to a greatly diversified forest cover in Sabah (Ashton, 1995). One example is the forest on ultramafic soils.

Ultramafic forest develops on soil which is derived from ultramafic rocks. Ultramafic soils are characterized by high concentrations of exchangeable magnesium and exceptionally low concentrations of exchangeable calcium (Rajakaruna and Baker 2004). Plants need to adapt to be able to survive and reproduce. Morphological adaptations in populations of plants growing on ultramafic soils are often prevalent compared to those on non-ultramafic soils (Boyd *et al*. 2009). Adaptation to insular soil (e.g. ultramafic) can provide isolation (e.g. genetic) and coupled with strong edaphic and climatic stresses, evolutionary divergence and speciation will be promoted, and thus the genesis of endemism (Kruckeberg, 1986). Ultramafic rocks are widespread and extensive in Sabah (Malaysia) covering an area of approximately 3500 km^2 (Proctor *et al*. 1988). In Sabah, ultramafics are found from sea level up to nearly 3100 m a.s.l. and occur in the northern part of Sabah from Banggi island and stretching southeast to the Lahad Datu area. These outcrops, listed from north to southeast are Banggi Island, Malawali island, Mt. Tambuyukon, Mt. Kinabalu, Bukit Hampuan and Kulung Hill, Morou Porou, Bidu-Bidu Hills, Meliau Range, Mt. Tawai, Mt Tinkar, Sg Imbak, Mt. Nicola, Mount Silam and Sakar Island (Fig. 1).

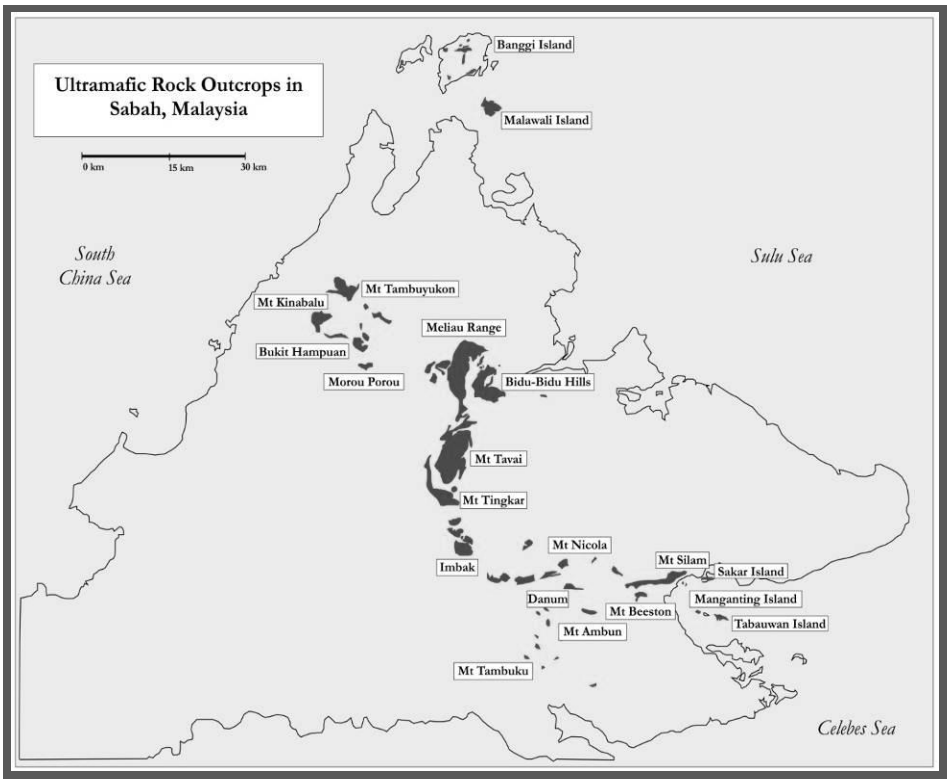

Figure 1: Ultramafic outcrops in Sabah. The outcrops are marked in red. 'Igneous Rocks of Sabah, Malaysia' by Geological Survey, Borneo Region, Malaysia, 1965.

Botanical exploration of the ultramafic forests was carried out at different times in the past. Table 1 shows the record of past and recent botanical explorations in the study areas.

Table 1: Record of past and recent botanical explorations in the study areas.

Forest Reserve	Main collectors	Years
Malawali island	Fox, J.D.; SFD (Sabah Forestry Department)	1970; 2002 (Sugau & Tangah, 2004)
Bukit Hampuan	Meijer, W.; SFD	1959; 2011
Bidu-Bidu Hills	Meijer, W.; SFD	1961; 2010
Meliau Range	Meijer, W.; SFD	1961; 2012
Mount Tawai	Meijer, W.; SFD	1963; 2009
Gunung Tinkar	Meijer, W.; SFD	1960; 2013
Sg Imbak (2a & 2b)	SFD	2013
Mt. Nicola	SFD	1992
Mount Silam	Wood, G.H.S.; Meijer, W.; Proctor, J.; SFD	1955; 1960; 1983; 2011
Sakar Island	Wood, G.H.S.; SFD	1954; 2009

This study was conducted to determine plant diversity and endemism in the ten forest reserves with ultramafic habitats in Sabah. This information can then be used in the formulation of plant conservation strategies and also forest management plan.

2.0 METHODS

Plant collection was carried out during the several surveys in ultramafic forests in Sabah. This included recent surveys and expeditions to the least collected areas, such as Sakar Island, Gunung Tinkar and Sg Imbak Forest Reserves. Data of plants from other forest reserves that have been explored much earlier, such as Bidu-Bidu FR, Bukit Hampuan FR, Bukit Tawai FR, Danum Valley FR (Mt. Nicola), Sapagaya FR (Mt. Silam), Sempilor Malawali FR and Ulu Tungud FR (Meliau Range) were retrieved from the database of the herbarium of the Forest Research Centre (SAN). These forest reserves are shown in Fig 2. Only taxa that have been identified to specific and infra-specific level are used in this paper. Relevant literature was also consulted to determine endemism of the plants listed.

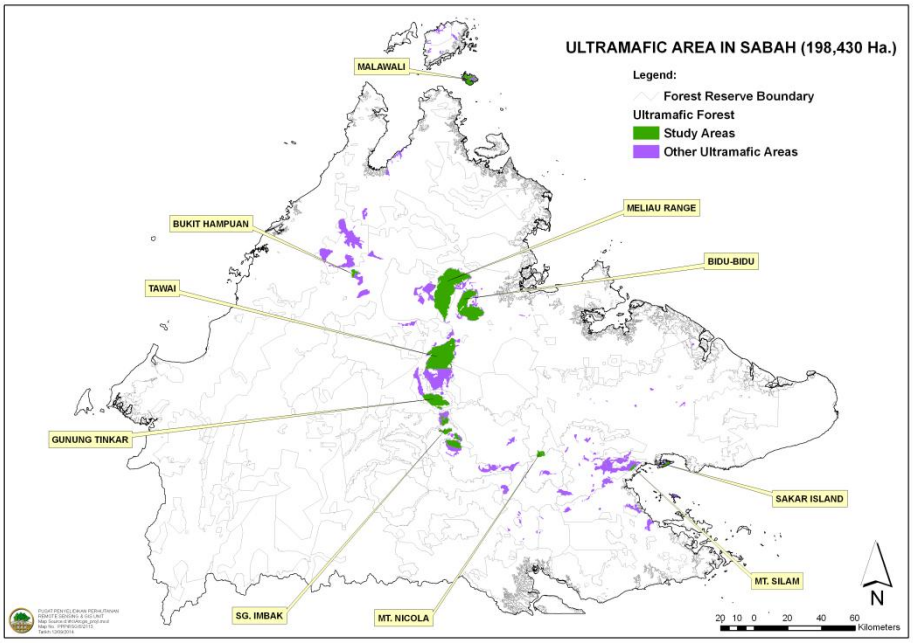

Figure 2: Location of the study areas (green) in Sabah.

3.0 RESULTS AND DISCUSSION

The total number of plant species recorded from ten forest reserves, when corrected for species shared between localities is 2673, which is more than 60% of the number of species recorded from ultramafic habitats in Sabah. The number of species recorded in each of these forest reserves is shown in Table 2. The highest number is from Sg Imbak while the lowest is from Mount Nicola. These figures may still under-represent the actual flora or biased for several localities, e.g. Bidu-Bidu Hills, Meliau Range, Malawali island and Mount Nicola.

Table 2: Number of taxa and endemic plants recorded from ten forest reserves in Sabah.

Location	Number of taxa	Number of Bornean endemic	Number of Sabah endemic	Number of Hyper-endemic
Bidu Bidu FR	461	112	27	
Bukit Hampuan FR	690	180	52	2
Bukit Tawai FR	824	211	50	5
Danum Valley FR (Mt. Nicola)	45	12	4	
Gunung Tinkar FR	857	204	39	
Sakar Island FR	309	43	6	
Sapagaya FR (Mt. Silam)	705	139	25	2
Sempilor Malawali FR	56	4	1	1
Sg Imbak FR (Block B)	832	218	30	
Ulu Tungud FR (Meliau Range)	414	120	29	
Total	2673	653	145	10

Further analysis of the data shows that the ten most collected plant families from ultramafic outcrops in the forest reserves were Orchidaceae (226), Rubiaceae (131), Dipterocarpaceae (118), Fabaceae (101), Myrtaceae (98), Euphorbiaceae (89), Phyllanthaceae (86), Annonaceae (84), Lauraceae (84) and Arecaceae (66).

Lower plants (the mosses and liverworth) were very poorly documented from ultramafics. There have been efforts to collect lower plants by the experts from several ultramafic outcrops (e.g. Sg Imbak FR, Block 2) but they have yet to be documented.

Plant species that were collected from most of the localities (nine ultramafic localities) are *Antidesma neurocarpum* (Phyllanthaceae), *Decaspermum fruitcosum* (Myrtaceae), *Gomphia serrata* (Ochnaceae) and *Xanthophyllum flavescens* (Polygalaceae) and plant species that were collected from more than 6 localities include the herb *Dianella ensifolia* (Xanthorrhoeaceae), the shrub *Psychotria aurantiaca* (Rubiaceae), the pitcher plant *Nepenthes macrovulgaris*, the trees *Buchanania arborescens* (Anacardiaceae) and *Borneodendron aenigmaticum* (Euphorbiaceae).

3.1 PLANT ENDEMISM AND RESTRICTION TO ULTRAMAFIC HABITATS

The most interesting features of many forests on ultramafic outcrops in Sabah, in particular, were the occurrence of ultramafic obligate taxa and number of endemic plant species. Of the 2673 taxa recorded from the reserves, 653 were endemic to Borneo, including 145 endemic to Sabah and 10 hyper-endemic (Table 2). However, the number of obligate taxa is still unknown.

Plants occurring on ultramafic soils may be grouped into three: (a) substrate-indifferent species from surrounding communities that occur on both substrates, but with some showing a higher abundance on ultramafics, called 'facultative ultramafic species'; (b) species that reach ultramafic sites as an extension of their normal range ('outliers'); and (c) endemics to the substrate (either specific or infraspecific taxa), called 'obligate ultramafic taxa' (Kruckeberg 1986, 1991).

Ultramafic obligate species are comparatively rare in the flora of Sabah, and the great majority of plant species are facultative ultramafic plant species (Van der Ent *et al.* 2014a). An explanation for this observation is that most plant species have the 'flexibility' to be able to adapt to a range of different soil types. However, some plant species might not occur on ultramafic soils as a result of competition with plant species that are highly specialised to grow under strong edaphic stress, and in turn ultramafic obligate species do not occur on other soils because of inherent slow growth rates (and are thus outcompeted) (Van der Ent *et al.* 2014b) .

In the study areas, ultramafic obligate species include the small shrub *Scaevola micrantha* (Goodeniaceae, also in the Philippines on Palawan Island), the widespread Malesian fern *Odontosoria retusa* (Dennstaedtiaceae) and in Sabah known only on ultramafic areas, the bamboos *Dinochloa darvelana*, *D. obclavata*, *D. prunifera*, *D. robusta*, *Racemobambos hirsuta* and *R. rigidifolia* (Poaceae) (the last shared with Palawan), and the rattan *Daemonorops serpentina* (Arecaceae), one of eleven species of rattans confined to lowland ultramafic areas (Wong 1998). Only a few tree species are currently known as ultramafic obligate species, these include *Borneodendron aenigmaticum* (Euphorbiaceae), a monotypic genus endemic to Sabah,

Where the effects of ultramafic bedrock and altitude combine, narrow (edaphic) endemics or hyper-endemics are often found. There are 10 hyper-endemics recorded in this study, namely *Calamus malawaliensis* (Arecaceae), which was restricted to Malawali island; *Pittosporum linearifolium* (Pittosporaceae) and the newly described *Timonius leopoldii* (Rubiaceae) (Chen *et., al.*, 2014) restricted to Bukit Hampuan; *Rhododendron sugauii* (Ericaceae), *Syzygium georgeae* (Myrtaceae), *Tristaniopsis merguensis* var. *tawaiense* (Myrtaceae), *Semecarpus angustifolius* (Anacardiaceae) and *Payena khoonmengiana* (Sapotaceae) restricted to Mt. Tawai FR; and *Syzygium silamense* (Myrtaceae) and the newly described *Ardisia silamensis* (Primulaceae) (Utteridge *et al.* 2014) restricted to Mt. Silam.

4.0 THREATS AND CONSERVATION OF PLANT DIVERSITY IN ULTRAMAFIC HABITATS

In Sabah, biodiversity is severely threatened by deforestation, especially through large-scale plantation agriculture. Between 1985 and 2005, Borneo lost an average of 850,000 ha annually, and this rose to 1.2 million ha annually during 2000-2002 (WWF 2005). In Sabah, 39.4% of its ultramafic areas are still under threat from land conversion due to logging or other land uses, such as oil palm plantations (Fig. 3).

Although less than 1% of the earth's land surface is ultramafic (Proctor 1999), such habitats are renowned as centres for plant diversity and support high levels of plant endemism (Rajakaruna and Baker 2004). Many plant species only occur in a single or a few ultramafic sites, and destruction of the ecosystem that supports them may therefore result in their extinction. For example, 40% of all species recorded from Kinabalu Park are only known from a single collection in localized areas (especially on ultramafic soils) (Beaman and Beaman 1990).

Forest fires have been a main threat to many ultramafic sites, with many sites around Telupid devastated by fire in recent years. This is due to the fact that most of the ultramafic areas are surrounded by plantations or human settlements. The majority of ultramafic outcrops are relatively small, and population sizes of plant species are

consequently also small, therefore rare plants face particular risks from the potential future effects of climate change induced droughts and fires.

There were also records of plants with high ornamental potential, e.g. *Paphiopedilum hookerae* var. *volonteanum* and *P. rothschildianum* being illegally collected from the reserves.

However, with the recent reclassification of several class 2 forest reserves into class 1 (protected forest reserve), especially around Kuamut and Danum Valley, where all the least explored ultramafic outcrops occur, more ultramafic forest is now protected (SFD, 2013) . At present 60.6% of ultramafic forest is within protected area. This figure is far more than the target required in National Strategy for plant conservation, which is 10% of the total ecological habitat (Fig. 3)

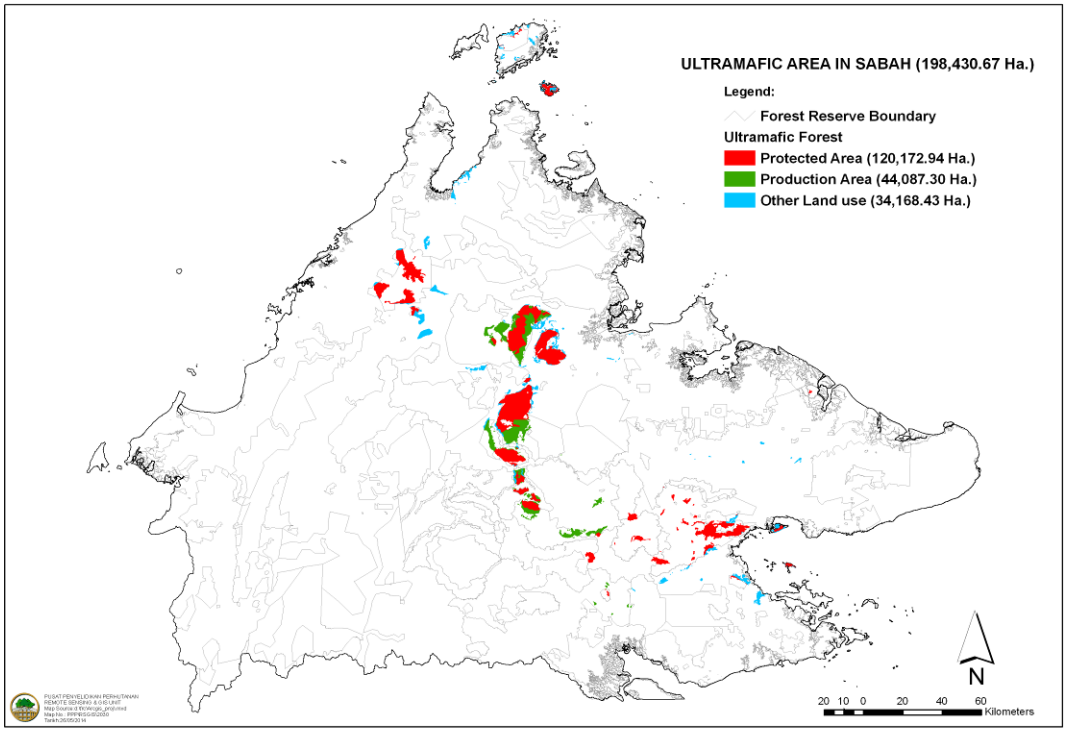

Figure 3: The ultramafic areas in Sabah. Protected areas are marked in red while areas marked in green and blue are under production and other land uses respectively.

5.0 ISSUES AND CHALLENGES

In Sabah, like other parts of Borneo i.e. Sarawak, Brunei, and Kalimantan, even though plant taxonomic studies have been in progress, the detailed taxonomic study and revision are still lacking for most of the plant groups. In many cases not all genera in one family (especially for the big plant families) are treated but only certain genera, for which experts are available have been studied recently.

One of the challenges and constraints in plant diversity documentation in Sabah is the lack of taxonomic specialists. With the large number of plants species, it is impossible to study every species, including flora in ultramafic areas.

Due to the lack of revision, there are so many synonyms which will lead to the inaccurate number of species and species identification of herbarium specimens in the local herbaria are 'poor' which will lead to misidentification.

Many other areas in Sabah have not been fully sampled such as Mount Tawai and Bidu-Bidu Hills, or are very poorly collected, notably the ultramafic outcrops in the interior, such as Mount Nicola, Mount Beeston and nearby ultramafic outcrops. This is mainly due to the difficult access.

6.0 RECOMMENDATIONS

In order to get a more representative or accurate result, some parts of certain forest reserves that have not been fully explored, e. g. Mount Tawai and Bidu-Bidu Hills must be further sampled. Those areas that are very poorly collected and has difficult access, notably the ultramafic outcrops in the interior, e.g. Mount Nicola, Mount Beeston and surrounding areas must be sampled through expeditions.

Serious and detailed studies of flora in Sabah must be carried out. Without knowledge of the diversity and distribution of plant species on ultramafics, it is difficult to establish which species may be under threat and therefore may need the formulation of conservation strategies.

Another research priority should be to conduct detailed ecological and biogeochemical studies on the characteristics of ultramafic ecosystems, such as plant-soil relationships, nutrient cycling, eco-physiological strategies and plant adaptation, and hyperaccumulator-herbivore interactions. Studies on the population genetics of these species should also be given priority in order to unravel plant evolutionary mechanisms among ultramafic-specific species.

It is highly recommended that forest fires prevention or mitigation measures are incorporated in the Forest Management Plan for any forest reserve that is prone to forest fires.

7.0 CONCLUSIONS

Plant diversity in ultramafic forest in Sabah is high. More than 60% of the known number of species recorded on ultramafic forest in Sabah occurs in the study areas. The most interesting features about the findings are the occurrence of ultramafic obligate taxa and high endemism in ultramafic forest. Out of the 6273 plant taxa recorded from the reserves, 653 are endemic to Borneo, including 145 endemic to Sabah and 10 hyper-endemic.

There are three main threats to the flora of ultramafics which are: deforestation for agriculture, forest fire and illegal collecting of plant with ornamental potential. However, with the recent reclassification of several class 2 forest reserves into class 1 (Protected forest reserve), at present 60.6% of ultramafic forests are under protected areas. This figure is far more than the target required in National Strategy for plant conservation, which is 10% of the total ecological habitat.

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PAPER 3: 6

USAHA-USAHA PENTING PEMELIHARAAN DAN PEMULIHARAAN KAWASAN HUTAN MELALUI INISIATIF PELAKSANAAN *CENTRAL FOREST SPINE* (CFS)

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ABSTRAK

Fragmentasi hutan dan kehilangan habitat telah dikenal pasti sebagai salah satu ancaman yang memberi kesan terhadap pemeliharaan biodiversiti hutan dan sekaligus akan menjejaskan sumbangannya kepada kepentingan sosioekonomi negara. Menyedari akan hakikat ini, pihak kerajaan telah menggariskan dasar pembangunan negara yang seimbang dengan mengambil kira kepentingan alam sekitar dan pemeliharaan khazanah biodiversiti negara melalui Dasar Rancangan Fizikal Negara (RFN). Salah satu dasar yang memberikan penekanan yang utama ke atas penyambungan kompleks hutan yang terpisah adalah dasar ke-23 iaitu *Central Forest Spine* (CFS) diwujudkan bagi membentuk tulang belakang jaringan Kawasan Sensitif Alam Sekitar (KSAS) dengan melibatkan 37 koridor ekologi di Semenanjung Malaysia. Bagi melaksanakan dasar ini, satu (1) Pelan Induk Koridor Ekologi CFS 2010 telah disediakan oleh Jabatan Perancangan Bandar dan Desa (JPBD) bagi menentukan halatuju perancangan dan pelaksanaan di peringkat persekutuan dan negeri di mana Jabatan Perhutanan Semenanjung Malaysia (JPSM) telah diberi tanggungjawab sebagai agensi pelaksana utama CFS. Memandangkan pelaksanaan CFS memerlukan komitmen yang tinggi dan kos pembangunan yang besar, maka pihak kerajaan telah melaksanakan satu projek perintis di *Primary Linkage* (PL) 2 Belum-Temengor Gerik, Perak bagi mendapatkan gambaran sebenar pelaksanaan CFS ini di lapangan sebelum ianya dilaksanakan secara menyeluruh di Semenanjung Malaysia.

Bermula pada tahun 2012 sehingga kini terdapat beberapa kejayaan yang telah dicapai terutamanya komitmen beberapa buah kerajaan negeri telah mewartakan tanah kerajaan dalam kawasan koridor ekologi kepada status Hutan Simpanan Kekal. Walau bagaimanapun, pelbagai isu dan cabaran telah dikenalpasti dalam menjayakan pelaksanaan CFS ini, di antaranya adalah keadaan status tanah dan aktiviti guna tanah yang berbeza di bawah pentadbiran dan bidang kuasa pelbagai agensi kerajaan. Di samping itu, sumber dana kewangan untuk membiayai kos pembangunan adalah terhad, penyelarasan usaha di antara agensi di peringkat persekutuan dan negeri serta bebanan kapasiti sumber manusia turut menjadi isu utama dalam melaksanakan inisiatif ini. Oleh yang demikian, kertas kerja ini menghuraikan konsep pelaksanaan CFS, mekanisme pelaksanaan dan usaha-usaha penting pelaksanaan CFS di Semenanjung Malaysia. Kertas ini juga menjelaskan isu dan cabaran di peringkat pelaksanaan di lapanan dan seterusnya menggariskan beberapa strategi penambahbaikan ke arah pelaksanaan inisiatif CFS yang lebih berkesan dan mengelakkan fragmentasi hutan.

1.0 PENDAHULUAN

Semenanjung Malaysia mempunyai keluasan seluas kira-kira 13.18 juta hektar di mana 44.0 peratus adalah litupan kawasan berhutan yang dianggarkan seluas kira-kira 5.83 juta hektar (Laporan tahunan JPSM, 2012). Kawasan hutan di Semenanjung Malaysia ini terdiri daripada Hutan Hujan Tropika yang kaya dengan pelbagai flora dan fauna serta diakui kebanyakan para saintis di seluruh dunia. Kawasan hutan ini mengandungi kira-kira 15,000 spesies tumbuhan berbunga (Towards the Flora of Malaysia, 2007); habitat untuk 229 spesies mamalia; 742 spesies burung; 567 spesies reptilia; 242 spesies amfibia; lebih daripada 449 spesies ikan air tawar dan dianggarkan terdapat kira-kira 150,000 spesies invertebrate (NRE, 2013).

Justeru itu, Malaysia telah diberi pengiktirafan sebagai salah satu daripada 17 negara *mega-diverse* di dunia (*Protected Area Inception Report*, 2013) kerana keunikan dan kepelbagaian biologi dalam kawasan hutannya yang sangat kompleks ini yang memerlukan pemeliharaan dan pemuliharaan dengan sebaik-baiknya. Di antara kepentingan kepelbagaian biologi yang terdapat dalam kawasan hutan ini adalah sebagai sumber makanan, kayu-kayan, perubatan, eko-pelancongan, tempat rekreasi dan pendidikan, sumber alternatif penduduk peribumi, air bersih, genetik, fungsi ekologi dan sebagainya (A Common Vision on Biodiversity, 2008).

Namun begitu, semenjak mencapai kemerdekaan kawasan hutan di Semenanjung Malaysia turut tidak terlepas daripada mengalami arus pembangunan yang sangat pesat untuk menstrukturkan semula sosio-ekonomi dan juga membasmi kemiskinan masyarakat. Kawasan hutan ini telah mengalami perubahan guna tanah yang sangat ketara kepada kawasan pertanian dan pembangunan infrastruktur yang meningkatkan risiko fragmentasi hutan dan kehilangan habitat semulajadi. Fragmentasi hutan telah dikenal pasti sebagai satu ancaman yang serius

kepada pemeliharaan hutan dan perlindungan biodiversiti serta program pemuliharaan di peringkat nasional secara keseluruhan.

Fragmentasi hutan dan kehilangan habitat semulajadi telah menyumbang kepada peningkatan konflik antara manusia dan hidupan liar. Ini adalah kerana laluan semulajadi hidupan liar dari satu kawasan hutan ke hutan yang lain telah dihalang dengan projek pembangunan termasuk jalan raya dan projek pertanian. Ekoran itu, hidupan liar seperti gajah terpaksa memasuki jalan raya dan kawasan pertanian. Manakala hidupan liar seperti harimau belang dan harimau kumbang memasuki kawasan ternakan dan mengancam haiwan ternakan. Sebagai contoh dari tahun 2006 hingga Julai 2013, sebanyak 21 ekor tapir telah mati dilanggar di jalan-jalan raya utama. Selain itu, sebanyak 323 ekor hidupan liar yang merangkumi 190 mamalia, 116 reptilia dan 17 burung telah menjadi mangsa dalam *road kill* di Semenanjung Malaysia dalam tempoh tersebut.

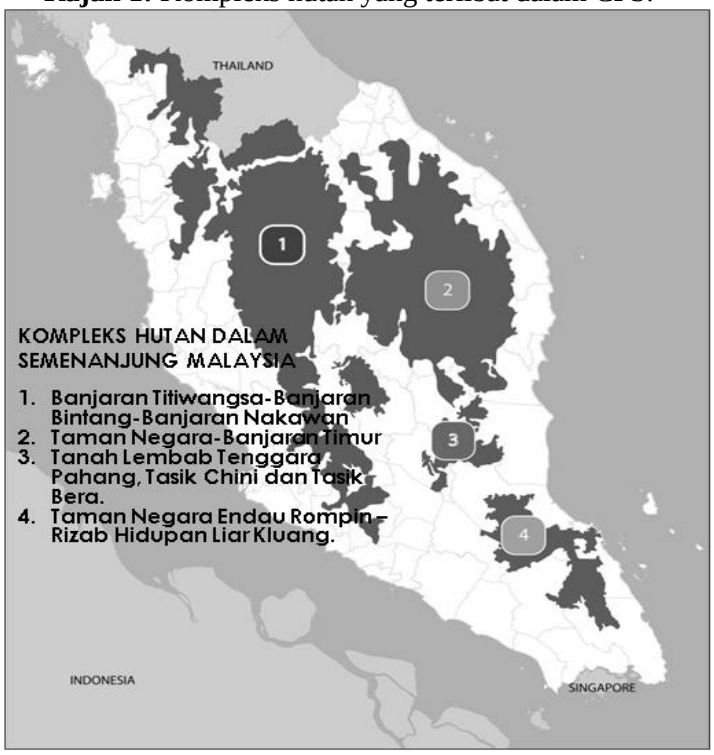
Menyedari akan isu ini, pihak Kerajaan Malaysia telah bersetuju untuk meningkatkan penyambungan kawasan-kawasan hutan yang terpisah ini melalui penubuhan rangkaian koridor ekologi di peringkat nasional. Komitmen ini telah dinyatakan dengan jelas dalam Dasar ke-23 Rancangan Fizikal Negara (RFN) iaitu "*Central Forest Spine* (CFS) akan diwujudkan bagi membentuk tulang belakang rangkaian Kawasan Sensitif Alam Sekitar (KSAS)" (Rancangan Fizikal Negara, 2009). Kawasan CFS diwujudkan bertujuan mengekalkan kawasan berhutan untuk pemeliharaan dan pemuliharaan kepelbagaian biologi menerusi penyambungan 4 kompleks hutan utama di Semenanjung Malaysia seperti dalam Rajah 1.

(i) Banjaran Titiwangsa-Banjaran Bintang-Banjaran Nakawan;
(ii) Taman Negara-Banjaran Timur;
(iii) Tanah Lembap Pahang Tenggara,Tasik Chini dan Tasik Bera; dan
(iv) Taman Negara Endau Rompin-Rezab Hidupan Liar Kluang.

Bagi memastikan CFS ini dapat dilaksanakan dengan jayanya, satu Pelan Induk Koridor Ekologi CFS (2010-2025) telah disediakan oleh Jabatan Perancangan Bandar dan Desa (JPBD) sebagai panduan bagi pelaksanaan CFS melibatkan pewujudan 37 koridor ekologi yang terdiri daripada 17 *Primary Linkages* (PL) dan 20 *Secondary Linkages* (SL).

Pelan Induk ini merupakan satu pelan jangka panjang untuk menyambung kawasan hutan terpencil bagi memelihara dan memulihara biodiversiti dalam 4 kompleks hutan tersebut. Di anggarkan seluas 5.3 juta hektar atau 40 peratus keluasan Semenanjung Malaysia adalah kawasan CFS. Daripada jumlah tersebut dianggarkan 80 peratus merupakan kawasan Hutan Simpanan Kekal (HSK) (Rancangan Fizikal Negara, 2009). Senarai koridor ekologi mengikut negeri adalah seperti dalam Rajah 2.

Rajah 1: Kompleks hutan yang terlibat dalam CFS.



Rajah 2: Senarai koridor ekologi mengikut negeri.

NEGERI	KORIDOR EKOLOGI		
	KORIDOR UTAMA (PL)	KORIDOR SEKUNDER (SL)	JUMLAH KORIDOR EKOLOGI
KEDAH	1	3	4
PERAK	5	3	8
KELANTAN	1	4	5
TERENGGANU	2	2	4
PAHANG	6	3	9
JOHOR	2	2	4
SELANGOR		1	1
NEGERI SEMBILAN		2	2
JUMLAH	**17**	**20**	**37**

Pelaksanaan CFS dilakukan dengan menggunakan pendekatan pembangunan seimbang selaras dengan prinsip pembangunan mapan merangkumi 4 komponen utama berikut:

(i) pengekalan kawasan berhutan;
(ii) Pengurusan Hutan Secara Berkekalan (PHSB);
(iii) pemulihan hutan; dan
(iv) pembangunan koridor ekologi (*ecological connectivity*).

Selain itu, terdapat juga perkara-perkara lain yang perlu diambil kira dalam pelaksanaan CFS adalah seperti berikut:

(i) CFS terdiri daripada kawasan Hutan Simpanan Kekal (HSK), Tanah Kerajaan, Tanah Berimilik dan lain-lain rezab;
(ii) kawasan CFS dibangunkan dan diurus menggunakan prinsip pembangunan mapan;
(iii) pembangunan CFS mengambilkira *status quo* atau pembangunan yang dirancang bagi kawasan yang terbabit;
(iv) tanah-tanah yang diperolehi untuk penyambungan koridor ekologi diwartakan sebagai HSK; dan
(v) CFS dilindungi di bawah kuasa atau perundangan sedia ada untuk menjamin kesinambungannya seperti diwartakan sebagai HSK, Taman Negara/Negeri atau Rezab Hidupan Liar.

Mekanisma dan pelaksanaan CFS

Pelaksanaan Pelan Induk Koridor Ekologi CFS ini telah dimandatkan kepada Kementerian Sumber Asli dan Alam Sekitar (NRE) dengan penglibatan secara bersepadu antara agensi-agensi di peringkat Persekutuan dan Negeri di mana Jabatan Perhutanan Semenanjung Malaysia (JPSM) bertindak sebagai agensi pelaksana utama. Sebanyak 8 buah negeri di Semenanjung Malaysia iaitu Negeri Johor, Kelantan, Kedah, Negeri Sembilan, Pahang, Perak, Selangor dan Terengganu telah terlibat dalam pelaksanaan CFS ini mengikut satu Kerangka Kerja Institusi yang telah diwujudkan seperti di Rajah 3.

(i) Jawatankuasa Pemandu Nasional Pelaksanaan *Central Forest Spine* (JPNP-CFS) dipengerusikan oleh Ketua Setiausaha Kementerian Sumber Asli dan Alam Sekitar (NRE) yang bertujuan untuk

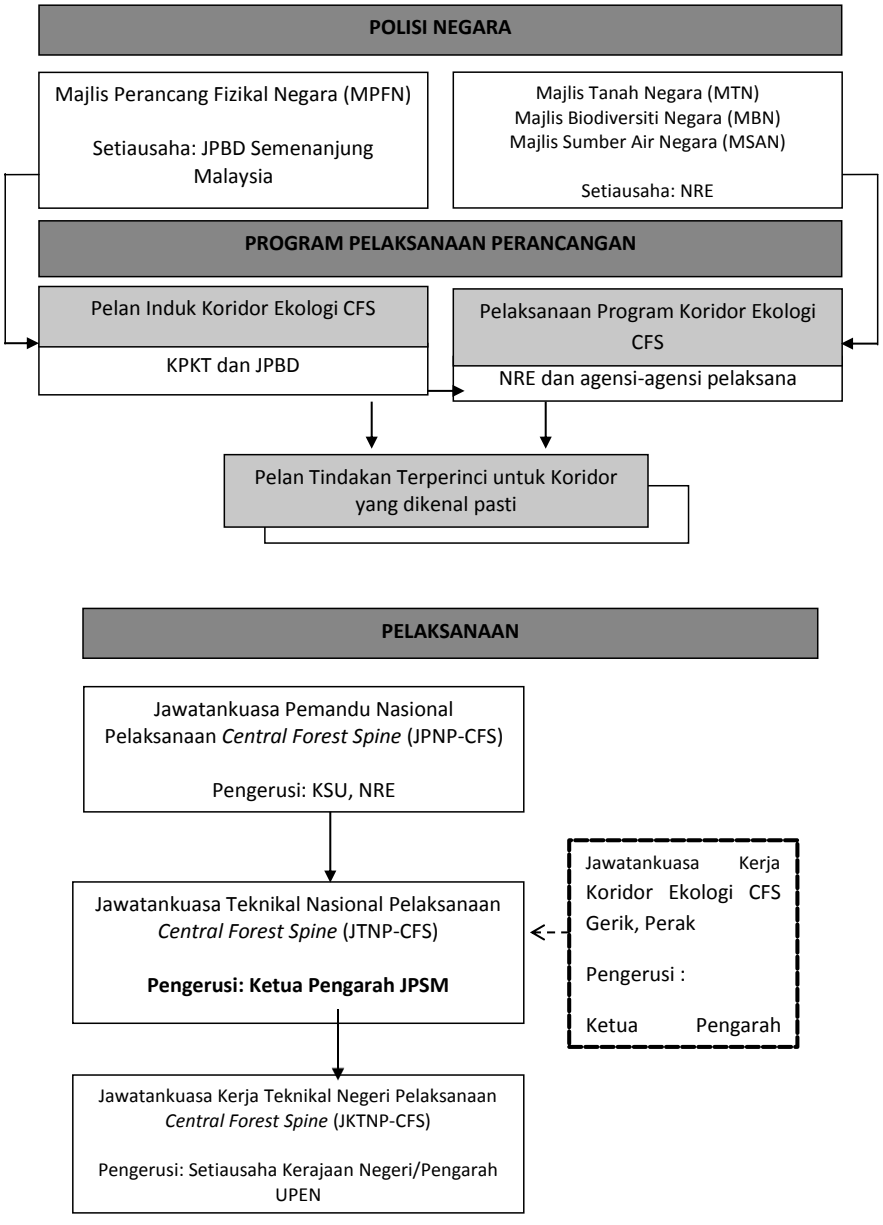
menyelaras pelaksanaan koridor ekologi CFS dengan kerjasama agensi-agensi di peringkat Persekutuan dan Negeri di Semenanjung Malaysia;

(ii) Jawatankuasa Teknikal Nasional Pelaksanaan *Central Forest Spine* (JTNP-CFS) dipengerusikan oleh YBhg. Dato' Prof. Dr. Ketua Pengarah Perhutanan Semenanjung Malaysia yang bertujuan menyelaras perkara-perkara teknikal berkaitan pelaksanaan koridor ekologi CFS dengan kerjasama agensi-agensi di peringkat Persekutuan dan Negeri di Semenanjung Malaysia; dan

(iii) Jawatankuasa Kerja Teknikal Negeri Pelaksanaan *Central Forest Spine* (JKTNP-CFS) dipengerusikan oleh Setiausaha Kerajaan Negeri/Pengarah Unit Perancang Ekonomi Negeri (UPEN) yang bertujuan menyelaraskan pembangunan koridor ekologi CFS dengan kerjasama agensi-agensi di peringkat negeri.

Kerangka kerja institusi bagi pelaksanaan koridor ekologi CFS adalah seperti di Rajah 3.

Rajah 3: Kerangka kerja institusi bagi pelaksanaan koridor ekologi CFS.



2.0 PROGRAM/USAHA YANG DILAKSANAKAN

Sepanjang tempoh pelaksanaan CFS ini, terdapat beberapa program/usaha yang telah dilaksanakan oleh pihak JPSM antaranya ialah:-

a) Penganjuran lab pelaksanaan koridor ekologi CFS dengan kerjasama Jabatan Perlindungan Hidupan Liar dan Taman Negara (PERHILITAN) dan Institut Penyelidikan Perhutanan Malaysia (FRIM) dari 14 hingga 16 Mei 2014 di Hotel Oriental Crystal, Kajang, Selangor. Lab selama tiga (3) hari ini telah dirasmikan oleh oleh YBhg. Datuk Dr. Abdul Rahim Bin Haji Nik, Timbalan Ketua Setiausaha (Alam Sekitar), NRE dan telah dihadiri oleh 56 peserta yang terdiri dari wakil dari Kerajaan Persekutuan dan Negeri, pertubuhan bukan kerajaan (NGOs) dan sektor swasta. Objektif lab pelaksanaan koridor ekologi CFS adalah mengenalpasti isu dan permasalahan utama pembangunan koridor ekologi CFS di Semenanjung Malaysia dan menyediakan strategi pelaksanaan koridor ekologi CFS bagi tempoh jangka pendek, sederhana dan panjang.

b) Sebagai inisiatif permulaan dalam melaksanakan Pelan Induk Koridor Ekologi CFS, Kerajaan Persekutuan telah memperuntukkan kewangan sebanyak RM60 juta untuk melaksanakan satu projek perintis iaitu Projek Pembangunan Koridor Ekologi PL2 di Gerik, Perak. Susulan daripada Lab Pengurusan Nilai yang telah diadakan oleh JPSM pada bulan September 2012 peruntukan sebanyak RM60 juta telah dikurangkan kepada RM49.625 juta untuk melaksanakan projek ini dari 2012 hingga 2015 dengan melibatkan 2 komponen utama, iaitu konservasi biodiversiti dan pembangunan infrastruktur. Bagi menyelaras dan memantau secara berkesan pelaksanaan projek perintis ini, satu Jawatankuasa Kerja *Ecological Linkages* CFS Gerik, Perak telah ditubuhkan. Jawatankuasa Kerja ini dipengerusikan oleh Ketua Pengarah JPSM. Ahli-ahlinya terdiri daripada wakil agensi-agensi kerajaan berkaitan di peringkat Persekutuan dan Negeri Perak. Di antara aktiviti-aktiviti yang telah dilaksanakan di bawah Projek Pembangunan Koridor Ekologi PL2 di Gerik, Perak tersebut adalah seperti berikut:

   (i) Pembinaan sebuah lintasan hidupan liar (*viaduct*) yang dijangka akan siap dibina pada pertengahan tahun 2015 dengan kerjasama Jabatan Pengairan dan Saliran (JPS);

   (ii) Kerajaan Negeri Perak telah mewartakan kawasan hutan tanah kerajaan seluas 18,866 hektar di kawasan koridor ekologi PL2: Belum-Temengor kepada HSK yang dinamakan sebagai Hutan Simpan Amanjaya. Aktiviti pengukuran sempadan kawasan ini sedang dilaksanakan dan dijangka akan siap penghujung tahun 2015;

   (iii) Mengadakan persidangan bertajuk *The Conference on Perak's Central Forest Spine: The Offing of The State's Biodiversity Bastion* telah diadakan pada 19 Februari 2013 bertempat di *Kinta Riverfront Hotel and Suites*, Ipoh;

   (iv) Kerajaan Negeri Perak melalui Jabatan Perhutanan Negeri Perak telah menandatangani satu perjanjian kerjasama dengan *Tropical Rainforest Conservation and Research Centre Bhd* (TRCRC) untuk memulihara kawasan koridor ekologi CFS Gerik, Perak pada 19 Februari 2013;

   (v) Mengadakan program penanaman pokok yang bertemakan *Amanjaya Tree Planting Program: Future Carbon Stocking and Cleaner Environment in a Biodiversed Forest* telah dianjurkan oleh Kerajaan Negeri Perak di Hutan Simpan Amanjaya pada 7 November 2013 dan dirasmikan oleh DYMM Pemangku Raja Perak, Raja Dr Nazrin Shah dengan melibatkan penyertaan para peserta tempatan dan wakil kedutaan di Malaysia;

   (vi) Melaksanakan pemulihan kawasan hutan di HS Amanjaya seluas 54 hektar dengan pelbagai spesies pokok hutan dan nadir untuk tujuan restorasi habitat hidupan liar;

   (vii) Melaksanakan pemantauan di kawasan koridor ekologi ekologi PL2: Belum-Temengor di bawah konsep 1NRE *Enforcement* yang diterajui oleh Jabatan Perhutanan Negeri Perak;

   (viii) Mengadakan kajian sosioekonomi, *Cost Benefit Analysis* (CBA), pengumpulan data satelit imej dan guna tanah di kawasan koridor ekologi ekologi PL2: Belum-Temengor; dan

   (ix) Mengadakan kajian flora dan fauna dengan kerjasama Jabatan Perlindungan Hidupan Liar dan Taman Negara (PERHILITAN) dan Institut Penyelidikan Perhutanan Malaysia (FRIM).

c) Projek UNDP/GEF-GOM : *Improving Connectivity In The Central Forest Spine* (CFS) *Landscape* (IC-CFS) merupakan satu projek yang diperkenalkan oleh Kerajaan Malaysia dengan kerjasama *United Nations Development Programme* (UNDP) bagi tujuan menyokong usaha-usaha pemuliharaan biodiversiti melalui penyambungan 4 Kompleks Hutan di Semenanjung Malaysia yang telah diperkenalkan dalam program *Central Forest Spine* (CFS). Projek ini akan dilaksanakan oleh Kementerian Sumber Asli dan Alam Sekitar (NRE) melalui Jabatan Perhutanan Semenanjung Malaysia (JPSM) dan dibiayai oleh *Global Environment Facility* (GEF). Tempoh pelaksanaan projek ini adalah selama enam (6) tahun bermula dari tahun 2014 sehingga 2019.

d) Selain itu, JPSM juga telah menggalakkan kerajaan-kerajaan negeri yang terlibat untuk menyediakan peruntukan khas bagi pelaksanaan CFS. Sebagai contoh, Kerajaan Negeri Sembilan telah menyalurkan peruntukan sejumlah RM84,528 pada tahun 2013 kepada Jabatan Perancang Bandar dan Desa (JPBD) Negeri untuk menjalankan Kajian Inventori Hidupan Liar dan Flora dalam kawasan CFS Negeri Sembilan. Manakala, Kerajaan Negeri Selangor juga telah memperuntukkan sejumlah RM50,000 setiap tahun bermula pada 2013 di bawah peruntukan pembangunan negeri khusus untuk pelaksanaan CFS. Kerajaan Negeri Kedah telah mewartakan cadangan Hutan Simpan Bukit Saiong seluas 8,119 hektar sebagai HSK di mana seluas 4,398 hektar termasuk dalam kawasan koridor ekologi SL7: HS Ulu Muda-HS Pedu-HS Chebar.

3.0 ISU DAN CABARAN PELAKSANAAN CFS DI SEMENANJUNG MALAYSIA

(i) Kawasan koridor ekologi melibatkan pelbagai pihak berkepentingan.

Perkara 74(2) Perlembagaan Persekutuan telah menetapkan bahawa tanah dan hutan adalah di bawah bidang kuasa Kerajaan Negeri. Pelaksanaan koridor ekologi CFS di lapangan adalah di bawah tanggungjawab Jabatan Perhutanan Negeri (JPN) sebagai agensi utama dengan penglibatan agensi-agensi lain di peringkat negeri yang berkaitan. Manakala Kerajaan Persekutuan akan memantau kemajuan dan menyelaraskan pelaksanaan Pelan Induk Koridor Ekologi CFS. Pelaksanaan koridor ekologi CFS di lapangan melibatkan tiga (3) kawasan utama iaitu Hutan Simpanan Kekal (HSK), Tanah Kerajaan dan Tanah Berimilik. Kuasa perundangan yang ada pada JPN adalah terhad kepada kawasan-kawasan berstatus HSK sahaja manakala kawasan-kawasan berstatus Tanah Kerajaan dan Tanah Berimilik adalah di bawah tanggungjawab Pejabat Tanah Negeri.

Pada dasarnya bagi kawasan HSK yang berada dalam kawasan koridor ekologi CFS pihak JPN dapat mengurus dan mengawal agar dapat mematuhi langkah-langkah yang digariskan dalan Pelan Induk CFS. Sementara itu, sebahagian daripada kawasan koridor ekologi CFS di Semenanjung Malaysia adalah melibatkan kawasan tanah berimilik, syarikat swasta dan kawasan yang telah diduduki secara haram. Keadaan ini menyukarkan pelaksanaan Pelan Induk CFS disebabkan penyelarasan yang terhad dalam kalangan sektor-sektor di peringkat Persekutuan, Negeri dan Agensi Kerajaan Tempatan.

(ii) Keperluan sumber manusia

Pelaksanaan 37 koridor ekologi yang terkandung dalam Pelan Induk CFS akan melibatkan bebanan, tanggungjawab dan fungsi tambahan kepada setiap agensi kerajaan yang terlibat samada di peringkat Persekutuan mahupun Negeri. Keadaan ini menunjukkan keperluan untuk memperkukuhkan organisasi agensi yang terlibat dengan membuat pertambahan sumber manusia bagi melaksanakan pembangunan koridor ekologi di lapangan.

(iii) Keperluan Maklumat Asas (*Base-line*)

Pelan Induk CFS telah menggariskan langkah-langkah susulan yang harus dilaksanakan bagi setiap koridor ekologi tersebut. Namun demikian, maklumat-maklumat asas bagi setiap koridor ekologi masih tidak mencukupi bagi perancangan dan pelaksanaan secara berkesan di lapangan. Maklumat-maklumat yang diperlukan adalah status guna tanah, flora, fauna, sosioekonomi, *Cost Benefit Analysis* (CBA), dan konflik antara manusia dengan hidupan liar.

(iv) Keperluan *Capacity Building*

Pelaksanaan koridor ekologi CFS melibatkan pelbagai agensi di peringkat Kerajaan Persekutuan, Negeri dan Pertubuhan Bukan Kerajaan (NGO). Kekurangan kepakaran di agensi-agensi yang terlibat akan menyebabkan

pelaksanaan CFS yang tidak lancar seterusnya memberi impak yang negatif terhadap pelaksanaan CFS secara menyeluruh. Justeru itu, *capacity building* ini perlu dipertingkat dan diperluaskan khususnya kepada pegawai-pegawai yang terlibat secara langsung untuk mengurus kawasan koridor ekologi.

(v) Keperluan Kewangan

Pelan Induk Koridor Ekologi CFS 2010 yang disediakan oleh Jabatan Perancangan Bandar dan Desa (JPBD) telah mengenal pasti keperluan peruntukan kewangan yang besar dengan anggaran sejumlah RM4.829 bilion. Keperluan peruntukan untuk melaksanakan Pelan Induk Koridor Ekologi CFS ini antaranya melibatkan beberapa komponen utama seperti:

(a) kajian-kajian untuk memperolehi maklumat asas untuk pembangunan kawasan koridor ekologi;
(b) pampasan pengambilan Tanah Kerajaan dan Tanah Berimilik; (yang dibayar melalui pampasan atau melalui Akta Pengambilan Tanah 1960);
(c) pembangunan infrastruktur seperti pembinaan viaduct;
(d) pemuliharaan habitat; dan
(e) pengurusan, pembangunan dan penguatkuasaan.

4.0 *LESSON LEARNT* DARIPADA PELAKSANAAN CFS

(i) Penglibatan aktif semua agensi dan Kerjasama yang bersepadu dari semua agensi

Pelaksanaan CFS ini melibatkan pelbagai agensi kerajaan di peringkat Persekutuan dan Negeri serta Badan Bukan Kerajaan (NGO). Agensi-agensi yang terlibat ini akan memainkan peranan di bawah bidang kuasa dan tindakan masing-masing. Penglibatan semua agensi secara optimum mengikut kepakaran masing-masing dapat membantu pelaksanaan CFS berjalan dengan lancar seterusnya menempa kejayaan. JPSM sebagai agensi peneraju utama pelaksanaan CFS tidak boleh bekerja dalam keadaan *silo* dan perlu mendapat kerjasama dan komitmen dari pelbagai agensi yang terlibat dalam pelaksanaan CFS. Kerjasama yang bersepadu dari pelbagai agensi kerajaan di peringkat Persekutuan dan Negeri serta Badan Bukan Kerajaan (NGO) perlu dikekalkan agar pelaksanaan CFS di lapangan dapat dilaksanakan dengan sebaik-baiknya.

(ii) Mengambil tindakan mewartakan kawasan tanah kerajaan yang terletak dalam koridor ekologi CFS sebagai HSK

Dianggarkan seluas kira-kira 228,546 hektar kawasan tanah kerajaan sedia ada yang terdapat dalam koridor ekologi CFS. Tanah tersebut perlu diwartakan segera sebagai HSK di bawah Akta Perhutanan Negara 1984 adalah untuk:

(a) memastikan kawasan tanah kerajaan dalam koridor ekologi CFS dilindungi di bawah perundangan perhutanan untuk menjamin keberkalaan kawasan yang terlibat;

(b) memastikan pelaksanaan dan penguatkuasaan Akta Perhutanan Negara 1984 dapat dijalankan dengan sempurna dan berkesan;

(c) kawasan tanah kerajaan yang telah dikenal pasti terlibat dalam koridor ekologi CFS merupakan habitat asal dan laluan kawasan keliaran bagi hidupan liar seperti gajah, harimau belang, tapir, harimau kumbang dan beruang matahari. Kawasan ini perlu dipelihara dan dilindungi habitatnya bagi memudahkan pergerakan hidupan liar dan mengelakkan *inbreeding* di kalangan spesies hidupan liar;

(d) kawasan tanah kerajaan ini memainkan peranan penting dalam menyambungkan kawasan-kawasan hutan yang terpencil dan terpisah serta mengurangkan konflik antara manusia dan hidupan liar; dan

(e) Pewartaan kawasan tanah kerajaan dalam koridor ekologi sebagai HSK secara tidak langsung akan membantu kerajaan memenuhi komitmen untuk mencapai sasaran ke atas litupan hutan dan pokok sekurang-kurangnya 50 peratus daripada keluasan tanah di Malaysia.

(iii) Penyediaan maklumat asas (*Base-line Information)*

Perancangan dan pelaksanaan CFS yang berkesan di lapangan amat bergantung kepada maklumat-maklumat asas yang telah diperolehi oleh agensi-agensi yang terlibat. Justeru itu, kajian awal perlu dilakukan segera untuk mendapatkan maklumat-maklumat asas yang diperlukan seperti berikut:-

(a) Kajian status guna tanah;
(b) Kajian flora dan fauna;
(c) Kajian sosioekonomi;
(d) Kajian *Cost Benefit Analysis* (CBA); dan
(e) Kajian konflik antara manusia dengan hidupan liar.

(iv) Unit khas untuk pelaksanaan CFS

Kawasan koridor ekologi CFS telah diuruskan secara berasingan mengikut tujuan guna tanah seperti perhutanan, pertanian, perlombongan, penempatan dan infrastruktur. Penyelarasan yang terhad di kalangan agensi-agensi kerajaan dan sektor-sektor swasta yang terlibat khususnya di peringkat Persekutuan dan Negeri merupakan satu kekangan dalam pelaksanaan CFS. Keadaan yang kurang teratur ini boleh menimbulkan konflik guna tanah yang tidak selaras dengan objektif pembangunan koridor ekologi CFS. Oleh yang demikian, adalah wajar supaya satu unit khas ditubuhkan supaya penumpuan penuh dapat diberi bagi merancang, menyelaras dan melaksanakan projek CFS. Penubuhan unit khas ini berdasarkan pendekatan *National Blue Ocean Strategy* yang melibatkan jawatan *pseudo* dari agensi yang berbeza dan berkaitan ataupun melalui penubuhan jawatan baru.

5.0 KESIMPULAN

Pewujudan CFS di Semenanjung Malaysia merupakan satu usaha kerajaan bagi menyambungkan kompleks-kompleks hutan yang terpisah akibat pembukaan hutan untuk pembangunan sosioekonomi negara. Pewujudan CFS ini melengkapi usaha negara untuk mengurus dan memelihara sumber biodiversiti secara berkekalan selaras dengan hasrat Kerajaan ke arah mencapai matlamat konservasi biodiversiti negara seperti yang termaktub di dalam Dasar Kepelbagaian Biologi Kebangsaan 1998. Usaha ini juga selaras dengan komitmen negara di bawah Konvensyen Kepelbagaian Biologi khususnya ke arah pencapaian *Aichi Biodiversity Targets.*

Pelaksanaan Pelan Induk Koridor Ekologi CFS memerlukan kerjasama bersepadu daripada pelbagai agensi kerajaan di peringkat persekutuan dan negeri serta komitmen yang tinggi daripada Kerajaan Negeri.

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WORKSHOP SESSION IV

PLANTATION FORESTRY: SUSTAINABLE WOOD PRODUCTION AND WOOD BASED INDUSTRY

PAPER 4: 1

PENGELUARAN KAYU-KAYAN SPESIES BALAK BERKUALITI TINGGI DI BAWAH KAEDAH/PENDEKATAN PENGURUSAN HUTAN PELBAGAI TINGKAT DI HUTAN SIMPAN CHIKUS, PERAK

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ABSTRAK

Projek pengurusan hutan pelbagai tingkat ditubuhkan pada November 1991 dengan kerjasama antara Jabatan Perhutanan Semenanjung Malaysia (JPSM) dan Japan International Cooperation Agency (JICA) dengan matlamat untuk mengenalpasti amalan silvikultur yang terbaik bagi pelbagai spesies balak di samping dapat mengeluarkan kayu-kayan dan biji benih berkualiti tinggi di dalam hutan pelbagai tingkat. Plot-plot kajian ditubuhkan untuk mengkaji peralihan ladang hutan sedia ada dan hutan sekunder kepada hutan pelbagai tingkat. Melalui kajian ini, spesies balak yang berkualiti tinggi bagi penubuhan hutan pelbagai tingkat di ladang hutan atau hutan asli dapat dikenalpasti. Kertas kerja ini bertujuan untuk menilai prestasi terkini kadar pertumbuhan dan produktiviti spesies-spesies terpilih melalui pendekatan pengurusan hutan pelbagai tingkat. Berdasarkan prestasi pertumbuhan dan produktiviti yang diperolehi mendapati bahawa kaedah penanaman secara teduhan adalah lebih baik dan praktikal berbanding dengan kaedah tanaman terbuka. Dalam konteks ini, spesies *Acacia mangium* ditanam 3 – 4 tahun lebih awal yang bertindak sebagai pokok teduhan. Terdapat lima (5) reka bentuk kajian dilaksanakan secara kaedah jalur tanaman pada jarak 3.0 x 3.7m yang berselang-seli di antara spesies tempatan dengan *Acacia mangium* dengan nisbah A(1:1, iaitu 1 baris *A. mangium* berselang-seli dengan spesies tempatan), B(2:2), C(4:4), D(8:8) dan E (16:16). Hasil awal kajian mendapati spesies tempatan memerlukan teduhan pada awal penubuhan dan pertumbuhannya baik pada barisan tanaman yang sempit seperti reka bentuk tanaman A(1:1) dan B(2:2). Namun begitu hasil penemuan terkini menunjukkan spesies tempatan memerlukan kadar cahaya matahari yang mencukupi selain keperluan persekitaran lain seperti kelembapan, tanah, cuaca dan sebagainya apabila usianya meningkat. Atas sebab itu ketiga-tiga spesies tempatan iaitu Meranti tembaga, Meranti sarang punai dan Chengal menunjukkan prestasi yang baik pada reka bentuk tanaman C(4:4), D(8:8) dan E(16:16). Perbezaan yang berlaku pada awal penubuhan projek dan sekarang adalah penting bagi mengetahui faktor persekitaran yang diperlukan oleh spesies tempatan supaya pengurusan hutan pelbagai tingkat dapat dijalankan dengan jayanya. Konsep pengurusan hutan pelbagai tingkat ini boleh diamalkan bagi penubuhan ladang hutan dan rawatan silvikultur di kawasan terosot dengan spesies balak tempatan yang berkualiti tinggi.

1.0 LATAR BELAKANG

1.1. Pembukaan kawasan hutan secara berleluasa menjadi punca terhadap berlakunya kemusnahan alam sekitar seperti hakisan tanah, banjir dan pemanasan global. Sejak 1980, amalan pengurusan hutan secara berkekalan mula dilakukan untuk mengawal pengeluaran sumber hutan secara ekonomik.

1.2. Bagi mengurangkan kebergantungan kepada hutan asli, ladang hutan ditubuhkan sebagai alternatif untuk mendapatkan bekalan kayu dengan menanam pelbagai spesies cepat tumbuh seperti *Acacia mangium*, Batai dan Yamane. Namun begitu, penubuhan ladang hutan ini menyebabkan banyak kawasan ditebang habis untuk menjalankan penanaman pokok secara monokultur.

1.3. Pada masa kini, masyarakat mula memandang serius dan lebih peka terhadap kepentingan dan pemeliharaan alam sekitar. Pelbagai usaha dijalankan seperti aktiviti konservasi, penanaman pokok dan penghutanan semula kawasan hutan dilakukan untuk menjamin kepelbagaian sumber hutan dan kestabilan alam sekitar.

1.4. Bagi tujuan tersebut, satu projek Pengurusan Hutan Pelbagai Tingkat (MSFM) telah dilaksanakan dengan kerjasama Jabatan Perhutanan Semenanjung Malaysia (JPSM) dan *Japan International Cooperation Agency* (JICA). Malaysia dipilih untuk melaksanakan projek ini atas sebab lokasinya yang terletak di tengah-tengah kawasan hutan hujan tropika dan

mempunyai semua keadaan persekitaran yang diperlukan untuk melaksanakan pengurusan hutan pelbagai tingkat.

1.5. Projek pengurusan hutan pelbagai tingkat mula dilaksanakan pada tahun 1991 hingga 1999 untuk mewujudkan satu model pengurusan hutan pelbagai tingkat untuk pengurusan hutan secara berkekalan di hutan hujan tropika dan menarik minat sektor swasta untuk melabur dalam aktiviti penghutanan semula.

2.0 PENUBUHAN PROJEK PENGURUSAN HUTAN PELBAGAI TINGKAT

2.1. Hutan pelbagai tingkat merupakan satu kawasan yang terdiri daripada pelbagai spesies dan mempunyai dua (2) atau lebih lapisan silara untuk membentuk satu struktur hutan yang kompleks.

2.2. Pada awal penubuhan, projek ini dijalankan di Hutan Simpan Chikus, Perak dan Hutan Simpan Bukit Kinta, Perak yang terdiri daripada kawasan ladang hutan dan hutan selepas diusahasil. Sebanyak 45 spesies telah ditanam yang terdiri daripada 21 spesies dipterokap dan 24 spesies bukan dipterokap.

2.3. Dua (2) kaedah tanaman dilakukan melalui pendekatan ini iaitu penanaman secara terbuka dan penanaman secara teduhan. Kaedah penanaman secara terbuka dilakukan dengan menanam spesies cepat tumbuh (*fast growing species*) seperti *Acacia mangium* dan spesies tempatan secara serentak di kawasan terbuka.

2.4. Walau bagaimanapun, pada tahun 1994 kaedah tanaman ini terpaksa diganti disebabkan kadar pertumbuhan yang tidak begitu baik dengan penanaman secara teduhan di kawasan belukar. Pokok spesies tempatan ditanam dalam baris (*strip*) yang ditubuhkan di dalam kawasan belukar.

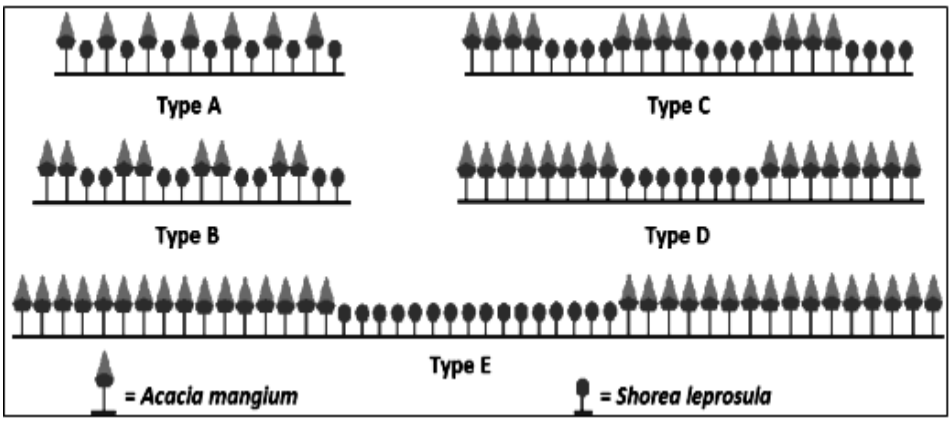
2.5. Kaedah tanaman secara teduhan dilakukan dengan menanam pokok spesies tempatan di antara barisan pokok *Acacia mangium* yang telah ditanam pada tahun 1989 yang berperanan sebagai pokok teduhan. Pada masa ini pokok *Acacia mangium* mencapai ketinggian hampir 13m.

2.6. Model MSFM ini dapat memberi faedah jika dibandingkan dengan penanaman pokok secara monokultur dari segi ketahanan kepada serangan serangga perosak dan penyakit, memberi penekanan kepada pemeliharaan alam sekitar dan menghasilkan pelbagai bekalan kayu dan bahan tanaman yang bermutu tinggi.

3.0. KAEDAH KAJIAN DAN REKABENTUK TANAMAN

3.1. Kajian ini dijalankan di Blok B92, Hutan Simpan Chikus yang merupakan Hutan Pamah Dipterokap. Kaedah tanaman yang dijalankan adalah tanaman secara teduhan di ladang *Acacia mangium*. Lima (5) rekabentuk tanaman yang dilaksanakan iaitu A(1:1), B(2:2), C(4:4), D(8:8) dan E(16:16).

Rajah 1: Kaedah tanaman secara teduhan di kawan ladang *Acacia mangium.*



3.2. Bancian 100% dilakukan pada tahun 2012-2013 dengan mengambil parameter diameter aras dada (DBH) dan ketinggian pokok berdiri di 30 petak kajian. Tiga (3) spesies pokok yang dibanci dengan mengambil kira lima (5) reka bentuk tanaman yang digunakan. Spesies yang terlibat adalah seperti berikut:

a) Meranti tembaga (*Shorea leprosula)*
Meranti tembaga merupakan spesies Meranti Merah yang mempunyai kadar pertumbuhan yang cepat pada awal penanamannya. Spesies ini pernah mencapai purata kenaikan diameter 0.8cm/setahun dan kenaikan isipadu sebanyak 8m^3/ha/tahun. Menurut Ng & Tang (1974) mendapati Meranti tembaga yang di tanam di arboretum, Institut Penyelidikan Perhutanan Malaysia (FRIM) mencapai purata diameter 45cm dalam masa 15 tahun.

b) Meranti sarang punai (*Shorea parvifolia)*
Meranti sarang punai merupakan antara spesies meranti yang mempunyai kadar pertumbuhan yang baik. Merujuk kepada Strugnell (1936) menyatakan Meranti sarang punai memerlukan teduhan dan kadar pertumbuhannya agak perlahan berbanding Meranti tembaga. Purata kenaikan diameternya adalah 1.3cm/tahun dan mencapai 60cm pada usia 50 tahun.

c) Chengal (*Neobalanocarpus heimii)*
Spesies Chengal mempunyai kadar pertumbuhan sangat perlahan dan memerlukan teduhan. Foxworthy (1927) menyatakan spesies Chengal tumbuh perlahan pada awal penanaman dan akan tumbuh pesat selepas diameter pokok adalah 25cm dan kadar pertumbuhan menjadi cepat sehingga lebih 80cm. Manakala pokok Chengal yang ditanam boleh berbuah pada usia bawah 10 tahun (Foxworthy 1927).

4.0. KEPUTUSAN DAN PERBINCANGAN

4.1. Kadar pertumbuhan spesies tempatan

4.1.1. Keputusan selepas lima (5) tahun penubuhan projek MSFM mendapati projek MSFM ini berpotensi dilaksanakan secara komersial bergantung kepada pemilihan spesies dan reka bentuk tanaman. Secara keseluruhannya menunjukkan kaedah tanaman secara terbuka adalah tidak sesuai untuk spesies tempatan berkualiti tinggi di samping memerlukan kos penubuhannya yang tinggi, kadar hidup yang rendah dan kadar pertumbuhan yang tidak baik. Manakala kaedah tanaman secara teduhan merupakan kaedah tanaman yang terbaik untuk spesies tempatan (Forestry Deparment Peninsular Malaysia (FDPM) 1996).

4.1.2. Hasil kajian juga menunjukkan spesies tempatan mempunyai kadar hidup yang baik apabila ditanam di barisan tanaman yang sempit dan mempunyai kadar pertumbuhan diameter yang baik di barisan tanaman yang lebar. Keputusan kajian juga mendapati semasa penuaian pokok teduhan dilakukan, kerosakan yang ketara berlaku pada spesies tempatan di barisan tanaman yang sempit (FDPM 1999).

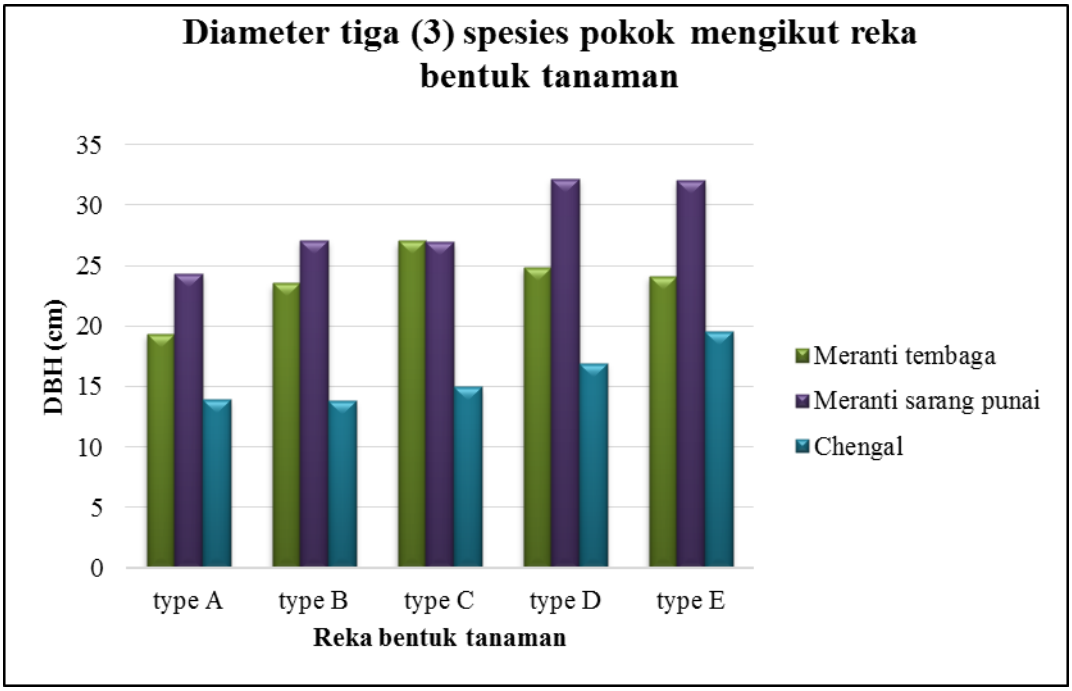
4.1.3. Berdasarkan kepada status terkini mendapati kadar pertumbuhan diameter spesies Meranti sarang punai menunjukkan pertumbuhan paling baik bagi semua reka bentuk tanaman iaitu A, B, C, D dan E. Manakala bagi spesies Meranti tembaga menunjukkan kadar pertumbuhan adalah baik di reka bentuk tanaman C dan spesies Chengal di reka bentuk D dan E. Ini menunjukkan keperluan cahaya matahari spesies tempatan meningkat apabila usia pokok meningkat. Oleh sebab itu, pertumbuhan di barisan tanaman yang lebar seperti reka bentuk D dan E adalah lebih baik jika dibandingkan dengan pertumbuhan awal spesies tempatan yang memerlukan teduhan. Dalam kaedah tanaman ini, faktor persekitaran seperti cahaya, kelembapan, suhu, tanah dan sebagainya berubah mengikut keterbukaan pokok teduhan kerana setiap faktor saling berkait antara satu sama lain.

4.1.4. Tiada perbezaan ketara yang dapat dilihat bagi pertumbuhan diameter dan ketinggian spesies pokok di antara reka bentuk yang digunakan sebagaimana di Jadual 1.

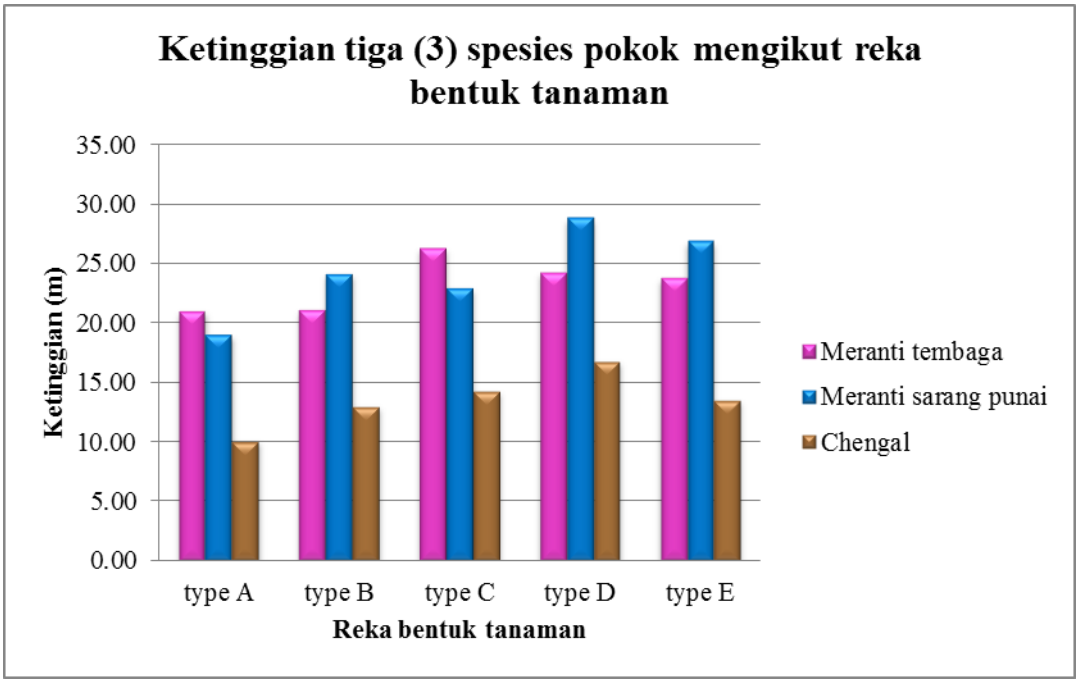
Jadual 1: Kadar pertumbuhan tiga (3) spesies pokok di projek MSFM.

Spesies (Nama Tempatan)	**Diameter Aras Dada (cm)**				
	type A	**type B**	**type C**	**type D**	**type E**
Meranti tembaga	19.364	23.569	27.048	24.858	24.164
Meranti sarang punai	24.357	27.099	27.009	32.206	32.099
Chengal	13.915	13.827	14.961	16.928	19.592
Spesies (Nama Tempatan)	**Ketinggian (m)**				
	type A	**type B**	**type C**	**type D**	**type E**
Meranti tembaga	20.99	21.10	26.31	24.26	23.79
Meranti sarang punai	19.00	24.13	22.93	28.80	26.89
Chengal	10.13	13.01	14.27	16.79	13.53

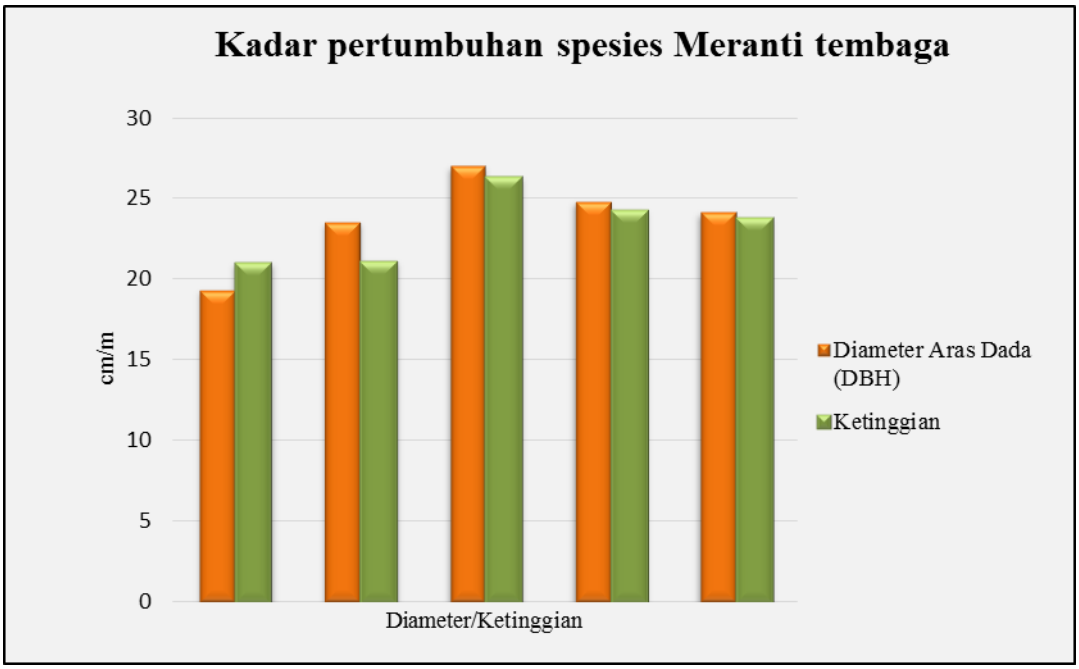
Rajah 2: Graf pertumbuhan diameter tiga (3) spesies di projek MSFM.



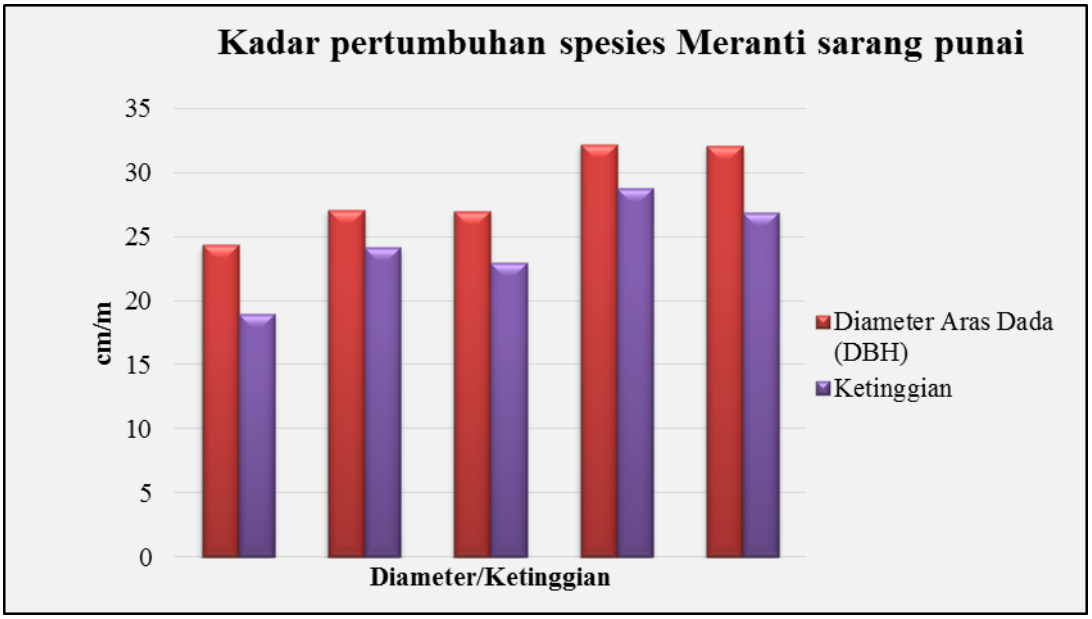
Rajah 3: Graf pertumbuhan ketinggian tiga (3) spesies di projek MSFM.



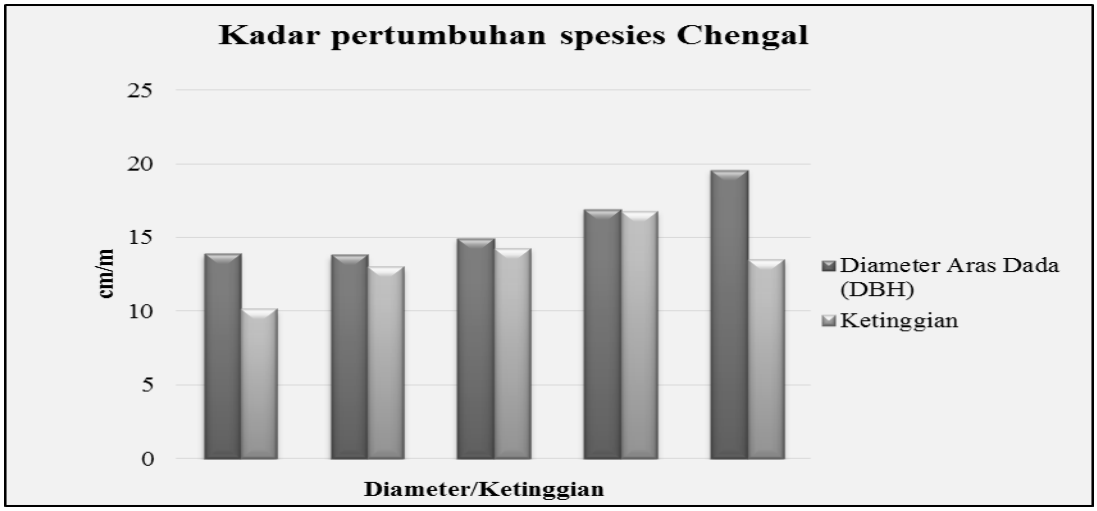
Rajah 4: Graf kadar pertumbuhan Meranti tembaga.



Rajah 5: Graf kadar pertumbuhan Meranti sarang punai.



Rajah 6: Graf kadar pertumbuhan Chengal.



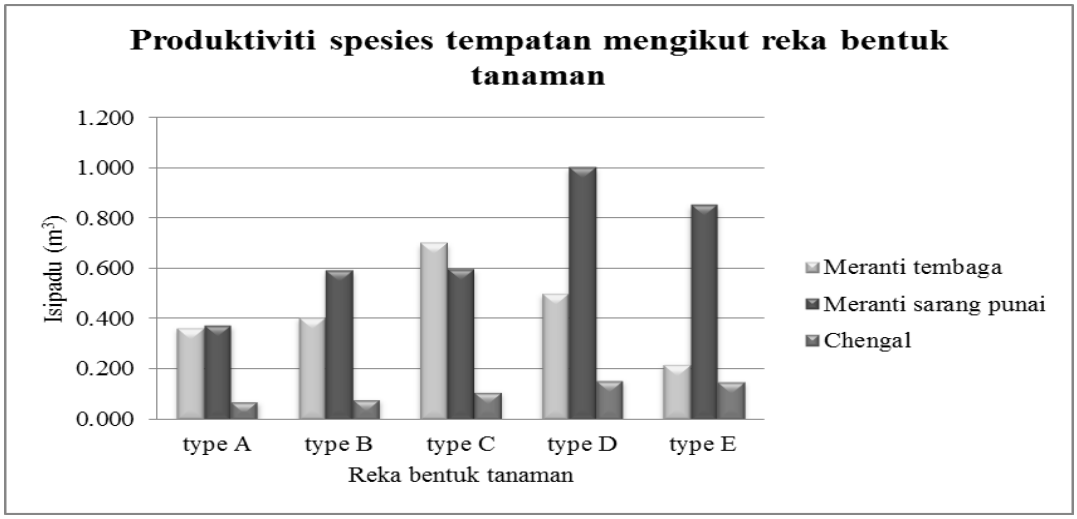
4.2. Pertumbuhan spesies pokok di projek MSFM

4.2.1. Melalui projek ini, pusingan tebangan dan pengeluaran untuk spesies cepat tumbuh seperti *Acacia mangium* juga dianggarkan. Tebangan pertama dilakukan pada tahun ke-7 untuk mengeluarkan pulpa kayu manakala tebangan kedua dilakukan pada tahun ke-15 untuk mengeluarkan kayu gergaji seperti mana yang diamalkan dalam program ladang kompensatori. Bagi spesies tempatan pula, usahasil dilakukan pada tahun ke-50 (FDPM 1996).

4.2.2. Bagi produktiviti di ladang *Acacia mangium*, anggaran isipadu yang paling baik adalah bagi spesies Meranti sarang punai di rekabentuk tanaman D dan E diikuti dengan spesies Meranti tembaga di rekabentuk C dan bagi spesies Chengal di rekabentuk D dan E.

4.2.3. Hasil bancian mendapati sebanyak 4,763 pokok yang masih hidup dengan anggaran isipadu sebanyak 2,038m^3. Berdasarkan kepada pemerhatian yang diperolehi juga mendapati kebanyakan spesies *Acacia mangium* yang tidak dituai telah mati dengan sendirinya selepas berusia 15 tahun.

Rajah 7: Graf anggaran produktiviti spesies mengikut reka bentuk tanaman.



4.3. Pokok Berbuah di projek MSFM

4.3.1. Hasil pemerhatian mendapati pokok spesies tempatan projek MSFM telah berbunga dan berbuah sejak tahun 2009. Hampir kesemua spesies Meranti tembaga dan Meranti sarang punai di ladang *Acacia mangium* telah berbuah. Manakala pokok Chengal juga telah berbuah

bermula pada tahun 2012. Ini menunjukkan pada usia 20 tahun, kebanyakan spesies di kawasan ini telah berbuah dan menjadi salah satu kawasan sumber perolehan biji benih pada setiap tahun.

5.0 KESIMPULAN

5.1. Pengurusan hutan pelbagai tingkat merupakan salah satu pengurusan hutan yang terbaik untuk diamalkan di kawasan terosot atau kawasan selepas diusahasil melalui kaedah tanaman secara teduhan untuk spesies tempatan di Semenanjung Malaysia. Selain menyediakan persekitaran yang kondusif untuk perkembangan awal spesies tempatan, banyak faedah lain diperolehi seperti pengeluaran kayu-kayan dan bahan tanaman berkualiti tinggi, mewujudkan landskap yang lebih baik dan pemeliharaan hutan yang mapan.

5.2. Berdasarkan penemuan yang diperolehi, pemilihan spesies dan kesesuaian kawasan tanaman perlu diambil perhatian kerana setiap spesies mempunyai keperluan persekitaran yang berlainan dan berubah apabila usia meningkat. Ia dapat dilihat pada awal penubuhan, teduhan diperlukan oleh spesies tempatan untuk mengawal cahaya matahari. Namun begitu, keperluan tersebut berubah apabila spesies tempatan seperti Meranti tembaga, Meranti sarang punai dan Chengal memerlukan cahaya apabila usianya mencapai 20 tahun. Oleh sebab itu, reka bentuk tanaman D dilihat lebih sesuai apabila usia spesies tempatan tersebut meningkat kerana cahaya yang mencukupi diperlukan. Selain itu, reka bentuk ini boleh dipertimbangkan dan diguna pakai atas sebab kesesuaian kaedah tanaman dengan keperluan spesies tempatan, kos penubuhan yang lebih relevan serta proses penuaian yang lebih menguntungkan dan kurang berlaku kerosakan terhadap pokok bawahan.

5.3. Projek seperti ini boleh dijalankan di kawasan lain menggunakan kaedah yang sama bukan sahaja untuk mendapatkan bekalan kayu malah mengambil kira pengurusan hutan secara berkekalan untuk masa akan datang.

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PAPER 4: 2

SAWING PATTERN FOR IMPROVING RECOVERY OF 'SUPERBULK' IN SARAWAK

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ABSTRACT

Sawing recovery of fast-grown *Acacia mangium* has been known to be unacceptably low. In this study, various sawing patterns are tried on 'Superbulk' which is widely planted in Sarawak. The results show that a 'modified cant' sawing pattern would be preferred if improved recovery in volumetric terms is desired.

1.0 INTRODUCTION

As of December 2013, 43 LPFs licenses have been issued covering an area of 2.89 million hectares with a net plantable area of 1.3 million hectares. To date, about 332,000 hectares of plantation forests have been established with *Acacia* species making up 74% of the total area planted.

Sarawak has 171 sawmills, employing about 9,500 workers, with an annual export of 687, 298m^3 in 2013 valued at more than RM617 million. The major timber markets for sawn timber are ASEAN, Middle East, Taiwan and Korea.

From 2001 till today, over 245,000 hectares of *Acacia mangium* and its hybrids have been planted by various Licence for Planted Forest (LPF) holders in Sarawak. Initially, *A. mangium* was planted to cater the raw material requirements of Sarawak's first pulp and paper mill. Subsequent plantings were meant to replace supplies from the natural forests. A considerable portion of these plantings have been of 'Superbulk' which is a selected clone of *A. mangium.* A lot of interest has been generated in the utilization of this improved clone that is reported to have good tree form and is relatively fast growing.

One of the main utilization issues of fast-grown timber is the relatively poor sawing recovery. This is due to the relatively small diameters and juvenile characteristics of saw logs. This consideration is important to sawmillers in view of the relentless necessity to reduce production cost and increase productivity to remain competitive. Hence, it is useful and important to know the effect of various sawing patterns on sawing recovery of 'Superbulk'.

1.1 Objective

The objective of this study is to identify the best sawing pattern for optimizing recovery of 12-year old 'Superbulk' planted in Sarawak.

2.0 MATERIALS AND METHODS

Twelve-year old 'Superbulk' logs (Figure 1) were collected from a plantation located at Bintulu, Sarawak. The log diameters ranged from 26 to 33 cm. The study was conducted at Timber Technology Centre (TTC), Sarawak Forestry Corporation, Kuching Sarawak. Testing was carried out in accordance with the ITTO Harmonized Testing Methods of Sawing Yield Test (Wong *et al*., 2010) as well as sawing patterns reviewed by How *et al*., (2009) and How *et al.,* (2007).

Figure 1: 2-year old 'Superbulk' logs.

2.1 Sample Preparation and Pre-sawing Measurement

The logs were debarked and cut to 10-feet length to conduct the sawing yield test. Each log was marked with a given ID number and the following measurements were taken for each log:

(i) Diameter of both ends (Figure 2)
(ii) Length of end split(s) at the both ends
(iii) Degree of log warp (Figure 3)
(iv) Number and size of knots

Figure 2: Measuring diameter at both ends**.**

Figure 3: Measuring degree of log warp.

2.2 Equipment Used

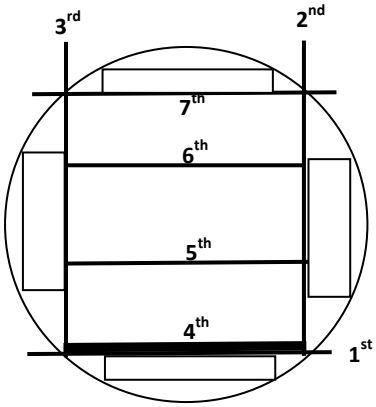
The KARA F2000 portable sawmill (Figures 4 & 5) was used for this study. It is well suited for sawing small-diameter logs and maybe single-handedly operated.

Figure 4 (Left) & Figure 5 (Right): KARA F2000 portable sawmill.

2.3 Testing Methodology

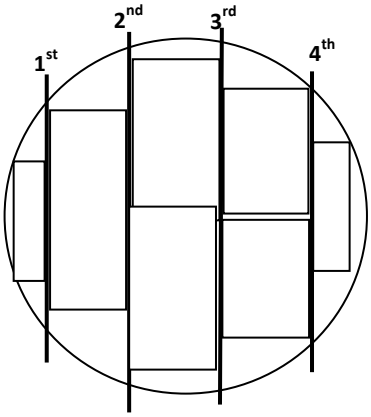
- Modified Cant Sawing

Figure 6: Modified Cant sawing.



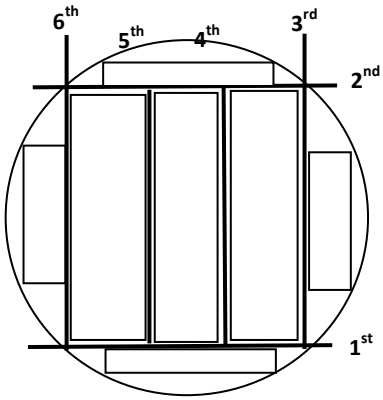
- Live Sawing

Figure 7: Live sawing.



- Turn Around at 180°

Figure 8: Turn Around at 180°.



The target sizes were:

- 50mm x 150mm
- 50mm x 125mm
- 50mm x 100mm
- 25mm x 150mm
- 25mm x 125mm
- 25mm x 100mm

Other relevant measurements and assessments:

- Determination of 'bow' and 'spring/crook' of each piece of sawn timber (Figures 9 & 10)
- Assignment of grade by means of visual grading based on Malaysian Grading Rules

Figure 9: Measurement of bow.

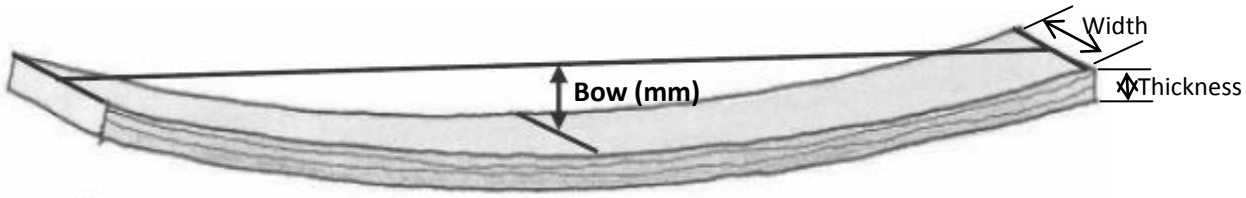
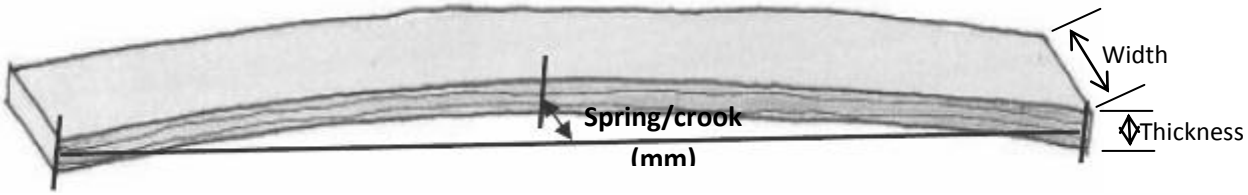


Figure 10: Measurement of spring/crook.

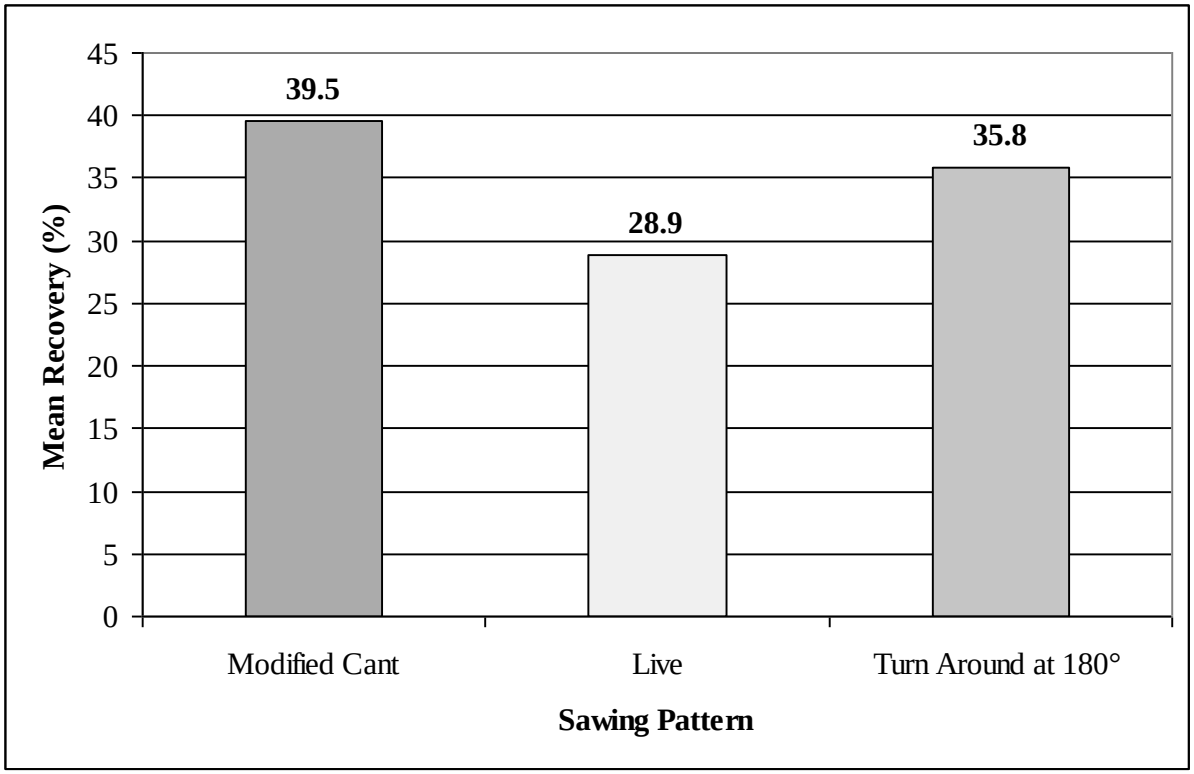


3.0 RESULTS AND DISCUSSION

3.1 Recovery Rates

The respective mean recoveries (volumetric yield) using three different types of sawing patterns are shown in Figure 11. Of these sawing patterns, the Modified Cant produced the highest recovery rate which is 39.5% as compared to Live sawing (28.9%) and Turn Around at 180° (35.8%).

Figure 11: Mean recovery in relation to sawing pattern.

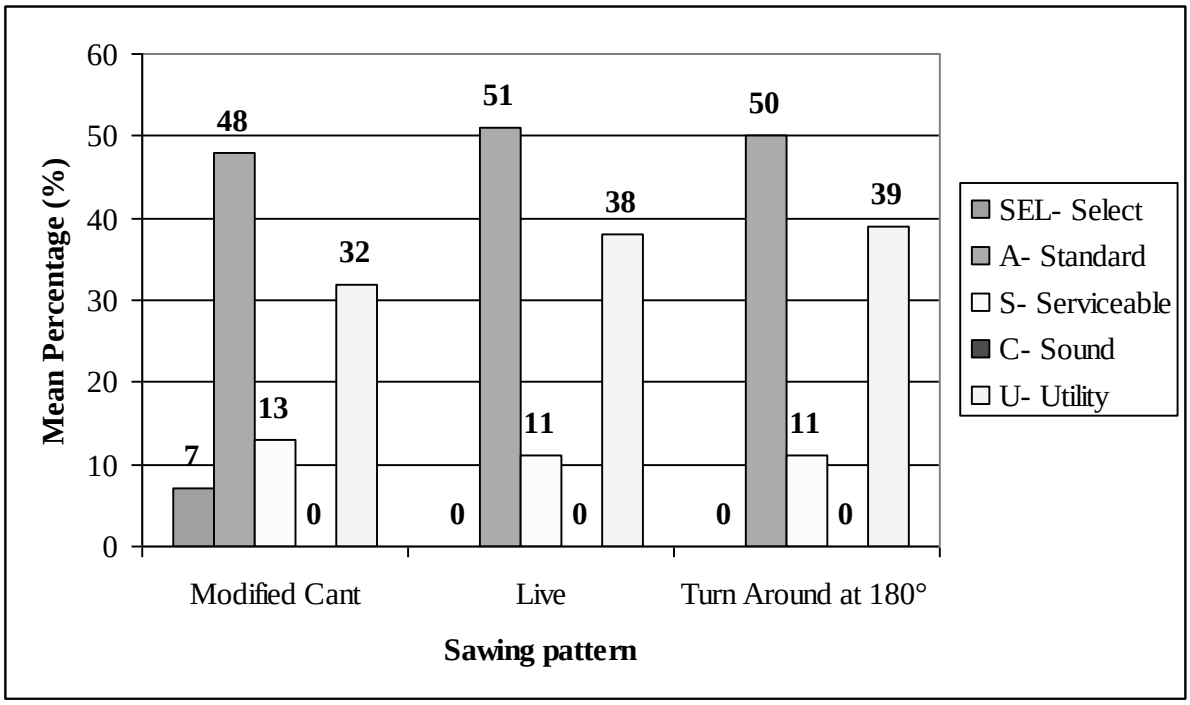


The mean recovery obtained using Modified Cant sawing is consistent with results obtained for *A. mangium* planted in Sarawak and Peninsular Malaysia. The higher recovery for Modified Cant sawing over other sawing patterns is also consistent with results obtained for 'baby small' keruing (Wong, 1998).

3.2 Timber Grades

The sawn timbers produced were graded into categories of Select (SEL), Standard (A), Serviceable (S), Sound (C) and Utility (U). For each of the sawing patterns, more than 60% of grades obtained were 'Serviceable' and better as shown in Figure 12 below. This compares favorably with results obtained for *A. mangium* (Teng & Chan, 2012; Khairul *et al.*, 2011). However, the grade of 'select' was obtained only through Modified Cant sawing.

Figure 12: Sawn timber MGR grades in relation to sawing pattern.



3.3 Physical Degrades

The amounts of degrade measured were compiled and presented in Table 1 below. It can only be inferred from the results that the effect of sawing pattern on the occurrence of degrade is inconclusive. This is most probably due to the fact that degrades such as end splitting and end checks are due more to drying than to sawing. In terms of degrades that can be attributed to sawing, i.e. bow and spring, none of the sawing patterns can be adjudged to be superior or otherwise.

Table 1: Different degrades over length of 10-feet samples.

Type of Degrade	Extent of degrade (mean)		
	Modified Cant	Live	Turn Around at 180°
Log warp	13.5 %	12.8 %	14.2 %
Log end checks	9.8 %	11.4 %	10.6 %
Bow	18.9 mm	22.9 mm	16.8 mm
Spring/Crook	7.2 mm	5.1 mm	8.2 mm
End splitting	60 %	68 %	62 %

4.0 CONCLUSION

The study shows that Modified Cant is the best sawing pattern for 'Superbulk' in terms of volumetric recovery. There is also reason to believe that higher grades of sawn timber may be more readily obtained by the Modified Cant sawing pattern as compared to the others. However, the effect of sawing pattern on physical degrades cannot be established from this study.

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PAPER 4: 3

MANGROVE TIMBER – POTENTIAL AS FLOORING MATERIAL

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Sabah Forestry Department

ABSTRACT

Sabah is the home to the largest area covering 341,000 hectares or 59% of the country's total mangrove forest. However, thus far, mangrove timber has been utilised for production of a limited range of products. Thus, there is a need to diversify their utilisation and one option is to use the timber as a flooring material. The suitability of the timber of three mangrove species from Sabah, namely Bangkita (*Rhizophora apiculata*), Bakau kurap (*Rhizophora mucronata*) and Lenggadai (*Bruguiera parviflora*), as a flooring material is examined in this paper, including their wood properties, seasoning characteristics and the abrasive resistance. The study results reveal that the mean air-dry density of *R. apiculata*, *R. mucronata* and *B. parviflora* is 1.03 g/cm^3, 1.01 g/cm^3 and 0.92 g/cm^3, while the green moisture content (MC) is 31.46%, 40.75% and 51.48%, respectively. The timbers were air-dried from the green condition to about 20% of MC under shade. The process lasted 3, 5, and up to 7 weeks, after which the samples were sawn into boards of 1 cm, 2 cm and 3 cm of thickness, respectively. The average number and the average length of surface checks that occurred during seasoning were lower for thinner boards. The abrasive resistance of the three mangrove species is equivalent or superior to Merbau (*Intsia palembanica*) and far superior to Nyatoh (*Palaquium* sp.), indicating their suitability for heavy traffic flooring. However, the selection of timber for a particular purpose depends not only on its technical performance, but also on other factors, such as cost and availability. Thus, the feasibility study on the raw material supply and economic investment is recommended.

1. INTRODUCTION

Malaysia contributes about 3.7% (577,500 ha) to the world's mangrove area, and Sabah is the host to the largest area covering 341,000 hectares or 59% of the country's total mangrove forest. In addition, 95.7% (326,487 ha) of this area is gazetted as Forest Reserves under the Forest Enactment, which is administered by Sabah Forestry Department (Anonymous, 2010).

Mangroves are tropical or subtropical intertidal ecosystems dominated largely by bakau (*Rhizophoraceae*) trees (Adenan, 2004). In Sabah, Bangkita (*Rhizophora apiculata*) and Bakau kurap (*Rhizophora mucronata*) are the major mangrove species, forming almost pure stands that line tidal river banks and estuarine deltas (Wong & Madani, 1995). In some areas, other major mangroves species, such as Tengar (*Ceriops tagal*) and Lenggadai (*Bruguiera parviflora*), display clumping distribution that sometimes appears as almost pure stands. Other major mangrove communities that are commonly found distributed randomly in this habitat are *Xylocarpus granatum*, *Avicennia alba* and *Sonneratia alba*.

In Malaysia, mangroves represent an important ecosystem and are thus accorded a high priority in maintaining protective and productive functions along the coastline. In addition to its valuable role in foreshore protection, reducing coastal erosion and reducing the impacts of storm surge, the forest also provides a wide variety of goods and services. For example, about 41,000 hectares of the mangrove forest in the state of Perak in Peninsular Malaysia is protected and managed by the Forestry Department for sustainable production of charcoal, firewood and poles. In Sabah, mangroves are regarded mainly as protection areas. Historically, mangrove timbers were not exploited extensively in Sabah due to the vastness of timber resources from inland forests. Thus, collection of poles and fuel wood, and similar activities, have been allowed to a level that results in a minimum disturbance to the ecosystem. At present, 90% of the mangrove areas are still largely intact and are under the stewardship of the Sabah Forestry Department (Anonymous, 2010).

Apart from the manufacturing of charcoal, there have been very few attempts to identify new products and hardly any effort within the downstream sector has been dedicated to exploring other potential uses of mangrove timbers. The production of sawntimber for general utilisation is yet to be adopted by the wood-based industries. Owing to the small size of mangrove logs, they are often used in the round form for heavy structures, piles, bridge decking, barrels, and buffers. Thus, there is a need to diversify the utilisation of mangrove timber, for example, as a flooring material.

In this paper, the results of the study of wood properties, seasoning characteristics and the abrasive resistance of mangrove timber are used as indicators for suitability of mangrove timber as a flooring material.

2. MATERIALS AND METHODS

2.1 Wood properties

Three trees of *Rhizophora apiculata*, four trees of *Rhizophora mucronata* and six trees of *Bruguiera parviflora* were selected from Sandakan and served as samples in the subsequent analyses. The particulars of the sample trees are presented in Table 1. For analyses, a disc of approximately 5 cm in thickness was taken at breast height (BH) level of the trees.

Table 1: Particulars of Sample Trees.

Species	No. of trees	Average DBH (cm)	Average Height (m)	Average Clear Bole (m)
Rhizophora apiculata (Bangkita)	3	26.9	20.2	5.5
Rhizophora mucronata (Bakau Kurap)	4	32.8	19.0	6.7
Bruguiera parviflora (Lenggadai)	6	27.7	18.4	8.1

DBH – Diameter at Breast Height

The discs taken from BH level of the trees were used for the determination of moisture content (MC), shrinkage and wood density. Radial strips of wood of about 2 cm width were cut from the discs and cubic samples of 2 × 2 × 2 cm dimensions were taken from one end to the other end of the strips (Figure 1). The procedures for the determination of MC, shrinkage and wood density were in accordance with the International Standard Organisation (ISO) 3030, 4469 and 3131 standard, respectively (Anonymous, 1975a, 1975b, 1981).

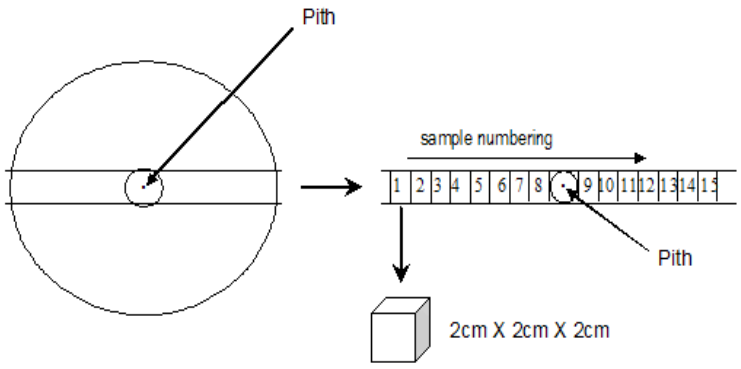


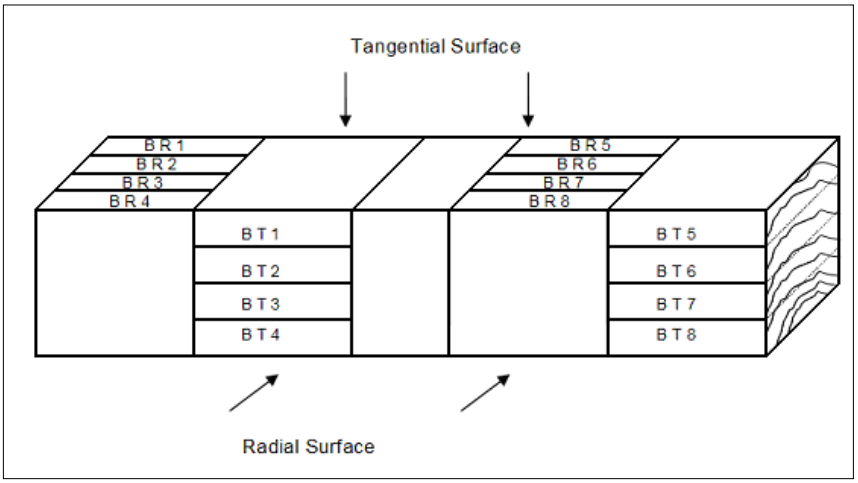
Figure 1: Process of obtaining cubic samples from a disc.

2.2 Seasoning characteristics

In order to determine the rate of air-drying, the logs of *R. apiculata* were sawn into boards of 1, 2, and 3 cm thickness and 10 cm width. The boards were cut further, in order to obtain samples of 60 cm in length. The initial weights of samples were recorded before they were stacked to air-dry in an open space under a shade. The daily weight of samples was recorded until they were fully air-dried (the weight remained constant). Samples of 1, 2, 3 and 4 cm thickness, 10 cm width and 60 cm length were also prepared from the logs of *R. apiculata*, *R. mucronata* and *B. parviflora*. All samples were stacked to air-dry under shade, as described above. The weight of the samples was monitored constantly until they were fully air-dried, and subsequently the number and the length of each visible surface check on boards were recorded.

2.3 Abrasive resistance

For this evaluation, boards of Bangkita, Bakau kurap and Lenggadai were chosen from material previously used in an air-seasoning study, while the boards of Merbau (*Intsia palembanica*) and Nyatoh (*Palaquium* sp.) were chosen from the air-dried material being kept in the sawmill at Forest Research Centre (FRC), Sandakan, Sabah. The two types of specimens, i.e. the radial and tangential face specimens were obtained from these boards. The cutting pattern and the final dimensions are shown in Figure 2 and Table 2, respectively. The test specimens were drilled, producing a 9.0 mm diameter circular central hole, before being seasoned for a minimum of 24 hours in an air conditioned atmosphere (in laboratory conditions, 50 percent relative humidity and 20-25 ^{o}C temperature) before testing.



The test procedure adopted in this study was in accordance to the American Society for Testing and Materials (ASTM) D-4060 (Anonymous, 2004). The test was performed at the Timber Research and Technical Training Centre (TRTTC), Kuching, Sarawak, by using the abrasion testing machine (Model 5151 Digital Abrasers with LED Readout). Characteristic rub-wear action of abrasers is produced by the contact of a test sample turning on a vertical axis against the sliding rotation of two abrading wheels. The weight loss of the specimens was measured after every 200, 400, 500, 800 and 1000 revolutions of the H-18 Calibrade wheel operating under 1000 gram load.

Table 2: Test Specimens for the Abrasive Resistance Test.

Species	Specimens Face	Number of Samples	Dimensions (W × L × T cm)
Bangkita (*Rhizophora apiculata*)	Tangential	8	10 × 10 × 1.2
	Radial	9	10 × 10 × 1.2
Bakau kurap (*Rhizophora mucronata*)	Tangential	8	10 × 9.4 × 1.2
	Radial	9	10 × 9.4 × 1.2
Lenggadai (*Bruguiera parviflora*)	Tangential	8	10 × 9.4 × 1.2
	Radial	5	10 × 9.4 × 1.2
Merbau (*Intsia palembanica*)	Tangential	9	10 × 9.3 × 1.2
	Radial	8	10 × 9.4 × 1.2
Nyatoh (*Palaquium* sp.)	Tangential	8	10 × 9.4 × 1.2
	Radial	8	10 × 9.4 × 1.2

W = Width L = Length T = Thickness

The test results are expressed as a wear factor in percentage of weight loss, or as numerical abrasion index of the specimens. The Taber wear index (rate of wear) represents the weight loss in milligrams per thousand cycles of abrasion for a test performed under specific set conditions. The lower the wear index, the better the abrasion resistance quality of the material.

3.0 RESULTS AND DISCUSSION

3.1 Wood properties

The mean values of moisture content, shrinkage and density of *R. apiculata*, *R. mucronata* and *B. parviflora* are presented in Table 3. As indicated, the green MC of mangroves timber is generally low. The shrinkage from green to air-dry conditions of all timbers is low to medium, with the exception of the tangential shrinkage of *B. parviflora*, which is somewhat higher at 5.7%.

Table 3: Wood properties of *R. apiculata*, *R. mucronata* and *B. parviflora*.

Species	Green MC (%)	Shrinkage from green to air-dry (%)		Air-dry density (g/cm^3)
		Radial	Tangential	
R. apiculata	31.46 (4.69)	0.92 (0.81)	3.57 (0.90)	1.03 (0.03)
R.mucronata	40.75 (4.77)	1.43 (0.44)	4.67 (1.21)	1.01 (0.04)
B. parviflora	51.48 (4.85)	2.14 (0.59)	5.7 (1.30)	0.92 (0.03)

( ) Standard Deviation

The density of *R. apiculata* (1.03 g/cm^3) is higher than that of *R. mucronat*a (1.01 g/cm^3) and *B. parviflora* (0.92 g/cm^3). These values are comparable to the densities of common heavy hardwood species, such as *Eusideroxylon zwagerii* (Belian; 0.84 – 1.19 g/cm^3), *Shorea* sp. (Selangan batu; 0.85 – 1.15 g/cm^3) and *Vatica* sp. (Resak; 0.66 – 1.16 g/cm^3). The air-dry density from pith to outer part of stem of the three species is shown in Figure 3, 4 and 5, respectively. Generally, the density of *R. apiculata* and *R. mucronata* is uniform from near the pith to the middle, and starts to decrease insignificantly towards the outer part of the trunk. The density of *B. parviflora*, on the other hand, decreases from near the pith to the outer part of the trunk.

Given their high density, the timbers could be used either for structural purposes or general utilisation, such as panelling and furniture making. However, the production of sawn timber for general utility purposes might be difficult, as mangrove trees are small in size and are normally available in very short length due to presence of knots. In view of these dimensional constraints, Lim (1984) considered the timber as only suitable for parquet flooring. Parquet is timber flooring made of parquet strips, or as a mosaic of small wood sections, manufactured in long or short lengths according to requirements. It can be produced for direct application to a fully supporting base. In Malaysia, board and parquetry flooring are most commonly used. The former is mainly found in low- to medium-cost houses, while the latter is favored for medium- to high-cost buildings or residential houses.

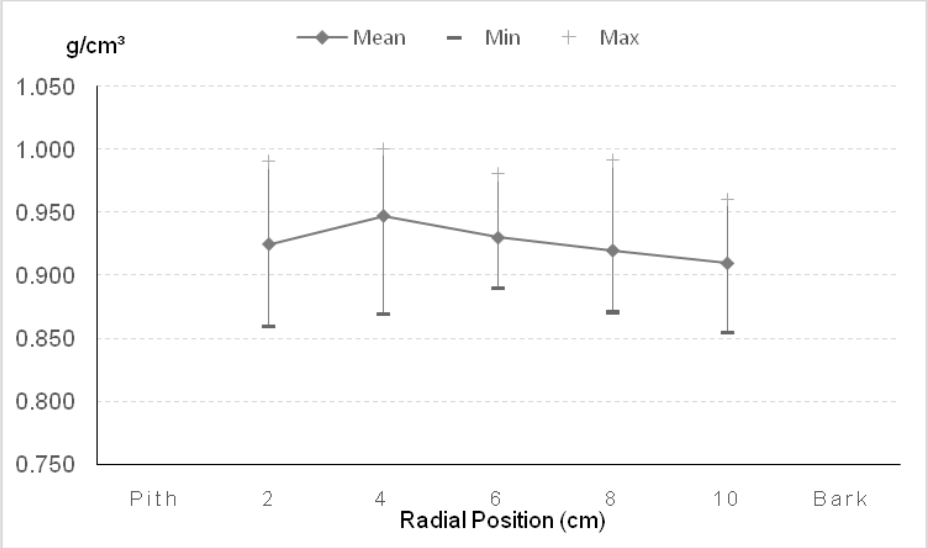


Figure 3: Air-dry density at radial position of *R. apiculata*.

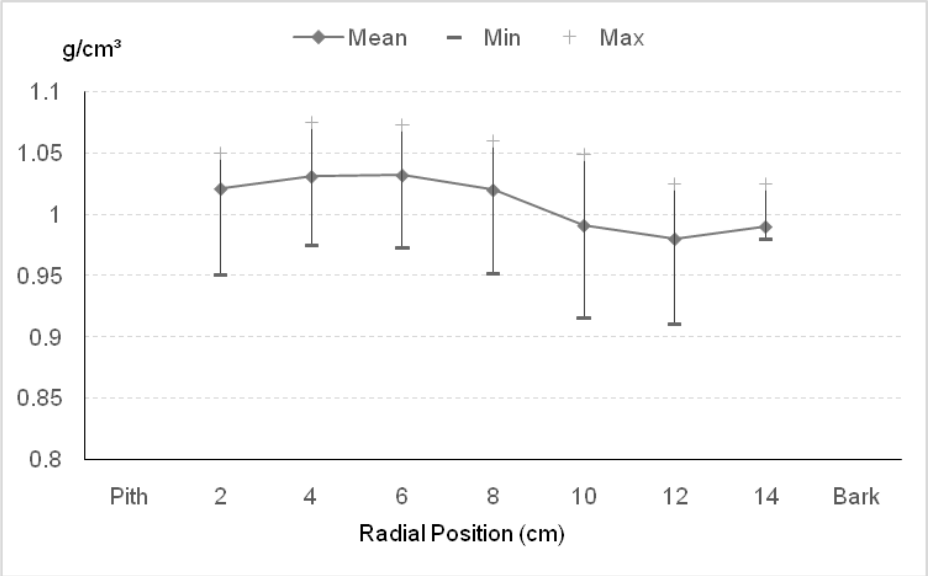


Figure 4: Air-dry density at radial position of *R. mucronata.*

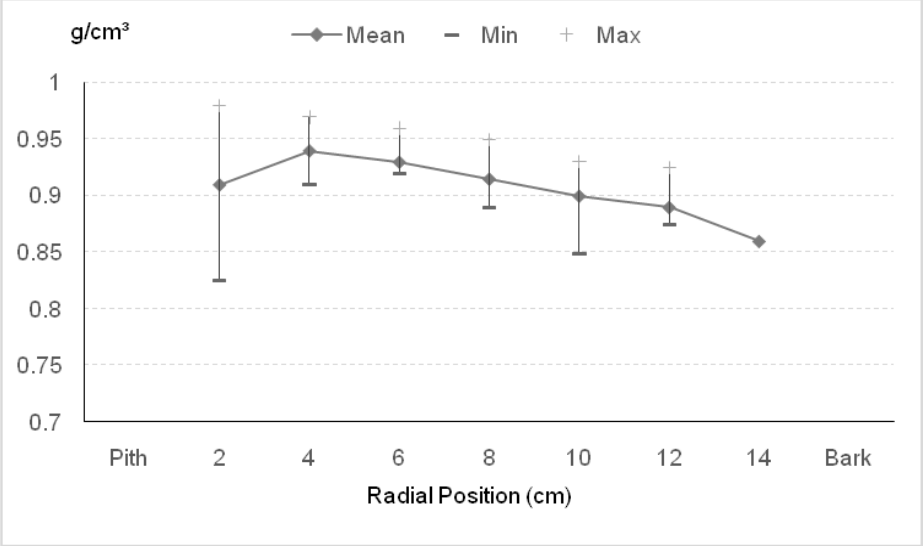


Figure 5: Air-dry density at radial position of *B. parviflora.*

3.2 Seasoning characteristics

The green MC of all the boards of *R. apiculata* tested ranged from 38 to 50%. The lower MC in some boards was probably due to inevitable drying which had taken place while still in log form. Irrespective of these auxiliary effects, all boards of 1 cm thickness dried to a stable weight and achieved MC of 18 – 20 % in about 3 to 4 weeks. The thicker (2 cm) boards took almost 5 weeks, while the boards of 3 cm thickness often required more than 7 weeks to fully dry (Figure 6). As expected, the occurrences of surface checks during seasoning of the timbers is a notable problem. The number of surface checks and the average length of surface checks that occurred on boards of the three species are presented in Figure 7 and 8.

In general, the surface checks seem to occur more frequently and tend to be longer on thickest boards of all three species. Therefore, their occurrence can be minimised with the production of thinner boards. For example, parquet strip could be used, as it is generally a short flooring element with a minimum thickness of 10 mm. The study also revealed that the surface checks tended to cease when the wood dried to uniform MC.

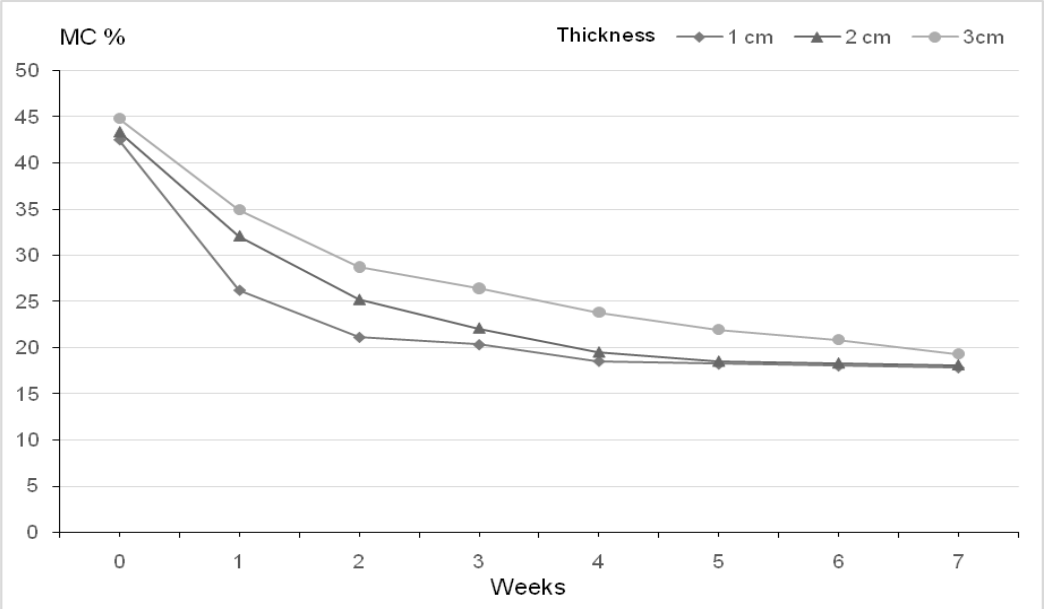


Figure 6: Moisture content changes in seasoning of *R. apiculata* timber.

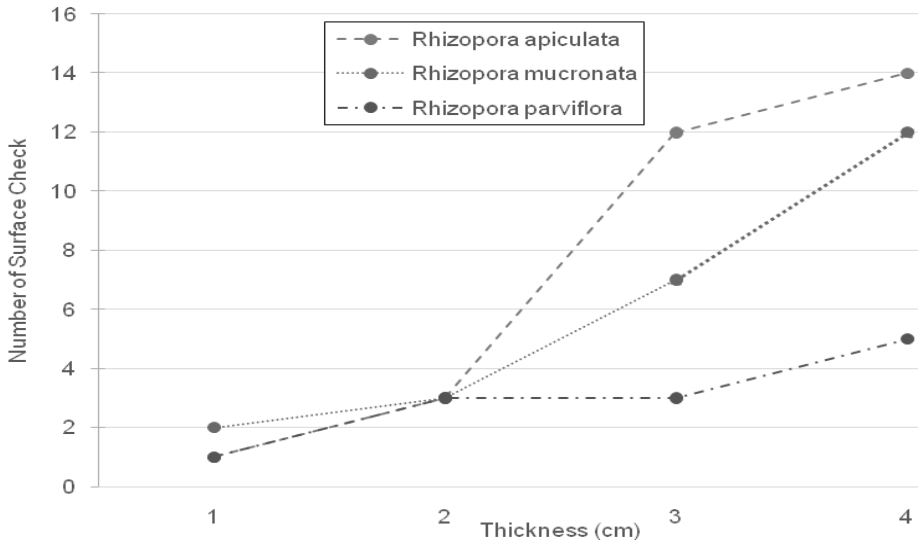


Figure 7: The average number of surface checks.

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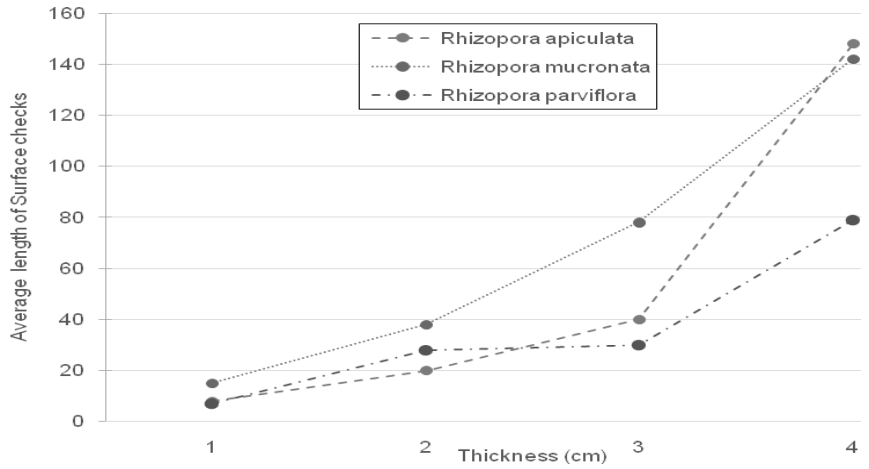

Figure 8: The average length of surface checks.

3.3 Abrasive resistance

Quantitative results of the abrasive test performed on the five species—Bangkita, Bakau kurap, Lenggadai, Merbau and Nyatoh—are shown in Table 4. Average values for the wood density, loss in weight after 200, 400, 500, 800 and 1000 revolutions, and percentage loss in weight after 1000 revolutions of the abrasive wheels are given for the two faces tested, i.e. tangential and radial faces.

In all species tested, the wearing resistance of timber at the radial face was lower than that measured at the tangential face. The percentage weight loss at the radial face after 1000 revolutions was 0.62%, 0.55%, 0.42%, 0.71% and 1.21%, for Bangkita, Bakau kurap, Lenggadai, Merbau and Nyatoh, respectively. On the other hand, the percentage weight loss at the tangential face was 0.60%, 0.37%, 0.34%, 0.68% and 1.08%, respectively. Mohd. Shukari (1983) also observed the least resistance to wear at radial face for the timber of Kempas (*Koompassia malaccensis*) and Rubberwood (*Hevea brasiliensis*).

Table 4: Loss in weight measured for Bangkita, Bakau Kurap, Lenggadai, Merbau and Nyatoh species.

Species	Density g/cm^3	Surface abraded	Loss in weight after n revolution of the abrasive wheels (gm)					Percentage loss in weight after 1000 revolution (%)
			200	400	500	800	1000	
Rhizophora apiculata	0.91	Radial	0.225	0.421	0.497	0.567	0.784	0.62
		Tangential	0.178	0.344	0.448	0.567	0.755	0.60
Rhizophora mucronata	0.90	Radial	0.104	0.193	0.498	0.560	0.647	0.55
		Tangential	0.105	0.214	0.266	0.374	0.419	0.37
Bruguiera parviflora	0.82	Radial	0.107	0.179	0.265	0.322	0.449	0.42
		Tangential	0.096	0.223	0.222	0.296	0.358	0.34
Intsia palembanica	0.78	Radial	0.154	0.293	0.397	0.531	0.728	0.71
		Tangential	0.153	0.282	0.305	0.471	0.576	0.68
Palaquium sp.	0.60	Radial	0.370	0.466	0.538	0.688	0.882	1.21
		Tangential	0.397	0.424	0.580	0.669	0.749	1.08

The percentage weight loss measured for the tested species at radial and tangential faces was plotted against the number of revolutions, as shown in Figure 9 and 10, respectively. The best average wear index was obtained for Lenggadai, followed by Bakau kurap, Merbau, Bangkita and Nyatoh, both at radial and tangential faces. This difference is perhaps due to the obvious difference in their densities. However, it has been demonstrated that, in addition to density, other factors related to the anatomical structures of the wood, in particular the size, arrangement and distribution of the pores and structure of the fibres, also play an important role in influencing the resistance to wear (Lim, 1983, Mohd. Shukari, 1983). The test results obtained in the present study also show that the tangential face is more resistant to wear compared to the radial face. These findings indicate that tangential boards would be more suitable than radial boards for producing floorboards.

Wong (1974) published a list of Malaysian timbers suitable for parquetry, heavy and general utility flooring based on hardness, resistance to abrasion, working properties, strength and nailing properties. Nearly a decade later, Lim (1983) gave an updated account of Malaysian timbers suitable for flooring, after reclassifying the types of flooring into heavy, medium and light traffic conditions. Based on this list, Merbau is considered suitable for heavy traffic flooring, even though it is preferred for use under medium traffic conditions. Similarly, Nyatoh is considered suitable for medium traffic, with preferred usage under light traffic conditions. The present study indicated that the average wear index of Lenggadai and Bakau kurap is insignificantly ($P > 0.05$) higher than that of Merbau. On the other hand, the average wear index of Bangkita is insignificantly ($P > 0.05$) lower than that of Merbau. Clearly, Lenggadai, Bakau kurap and Bangkita are equivalent, or more resistant to wear, than Merbau and are far superior to Nyatoh. Therefore, these species are suitable for use as a heavy duty flooring material.

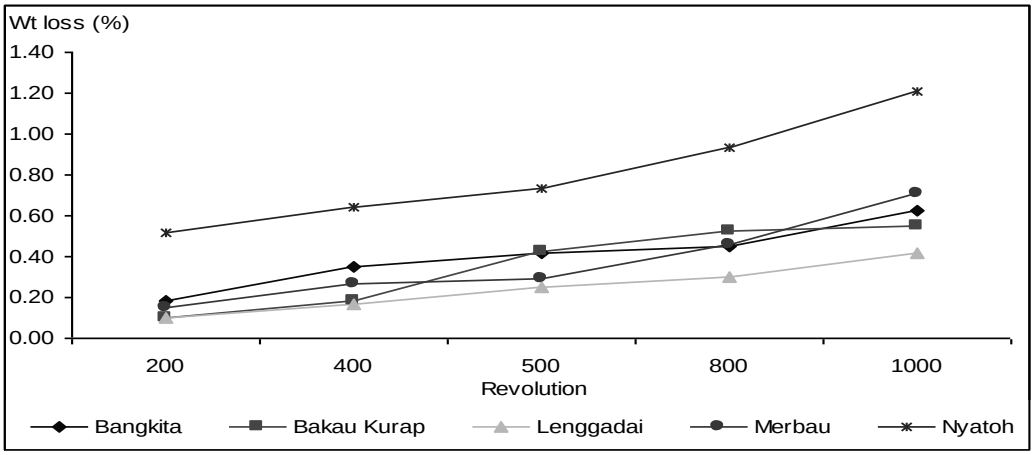

Figure 9: Percentage weight loss at the radial face of the examined species.

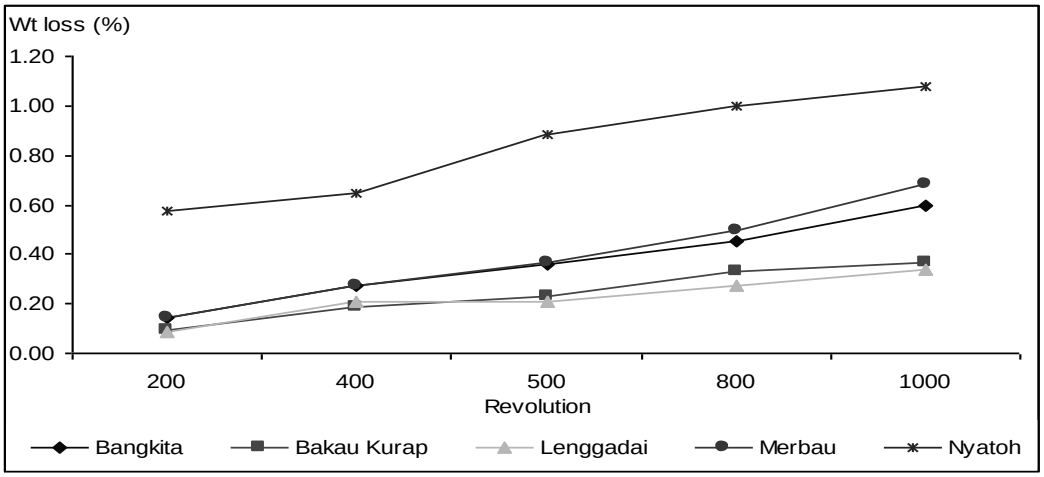

Figure 10: Percentage weight loss at the tangential face of the examined species.

3.4 Other important characteristics

In addition to the favorable properties revealed in the present study, the mangroves have other important characteristics that determine suitability of timber as a flooring material, such as strength, stability, nailing property and durability.

Keating and Bolza (1982) classified the *Rhizophora* sp. from Malaysia under the strength group of S3 (based on the Minimum Standard of Strength Classification). While this is lower than the strength of Belian, Selangan batu, Resak and Merbau, it is equivalent to Kapur and Kempas. The modulus of rupture (MOR), modulus of elasticity (MOE), compression and shear strength at 12% MC for timbers under strength group S3 are 114 N/mm^2, 14.2 N/mm^2, 62.0 N/mm^2 and 15.0 N/mm^2, respectively. In terms of strength, the *Rhizophora* sp. timbers are weaker than common heavy hardwoods, such as Belian, Selangan batu, Resak and Merbau, but are comparable to Kapur and Kempas, the common species used for flooring. In fact, the strength of the timber is typically not an essential criterion when the timber is used as parquet for surfacing an existing floor.

According to Burgess (1966), the timber of *Rhizophora* sp. is difficult to season, owing to its very high shrinkage and liability to checks and end-splits. However, the present study indicates that the shrinkage of mangroves is generally low to moderately high, with the exception of tangential shrinkage of the *B. parviflora*. While Keating & Bolza (1982) reported problems with distortion and checking in seasoning of *Rhizophora* sp., they stressed that the timber is very stable once dried to equilibrium moisture content (EMC). The authors further elaborated that, although the timbers may tend to split during nailing, they are moderately easy to glue and take good polish without filling. They also recommended that timbers that are likely to split badly when nailed be prebored. However, for timber flooring that requires little nailing, such as parquet and wood block flooring, this issue does not arise.

The timbers of *Rhizophora* sp. are not prone to termite and fungal attacks (Keating & Bolza, 1982) and are commercially non-susceptible to attacks by powder-post beetles (Burgess, 1966). These factors are very important, as they not only enhance the life in service of timber in utilisation, but also help maintain the appearance. Unfortunately, the timbers of *Rhizophora* sp. are only recommended for interior use, as they are not durable under external conditions, where weather exposure is significant (Burgess, 1966, Wong, 1976, Keating & Bolza, 1982). Thus, the production of parquet for interior flooring seems to be the most practical option.

Parquets or strips are frequently adopted as a floor covering, placed on solid concrete, owing to their aesthetic appeal in term of colour, grain and shape. It is interesting to note that the sapwoods of *R. apiculata*, *R. mucronata* and *B. parviflora* are very narrow and not well demarcated from the fairly attractive heartwoods, which are purplish-red, dark red-brown to yellowish-red in colour. The fine and even texture with fairly straight grain also produces a very fine planed surface.

4. CONCLUSION

As timber production and revenue from lowland dipterocarp forests has declined, it is essential to promote the utilisation of mangroves as an alternative source of timber. Apart from the current popular uses in charcoal production, mangrove timbers show the potential as flooring material, as indicated by the findings of the present study.

However, selection of the timber for a particular purpose depends not only on its technical performance, but on other factors, such as cost and availability. Thus, the slow growth rate of mangrove species should be taken into consideration when deciding to use them as flooring material. According to Abdul Rahman *et al*. (2004), the mean diameter at breast height of a 25-year-old stand of mangrove swamp forest dominated by *R. apiculata* in Matang, Perak is in the 15 − 20 cm range. Therefore, a detailed feasibility study on the raw material supply and economics needs to be conducted before the production of mangrove parquet can be promoted.

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PENDEKATAN PENGLIBATAN SWASTA DI DALAM PENUBUHAN LADANG HUTAN KOMERSIAL DI SEMENANJUNG MALAYSIA

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ABSTRAK

Penglibatan Jabatan Perhutanan Semenanjung Malaysia (JPSM) dalam penubuhan ladang hutan komersial dalam skala besar di Semenanjung Malaysia bermula seawal tahun 1960an, dengan penanaman beberapa spesies eksotik cepat tumbuh seperti *Pinus caribaea* dan spesies *Eucalyptus*. Inisiatif ini mendapat momentum di awal tahun 1980an dengan pelancaran Projek Ladang Hutan Kompensatori yang mensasarkan penanaman spesies cepat tumbuh seperti *Acacia mangium*, *Gmelina arborea*, *Araucaria heterophylla*, *Maesopsis eminii* dan *Paraserianthes falcataria* bagi menampung kekurangan kayu balak yang dijangkakan untuk sektor perumahan dan perabot. Pendekatan inisiatif awam didapati kurang berjaya dan Kerajaan telah mengambil langkah-langkah untuk melaksanakan perubahan dengan melibatkan pihak swasta yang didorong di bawah dasar penswastaan. Umumnya, tiga (3) kekangan masih wujud di dalam penubuhan ladang hutan iaitu, kos yang tinggi, risiko yang tinggi dan tempoh matang yang panjang. Industri berasaskan kayu kekal penting dalam pembangunan sosio-ekonomi Negara. Pada tahun 2006 Dasar Perindustrian Perkayuan Negara (NATIP) telah diperkenalkan oleh Kerajaan yang mensasarkan mewujudkan ladang hutan seluas 375,000 hektar dalam tempoh 15 tahun bagi menghasilkan 75 juta m^3 kayu dan dijangka dapat menjana pendapatan eksport sebanyak RM53 billion pada tahun 2020. Bagi mencapai matlamat ini, keluasan tanah yang luas untuk penubuhan ladang hutan yang luas bagi penghasilan bahan mentah perlu disediakan. Dalam usaha ini, JPSM telah mengambil inisiatif dengan menyediakan kawasan Hutan Simpan Kekal (HSK) yang sesuai bagi penubuhan ladang hutan berkenaan. Sehubungan itu, Majlis Tanah Negara pada tahun 2012 telah meluluskan Zon Pembangunan Ladang Hutan seluas 439,189 hektar di dalam HSK untuk tujuan ini. Kertas kerja ini bertujuan untuk berkongsi pengalaman JPSM mengenai isu-isu dan cabaran yang berkaitan dengan pendekatan swasta dalam penubuhan ladang hutan komersial.

1.0 PENDAHULUAN

1.1 Dasar Perhutanan Negara (DPN) 1978 (Pindaan 1992) menekankan kepentingan penubuhan ladang hutan untuk menampung bekalan mentah untuk industri pemprosesan berasaskan kayu-kayan serta menggalakkan pelaburan sektor swasta yang aktif dalam penubuhan dan pembangunan ladang hutan (Anon, 1978).

1.2 Di Semenanjung Malaysia, usaha-usaha pembangunan ladang hutan di bawah pendekatan penubuhan ladang hutan (*forest plantation*) telah dimulakan sejak tahun 1950an seperti Meranti dan Jati ditanam untuk menghasilkan kayu gergaji bermutu tinggi (Wyatt Smith, 1961). Pada awal tahun 1960an, Kerajaan Malaysia merancang untuk membina kilang pulpa dan kertas bagi menampung peningkatan penggunaan kertas dan produk kertas negara yang kebanyakannya diimport. Pada akhir tahun 1960, Kerajaan Malaysia dengan bantuan Pertubuhan Makanan dan Pertanian Bangsa-Bangsa Bersatu (FAO) telah melaksanakan projek ladang hutan perintis spesies cepat tumbuh dari jenis pine (*Pinus caribaea var hondurensis*) di negeri Pahang, Johor, Selangor dan Negeri Sembilan untuk menghasilkan kayu pulpa yang diperlukan untuk industri kertas. Sehingga akhir tahun 1980, seluas 4,500 hektar ladang pine telah ditubuhkan. Namun begitu, projek ladang pine dihentikan apabila rancangan membina kilang pulpa dan kertas didapati tidak berdaya maju dan terdapat masalah teknikal di mana kemandirian pokok pine tidak sesuai dengan keadaan tempatan.

1.3 Jabatan Perhutanan Semenanjung Malaysia (JPSM) mengunjurkan bahawa Semenanjung Malaysia akan mengalami kekurangan bekalan bahan kayu dari hutan asli menjelang akhir tahun 1990an di mana bekalan bahan kayu dianggarkan akan berkurangan sebanyak 8.12 juta meter padu setiap tahun. Bagi mengatasi kekurangan tersebut, Projek Ladang Hutan Kompensatori dilancarkan dengan tujuan menambah bekalan bahan kayu melalui penanaman spesies cepat tumbuh seperti *Acacia mangium* (Acacia), *Gmelina arborea* (Yemane) dan *Paraserianthes falcataria* (Batai). Projek Ladang Hutan Kompensatori mula dilaksanakan di Negeri Pahang, Johor, Selangor dan Negeri Sembilan dan

kemudian dilanjutkan ke negeri Perak, Terengganu dan Kelantan. Projek ini dibiayai sebahagiannya melalui pinjaman Persekutuan dan sebahagian lagi melalui Asian Development Bank (ADB).

1.4 Projek ini mensasarkan kawasan seluas 180,000 hektar ladang hutan dengan unjuran hasil sebanyak 180 m^3 sehektar untuk kegunaan umum industri berasaskan kayu pada pusingan tebangan 15 tahun. Selain itu, penubuhan ladang hutan ini juga akan dapat mengurangkan import kayu-kayan dan menjimatkan pertukaran mata wang asing.

1.5 Projek Ladang Hutan Kompensatori di semua negeri yang terlibat diswastakan di bawah Penswastaan Ladang Hutan selaras dengan ketetapan Majlis Perhutanan Negara ke-12 yang menyatakan bahawa Kerajaan tidak lagi terlibat secara langsung dengan penubuhan kawasan ladang hutan yang baru. Namun begitu, pihak swasta kurang memberikan sambutan dalam penubuhan ladang hutan yang baru kerana sering berhadapan dengan tiga (3) masalah utama yang berkaitan pelaburan dalam perladangan hutan iaitu pelaburan awal yang tinggi, tempoh pusingan tebangan (*gestation period*) yang panjang (minima 15 tahun) dan berisiko tinggi kepada kejadian kebakaran, serangan penyakit dan serangga perosak meskipun terdapat pelbagai insentif berbentuk skim galakan pelaburan yang diberikan oleh pihak Kerajaan.

1.6 Dasar Perindustian Perkayuan Negara (NATIP) telah diperkenalkan Kerajaan pada tahun 2006 bagi menyediakan halatuju pembangunan industri perkayuan dengan objektif khusus bagi memastikan sinergi aktiviti pembangunan huluan dan hiliran industri berasaskan kayu bagi meningkatkan persaingan antara industri untuk memenuhi cabaran global dan liberalisasi (Anon, 2009). Sasaran NATIP di bawah teras 2 iaitu Pembekalan Bahan Mentah untuk membangunkan seluas 375,000 hektar dalam tempoh 15 tahun mulai tahun 2009 sehingga 2020 bagi menghasilkan 75 juta m^3 kayu dan dijangkakan memperolehi pendapatan eksport sebanyak RM53 billion.

1.7 Selaras dengan NATIP, Pekeliling Ketua Pengarah Perhutanan Semenanjung Malaysia Bil 1 Tahun 2010 secara jelas telah menetapkan panduan penilaian ke atas kawasan dalam Hutan Simpan Kekal (HSK) bagi pembangunan ladang hutan perlu dilaksanakan di dalam zon pembangunan ladang hutan dan kawasan tersebut mempunyai tahap kesesuaian untuk penubuhan ladang hutan, tiada kesan negatif terhadap impak kepada alam sekitar, pemilihan spesies berdasarkan senarai yang telah ditetapkan dan pusingan tebangan yang munasabah dengan regim pengurusan dan silvukultur yang sesuai serta menyediakan Rancangan Pengurusan Ladang Hutan (Anon, 2010)

1.8 Selain itu, penubuhan dan pembangunan ladang hutan di dalam HSK juga perlu mematuhi kriteria yang telah ditetapkan di dalam Kriteria dan Petunjuk Untuk Pensijilan Pengurusan Hutan di Malaysia (MC&I) 2002 di bawah Kriteria 6.10 iaitu Perubahan Hutan kepada Ladang atau penggunaan tanah yang bukan untuk tujuan perhutanan tidak harus berlaku, kecuali dalam keadaan di mana perubahan meliputi bahagian yang terhad dari unit pengurusan hutan; tidak berlaku dikawasan hutan yang mempunyai nilai pemeliharaan yang tinggi dan akan membolehkan secara jelas pertambahan yang lebih luas dan terjamin untuk faedah–faedah pemeliharaan jangkamasa panjang merentasi unit pengurusan hutan (Anon, 2002)

2.0 STATUS PERLADANGAN HUTAN MASA KINI

2.1 Selaras dengan keputusan Jemaah Menteri pada 2 Mac 2005 telah bersetuju pihak Kementerian Perusahaan Perladangan dan Komoditi (KPPK) diberi tanggungjawab menerajui pelaksanaan Program Tanaman Ladang Hutan dengan spesies balak cepat tumbuh secara komersial dan berskala besar bagi menghasilkan produk-produk berasaskan kayu terutama bagi pembuatan perabot.

2.2 Dalam hal ini juga, pihak JPSM telah mengambil inisiatif untuk mengambil bahagian di bawah Skim Kebangsaan dengan memperuntukkan sejumlah kawasan dalam HSK yang besar dan sesuai bagi penubuhan ladang hutan. Justeru itu, Majlis Tanah Negara pada tahun 2012 telah bersetuju untuk meluluskan Zon Pembangunan Ladang Hutan dalam HSK seluas 439,189 hektar di Semenanjung Malaysia yang akan diperuntukkan untuk tujuan ini seperti yang ditunjukkan dalam Jadual 1.

Jadual 1: Cadangan Penzonan Kawasan Hutan Simpanan Kekal (HSK) untuk tujuan penubuhan ladang hutan.

Negeri	HSK(ha)	Zon Pembangunan Ladang Hutan (ha)
Johor	351,301	37,880
Kedah	307,046	15,380
Kelantan	623,849	199,000
Melaka	4,789	0
Negeri Sembilan	153,459	3,000
Pahang	1,562,902	36,030
Perak	986,140	100,000
Perlis	10,615	0
Pulau Pinang	5,139	0
Selangor	250,128	11,000
Terengganu	538,973	36,899
Jumlah	**4,794,341**	**439,189**

Sumber: JPSM, 2013.

2.3 Bagi memenuhi ketetapan pembangunan ladang hutan di negeri-negeri, Jabatan Perhutanan Negeri telah diperuntukkan seluas 324,417.61 hektar melalui kelulusan dasar keluasan ladang hutan negeri masing-masing seperti yang ditunjukkan di **Jadual 2**.

Jadual 2: Keluasan Ladang Hutan Mengikut Kelulusan Dasar Sehingga Tahun 2013.

Negeri	Keluasan Ladang Hutan Mengikut Kelulusan Dasar (Ha)
Johor	45,544.25
Kedah	9,133.00
Kelantan	162,485.00
Melaka	36.00
Negeri Sembilan	3,000.00
Pahang	31,831.00
Perak	56,503.00
Perlis	671.00
Pulau Pinang	0
Selangor	11,381.36
Terengganu	3,833.00
Wilayah Persekutuan	0
JUMLAH	**324,417.61**

Sumber: JPSM, 2013.

2.4 Walau bagaimanapun sehingga kini, keluasan ladang hutan yang telah ditanam di dalam HSK oleh JPSM adalah berjumlah 97,796.83 hektar sepertia yang ditunjukkan di **Jadual 3**.

Jadual 3: Keluasan Ladang Hutan di tanam dalam HSK mengikut spesies pada Tahun 2013.

Negeri	*Acacia mangium*	*Tectona grandis*	*Pinus*	*Hevea brasilensis*	*Khaya ivorensis*	Lain-lain	Jumlah (ha)
Johor	28,730	-	-	6,659	-	-	35,389
Kedah	25	1,962	68	1,167	218	460	3,900
Kelantan	-	111	-	16,536	15	666	17,328
Melaka	-	-	-	-	-	36	36
N. Sembilan	-	-	-	25	-	15	40
Pahang	14,164	-	-	8,669	40	228	23,101
Perak	-	119	34	767	13	1,184	2,117

Perlis	-	625	-	-	-	46	671
Pulau Pinang	-	-	-	-	-	-	-
Selangor	-	30	271	6,338	583	4,159	11,381
Terengganu	3,207	-	-	211	-	415	3,833
Jumlah (ha)	**46,126**	**2,847**	**373**	**40,372**	**869**	**7,209**	**97,796**

Sumber: Anon, 2013.

2.5 Walau bagaimanapun, keluasan kawasan pembangunan ladang hutan di negeri-negeri tidak selari dengan keluasan kelulusan dasar disebabkan oleh beberapa faktor. Antaranya ialah ketidaksesuaian tanah, kecerunan, topografi dan kedudukan kawasan cadangan kawasan ladang hutan, proses kelulusan penilaian impak alam sekitar (EIA) yang mengambil masa, ketidaktentuan harga pasaran kayu kayan semasa dan juga kekangan sumber dana. Semua faktor ini secara langsung atau tidak langsung akan mempengaruhi proses pengeluaran lesen pembalakan sekaligus akan mengganggu aktiviti penubuhan dan pembangunan ladang hutan.

3.0 PENGLIBATAN SEKTOR SWASTA DALAM PERLADANGAN HUTAN

3.1 Kerajaan telah menyediakan insentif untuk menggalakkan pelaburan dalam perladangan hutan dan menggalakkan penyertaan lebih besar daripada sektor swasta dalam pembangunan ladang hutan. Insentif ini telah diperuntukkan di bawah Akta Penggalakan Pelaburan 1986 dan Akta Cukai Pendapatan 1967. Insentif penubuhan ladang hutan juga turut disediakan oleh kerajaan negeri termasuk Sabah, Sarawak, Johor, Pahang, Negeri Sembilan, Selangor dan Kelantan. Peruntukan yang disalurkan adalah berbeza mengikut keperluan dan keadaan semasa yang wujud di negeri masing-masing.

3.2 Kerajaan Persekutuan melalui KPPK telah mewujudkan tabung pinjaman berjumlah RM1.045 billion bagi membiayai penubuhan Tanaman Ladang Hutan Komersial. Di bawah program ini, seluas 375,000 hektar akan dibangunkan dalam tempoh 15 tahun mulai 2009 sehingga 2020 dengan sasaran 25,000 hektar setahun serta menghasilkan sejumlah 5 juta m^3 kayu balak setahun. Sehingga kini, beberapa negeri di Semenanjung Malaysia, Sabah dan Sarawak telah mengambil bahagian di dalam program ini. Selari dengan program tersebut, Dasar Perindustrian Kayu Negara (National Timber Industry Policy, NATIP) telah dilancarkan oleh Kerajaan untuk tempoh 2009 hingga 2020.

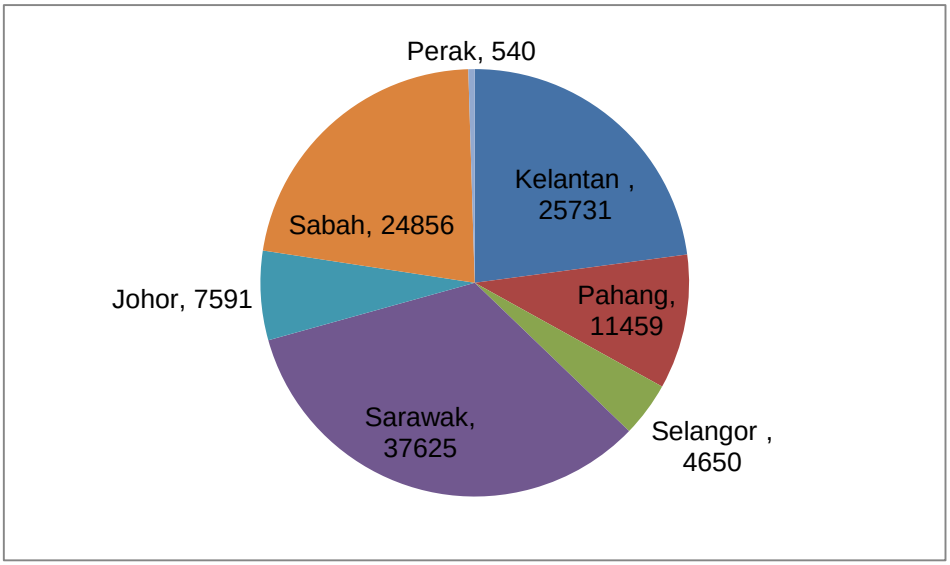
3.3 Bagi syarikat-syarikat swasta, syarikat milik kerajaan serta agensi kerajaan yang komited dan berminat untuk mengikut program tersebut perlu mematuhi syarat-syarat dan kriteria yang diperlukan untuk kelayakan pinjaman mudah ini. Antara kriteria dan syarat pinjaman pembangunan ladang hutan komersial ialah penubuhan ladang hutan perlu ditanam dengan spesies seperti berikut iaitu;

- *Acacia mangium* (Akasia)
- *Hevea brasiliensis* (Getah TLC);
- *Khaya ivorensis* (Khaya);
- *Tectona grandis* (Jati);
- *Neolamarkia cadamba* (Kelampayan/Laran);
- *Azadirachta excelsa* (Sentang);
- *Octomeles sumatrana* (Binuang); dan
- *Paraserienthes falcataria* (Batai).

Kriteria dan syarat-syarat lain pinjaman pembangunan ladang hutan komersial adalah seperti di **Lampiran 1.**

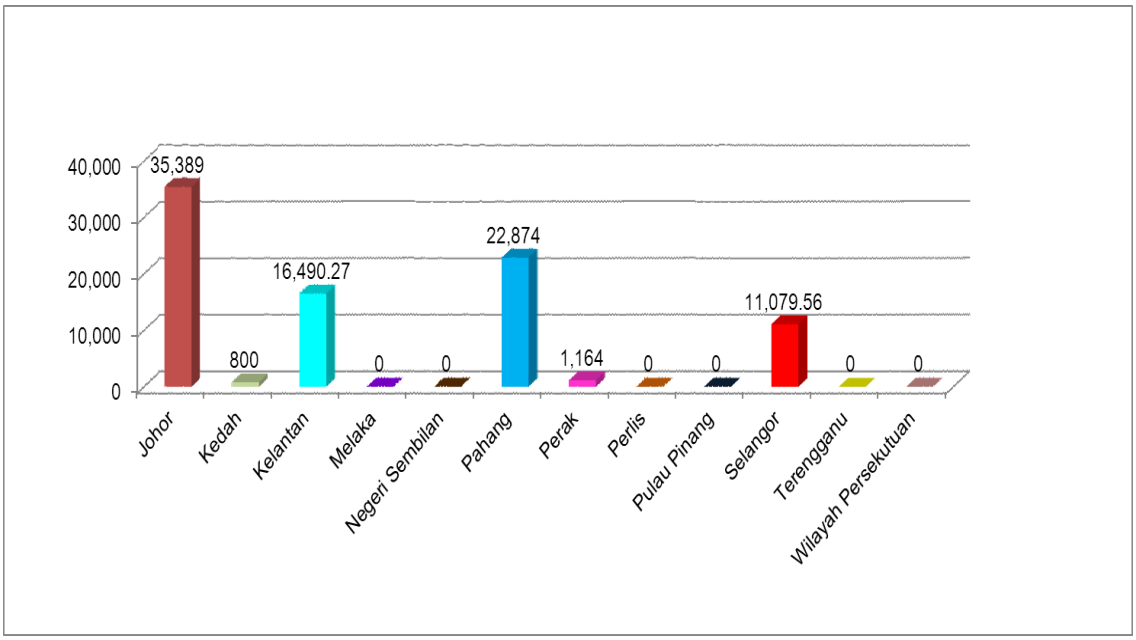
3.4 Mengikut laporan Forest Plantation Development Sdn. Bhd. yang ditubuhkan oleh Malaysian Timber Industry Board (MTIB) bagi menguruskan penubuhan Ladang Hutan Komersial di bawah KPPK, sehingga bulan Jun 2014 sebanyak 59 syarikat telah diluluskan pinjaman bernilai RM862,662,180.00 bagi penubuhan ladang hutan seluas 112,451.89 hektar bagi spesies kayu getah klon balak (*Timber Latex Clone*, *TLC*) dan spesies hutan di Kawasan Semenanjung Malaysia, Sabah dan Sarawak (Anon, 2014).

Rajah 1: Keluasan kawasan ladang hutan mengikut negeri di bawah kelulusan KPPK sehingga Jun 2014 (ha).



3.5 JPSM juga turut menggalakkan penglibatan sektor swasta dalam perladangan hutan di Semenanjung Malaysia. Ini dapat ditunjukkan pada **Rajah 2**, yang mana seluas 87,797 hektar ladang hutan telah dibangunkan oleh sektor swasta di dalam HSK.

Rajah 2: Penglibatan Sektor Swasta Dalam Perladangan Hutan di dalam HSK Mengikut Negeri (ha).



3.6 Kawasan-kawasan ladang hutan di dalam HSK yang ditubuhkan sehingga 2013 berupaya menghasilkan sejumlah 1.3 juta m^3 setahun. Pengeluaran kayu balak daripada kawasan hutan asli pada tahun 2013 berada di paras 4.18 juta m^3, manakala corak penggunaan kayu balak untuk memenuhi keperluan industri berasas kayu berdasarkan rekod penggunaan tertinggi semenjak tahun 2004–2013 berjumlah 7.28 juta m^3 setahun (kilang papan: 6.5 juta m^3/tahun dan kilang papan lapis venir: 0.78 juta m^3/tahun). Bekalan kayu balak dalam tahun 2013 menunjukkan terdapatnya defisit sebanyak 3.1 juta m^3 setahun. Dengan mengambil kira bekalan kayu daripada ladang hutan bekalan kayu masih mengalami defisit sebanyak 1.79 juta m^3 setahun. Walaubagaimanpun, defisit ini didapati berkurangan, sebanyak 0.48 juta $m^{3/}$ setahun berbanding dengan tahun 2010 sebanyak 2.2 juta m^3.

3.7 Oleh yang demikian, pengurangan defisit bekalan kayu ini menunjukkan bahawa penubuhan ladang hutan dapat mengurangkan kebergantungan bekalan bahan kayu dari hutan asli. Secara tidak langsung juga, dengan penglibatan sektor swasta dalam pembangunan ladang hutan ini telah dapat meningkatkan tahap sosio-ekonomi dengan menyediakan peluang-peluang pekerjaan yang mana sekaligus turut menyumbang kepada peningkatan Keluaran Dalam Negara Kasar (KDNK) selaras dengan hasrat Kerajaan ke arah negara berpendapatan tinggi.

4.0 ISU DAN CABARAN

4.1 Kesukaran Memperolehi Dana di Peringkat Awal Penubuhan Ladang

Kebimbangan utama bagi industri kayu itu mengumpul dana bagi syarikat baru untuk Perniagaan Kecil dan Sederhana (PKS) yang terlibat dalam aktiviti pemprosesan kayu. Kesukaran mendapatkan pinjaman adalah berkaitan dengan masalah mendapatkan bekalan jangka panjang bahan mentah. Terma khas dan mudah perlu disediakan untuk PKS yang mempunyai potensi pertumbuhan yang tinggi dan asas yang kukuh. Penyediaan insentif cukai untuk penyelidikan dan pembelian aset tetap dan insentif kewangan untuk menaik taraf dan memperluaskan kemudahan sedia ada juga penting dalam menyediakan asas yang kukuh bagi industri perkayuan.

4.2 Birokrasi Dan Kesukaran Untuk Mendapatkan Sumber Kewangan Dari Bank-Bank Perdagangan

Industri menghadapi proses permohonan yang panjang dan rumit semasa membuat permohonan pinjaman. Pemohon-pemohon selalunya keliru dan menghadapi kerumitan semasa mengisi maklumat dalam borang yang disediakan. Pihak industri juga menghadapi masalah untuk berhubung dengan agensi-agensi kerajaan kerana terdapat masalah berkaitan birokrasi dan kelewatan di mana permohonan untuk kemudahan pembiayaan biasanya akan melalui beberapa peringkat prosedur pentadbiran.
Terdapat beberapa peluang bagi pembiayaan tersebut tetapi dalam kebanyakan kes, masalah yang timbul adalah berkaitan polisi dan proses permohonan pembiayaan. Justeru itu, objektif untuk meningkatkan pembangunan perniagaan kecil, terutamanya di kalangan syarikat-syarikat Bumiputera oleh Kerajaan tidak dapat dilaksanakan.

4.3 Kurangnya kesedaran oleh Perniagaan Kecil dan Sederhana (PKS)

Kurangnya kesedaran di kalangan usahawan berkaitan insentif, kemudahan kewangan dan geran yang boleh didapati. Kebanyakan mereka mungkin tahu atau telah mendengar mengenai insentif, kemudahan kewangan dan geran tetapi tidak mempunyai pemahaman mengenai bagaimana untuk memohon bagi mendapat manfaat daripada insentif, kemudahan kewangan dan geran tersebut.

4.4 Insentif yang kurang menarik untuk aktiviti perladangan hutan

Insentif semasa yang disediakan oleh kerajaan di bawah Akta Penggalakan Pelaburan 1986 dan Akta Cukai Pendapatan 1967 serta pinjaman mudah untuk program perladangan hutan dianggap oleh pelabur sebagai tidak menarik atau tidak menguntungkan. Ini kerana, keperluan pengurusan perladangan hutan perlu diuruskan secara mampan dan dikaji semula supaya lebih fleksibel bagi mengurangkan risiko dan meningkatkan aliran tunai mereka.

4.5 Perlesenan dan kaedah pengutipan cukai hasil getah

Hasil kayu yang diusahasil daripada kawasan ladang hutan boleh dinyatakan sebagai Hasil Hutan Kecil iaitu hasil-hasil hutan lain yang tidak termasuk sebagai hasil hutan utama. Syarat-syarat perlesenan hasil hutan kecil adalah tertakluk kepada Bab 3 Seskyen 30 Subsekyen 4 Akta Perhutanan Negara 1984 Pindaan 1992 di mana adalah mengikut syarat Lesen Kecil (Borang 3). Walau bagaimanapun, perlesenan dan kaedah pengutipan cukai hasil getah daripada kawasan ladang hutan dalam HSK belum lagi dikuatkuasakan.

4.6 Pensijilan Ladang Hutan di bawah Skim Pensjilian MTCS

Pemantauan yang rapi dalam aktiviti penubuhan dan pembangunan ladang hutan perlu selaras mengikut Kriteria dan Indikator Pensijilan Pengurusan Hutan (Ladang Hutan) dalam peringkat perundingan yang mana dijangka akan dikuatkuasakan pada 2015.

5.0 KESIMPULAN

5.1. Industri perkayuan merupakan industri berasaskan sumber dan amat bergantung kepada bekalan bahan mentah yang mencukupi dan diperolehi pada harga yang kompetitif. Majoriti syarikat yang terlibat dalam industri perkayuan adalah daripada PKS dan dengan itu memerlukan sokongan kewangan dan infrastruktur yang kukuh untuk membantu membangunkan industri. Sehubungan itu, skim perolehan dana yang lebih mudah dan fleksibel serta bantuan berkaitan promosi insentif dan kemudahan pinjaman adalah amat perlu bagi meningkatkan penglibatan sektor swasta dalam pembangunan ladang hutan di Semenanjung Malaysia.

5.2 Peningkatan penglibatan sektor swasta dalam pembangunan ladang hutan di Semenanjung Malaysia memberi impak yang positif dalam meningkatkan keupayaan pembekalan bahan mentah berasaskan kayu yang secara tidak langsung menyumbang kepada peningkatan sosio-ekonomi Negara.

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Lampiran 1

KRITERIA DAN SYARAT PINJAMAN PEMBANGUNAN LADANG HUTAN KOMERSIAL

No	Kriteria/Syarat
1.	Penanaman dengan spesies yang disyorkan
2.	Objektif penanaman ladang hutan untuk bekalan kayu balak bagi industry perabot (15 tahun tanaman/pusingan)
3.	Keluasan minima kawasan tanaman ladang hutan mestilah: I. 2,500 hektar bagi tanaman Getah dan 15,000 hektar untuk tanaman spesies hutan (Semenanjung Malaysia sahaja); ataupun II. 15,000 hektar tanaman Getah dan tanaman spesies hutan bagi Sabah dan Sarawak
4.	Bagi luas kawasan kurang daripada 15,000 hektar, surat sokongan atau jaminan tanah tambahan diperlukan
5.	I. Syarikat perlu mempunyai 100% ekuiti tempatan serta berdaftar di bawah Akta Syarikat 1965 II. Maklumat M&A
6.	Modal berbayar syarikat hendaklah lebih dari RM500,000
7.	Tanah milik sendiri atau pajakan selama 30 tahun disertai dengan geran tanah dan surat pajakan berkaitan (Nombor Lot/Nombor Lesen)
8.	Ladang hutan yang diusahakan bukan di dalam kawasan Hutan Simpan Kekal (HSK) kecuali diberikan lesen untuk mengusahakannya di Semenanjung, **Licence for Planted Forest (LPF) di Sarawak** dan kawasan yang diluluskan untuk digunakan sebagai Industrial Tree Planting (ITP) di kawasan **Sustainable Forest Management Licence Agreement (SFMLA) di Sabah.**
9.	Mempunyai bekalan bijih benih yang mencukupi samada dari sumber sendiri atau daripada tapak semaian swasta yang mendapat kelulusan dari Lembaga Getah Malaysia (LGM) bagi bijih benih kayu Getah dan Institusi Penyelidikan Perhutanan Malaysia (FRIM) bagi lain-lain bijih benih.
10.	Dikehendaki menyediakan 10% peruntukan kewangan dari jumlah kos projek dengan modal sendiri bagi tanaman getah dan 20% dari jumlah kos projek bagi tanaman spesies hutan lain. (Pembiayaan adalah 90% daripada jumlah kos pembiayaan sehektar kayu getah (RM6,000) dan 80% bagi sehektar tanaman spesies hutan (RM4,000) bagi Syarikat swasta. Bagi Syarikat GLC, Syarikat Kerajaan atau badan-badan Kerajaan, pembiayaan adalah 100%)
11.	Tanah yang hendak diusahakan dengan tanaman ladang hutan, perlulah bebas dan tidak mempunyai lain-lain tanaman seperti kelapa sawit dan lain-lain.
12.	Pembiayaan adalah untuk tanaman baru dan masih belum dimulakan kecuali kerja-kerja tapak penyediaan untuk tanaman.
13.	Menunjukkan aliran tunai dan ‘Business Plan’ yang memuaskan dan munasabah serta keupayaan membuat bayaran balik pinjaman.
14.	Syarikat tidak mempunyai rekod hutang yang tidak baik dengan mana-mana institusi kewangan atau agensi kerajaan.

PAPER 4: 5

THE ESSENTIAL ROLES OF FOREST PLANTATION TOWARDS SUSTAINABILITY OF WOOD PRODUCTION AND WOOD-BASED INDUSTRIES IN SARAWAK

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ABSTRACT

The future of wood-based industries in Sarawak depends heavily on the wood production sustainability from our forests. This paper examines the roles and challenges of forest plantations in ensuring the sustainability of wood supply and the sustainable development of the wood-based industries in Sarawak. Analysis of the current structure of the forest plantation subsectors in terms of geographical or spatial distribution of licensed areas, as well as the extent and characteristic of growing stock was carried out. It is envisaged that the shortfall of wood supply for the sustainability and survival of the wood-based industries should soon be met from the production of forest plantations.

1. INTRODUCTION

The idea of setting up tree plantations in Sarawak is not new. The State Government through Forest Department Sarawak has begun to undertake trial tree planting covering sizeable areas in its efforts to rehabilitate and reforest the degraded forests and shifting cultivation areas inside the forest reserves since early 1970s. Timber harvested from the natural forests has reached its peak and threshold in early 1990s. Hence, concerted efforts among key players and stakeholders have been made to look into ways to sustain wood production as to meet the demands of the local wood- based industries.

The establishment of the planted forests was seen as the only way forward in ensuring sustainable future timber supply. Towards this end, the Forests Ordinance was amended in 1997 as to enable issuance of Licence for Planted Forests (LPF). With this legal instrument in place, to date a total of 43 LPFs have been issued covering a gross licensed area of 2.82 million hectares.

In the course of forest plantation development, it is anticipated that the plantation holders would face numerous issues and challenges encompassing land disputes with the local inhabitants in the vicinity of the licensed areas, pest and diseases, the availability of local labor supply and huge capital investment. These together with its long gestation period have amplified the risk of the investment. Recognizing the risks and challenges at stake, both State and Federal Governments have thence offered various incentives as encouragement to ensure its success. In the long run, LPF holders are also advised to undertake sustainable Forest Plantation Management Certification to promote eco-friendly developments and wood products as the relevancy of the future wood-based industry lies heavily on the success of forest plantations.

1.1 Chronology

The chronological events leading to the development of forest plantations include:

In 1965	Reforestation Research Programme was initiated and fast growing species of tropical conifers were tested but was found unsuitable.
Early 1970 ‘s	Experimented on fast growing exotic tropical hardwood species such as *Acacia mangium*, *Gmelina arborea* and *Paraserianthes falcataria.*
1985 -1995	About 13,000 hectares were planted with various fast growing tree species.
1991	Log production from natural forests reached its peak of 19.41 million m^3.
1997	Decided to embark on forest plantation development and The Forests (Planted Forests) Rules 1997 was enacted.
1998	The first Licence for Planted Forest was issued. An International Conference on Planted Forests was held in Kuching. One (1) million hectares was set as a target for planted forests by 2020.

2011	Trial harvestings commenced in forest plantations with 62,741 m^3 of wood produced.
2013	Log production from natural forests dwindled to merely 8.21 million m^3 while that from forest plantations increased to 537,752 m^3.

2.0 OBJECTIVES

The primary objectives of this paper are to discuss:

i. The roles of forest plantations in the sustainability of wood-based industries in Sarawak.
ii. Issues and challenges faced by forest plantation industries.
iii. The way forward to ensure the sustainability of timber wood supply.

3.0 CURRENT SCENARIOS

3.1 Forest Plantation

There are now 43 Licenses for Planted Forests (LPFs) with a gross licensed area of 2.82 million hectares of which the total plantable area is about 1.59 million hectares (Table 1). The current State Policy allows a maximum 20% of the plantable area for oil palm development of one 25-year rotation cycle as to enable the LPF holders to generate some internal funding for forest plantation development, and hence the immediate net plantable area available for forest plantation is left with about 1.3 million hectares.

The progress of forest plantation development has been rather slow and unsatisfactory with merely 335,049 hectares planted as at June, 2014. The LPFs holders have been directed to come up with catch-up plans to accelerate their planting progress to clear the backlogs in line with the approved Tree Planting Plan (TPP).

Table 1: Summary of Licences for Planted Forests (LPFs) in Sarawak.

No. of LPFs	Gross Area (ha)	Plantable Area (ha)	Planted Forests as at June 2014 (ha)
43	2,819,974	1,595,790	335,049

3.2 Distribution of Licenses for Planted Forests in Sarawak

The distribution of the 43 LPFs is over various parts of Sarawak (Figure 1). They are mostly owned by the existing forest timber concessionaires who are interested in venturing forest plantations aiming to supplement wood supply for their own mills.

The distribution of the LPF areas by region is shown in the Table 2 below. Most of these LPFs are in Sibu, Bintulu and Miri regions.

Table 2: Distribution of LPFs Area and Planting Progress by Region.

	KUCHING	SIBU	BINTULU	MIRI	Total
Total LPF Area (ha)	32,990	1,292,228	741,376	753,380	2,819,974
Total Plantable Area (ha)	24,995	732,613	370,240	467,942	1,595,790
Planted Area (ha)	300	115,479	176,282	42,988	335,049

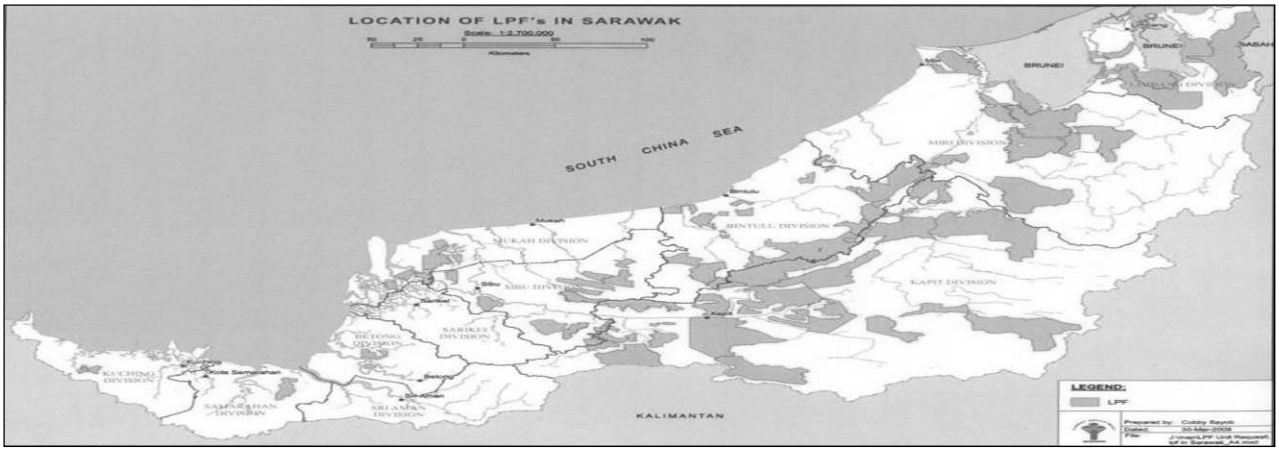

Figure 1: The Distribution of Licences for Planted Forests (LPFs) in Sarawak.

3.3 Growing Stock and Species

The trees planted are mostly of fast growing species (Table 3). Once LPFs are fully established and developed, it is expected to produce at least 15 million m^3 of wood per annum. This will generate a gross revenue of RM150 million per year to the State Government based on the current combined royalty and cess of RM10/m^3 payable to the government.

The downward trend of production from the natural forests is likely to continue. Hence, the anticipated reduction in revenue generated from the natural forests due to falling production is expected to be offset by the revenue generated from the plantation forests. Similarly, increased production from LPFs will help to meet the shortfall of supply from the natural forests in catering for the demand of the local mills.

Table 3: Total Area planted by species as at June, 2014.

No.	Species	Total Area Planted (Ha)	Percentage (%)
1	Acacia species	230,110	69
2	Batai (*Paraserianthes falcataria)*	46,457	14
3	Eucalyptus species	26,527	8
4	Kelampayan *(Neomalarckia cadamba*)	20,833	6
5	Others (Rubber (*Hevea brasiliensis*), Meranti, Kapur, Keruing etc.)	10,264	3
	Grand Total	335,049	100%

3.4 Harvesting

Trial harvesting of Planted Forests commenced in the year 2011. Currently, there are eight (8) LPFs harvesting their mature planted forest stands. Acacia species planted before 2006 for pulp and wood chip production have mature for harvesting while those areas planted before 2003 for general utility timber are also ready for harvesting.

These forest plantations are trying their own modified excavator based yarder systems in their harvesting. Efforts have been made to improve the efficiencies and also for better environmental and soil protection through regular performance assessments.

3.5 Log Production

3.5.1 Log Production from Natural Forests

Log production from natural forests reached its peak of 19.41 million m³ in 1991 (Table 4) and has since then is on its downward trend (Figure 2). In 2013, the production decreased to only 8.21 million m³.

Table 4: Annual Log Production from Natural Forests (1980 - 2013).

Year	1980	1985	1990	1991	1995
Production (m^3)	8,399,069	12,285,328	18,873,760	19,410,900	16,091,920

Year	2000	2005	2010	2011	2013
Production (m^3)	14,274,049	12,036,153	10,151,766	9,222,205	8,211,078

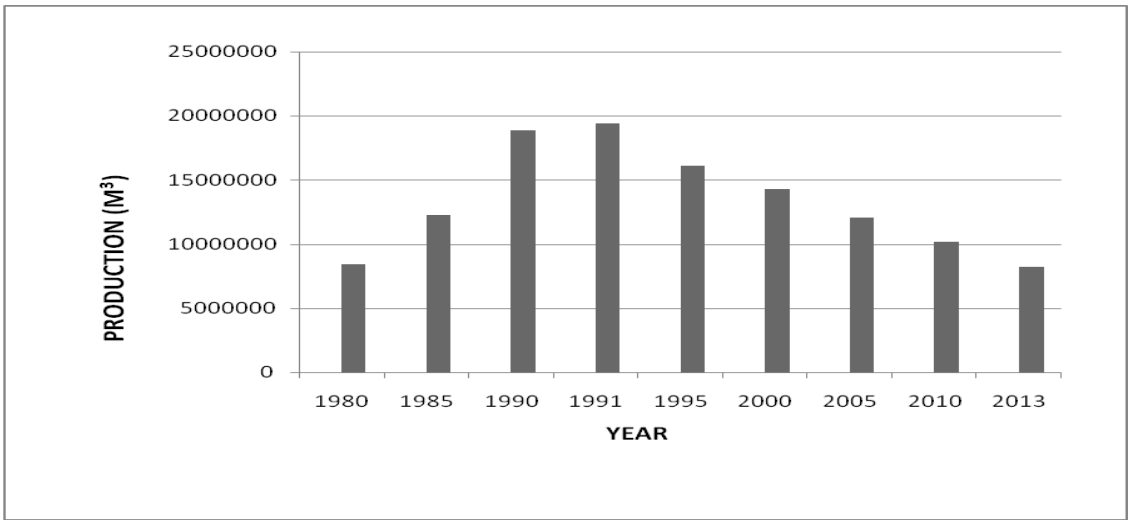

Figure 2: Annual Log Production from Natural Forests (1980-2013).

3.5.2 Log Production from Planted Forests

The log production from planted forests began in 2011 with 62,741 m^3 produced and has since increased to 537,752 m³ in 2013 (Table 5). This upward production trend for timber produced from LPFs is expected to continue as more plantation forests mature (Figure 3).

Table 5: Annual Log Production from Forest Plantations.

Year	2011	20012	2013
Production (m^3)	62,741	235,171	537,752

Source: Forest Department Sarawak Annual Reports.

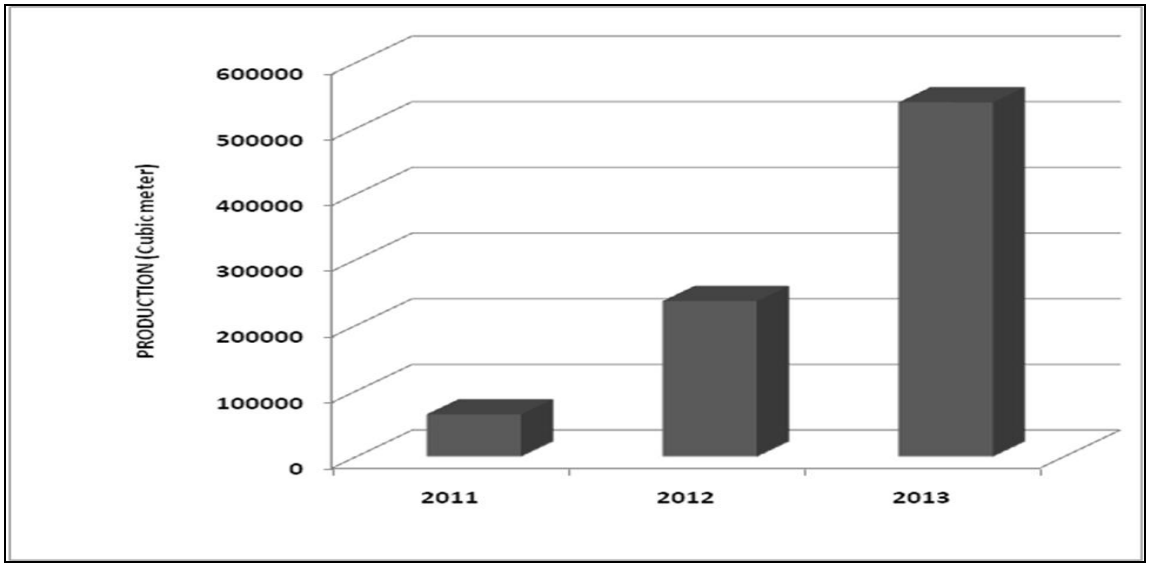

Figure 3: Log Production from Planted Forests (2011- 2013).

3.6 Mills Capacity

The total installed capacity of primary processing mills in Sarawak is 11.3 million m^3 per year (Table 6). Meanwhile the total mills operative capacity is only between 6.5 – 8.5 million m^3 per year. The installed mills capacity is defined as the capacity of mills assuming that if they are in full operations while the operative mills capacity is the capacity of all those mills which are currently in operations.

Table 6: Summary of Mills Capacity in Sarawak.

No.	Type of mill	No. of mills	Total capacity (m^3)
1	Sawmill	167	4,778,200
2	Veneer & Plywood	73	6,555,700
Total		240	11,333,900

Source: Sarawak Timber Industry Development Corporation.

In 2013, the total log consumed by the mills was 6.87 million m^3 while compared to 8.34 million m^3 in 2009 (Table 7). Unless more logs are available at affordable market prices, it is expected that more and more mills will not be able to maintain their current operative capacity.

Table 7: Annual mills log consumption (2009-2013).

Consumption (m^3)	Year				
	2009	2010	2011	2012	2013
Sawmill	2,254,296	2,431,758	2,031,708	2,320,970	1,854,081
Veneer/Plywood	6,083,400	6,013,013	5,645,871	5,720,406	5,019,024
TOTAL	8,337,696	8,444,771	7,677,579	8,041,376	6,873,105

Source: Sarawak Timber Industry Development Corporation

4.0 INCENTIVES FOR FOREST PLANTATION ESTABLISHMENT

In order to encourage and promote forest plantation establishment for future timber supply to the industries, both Federal and State Governments give a number of incentives to the forest plantation developers.

The incentives given by the State Government to LPF holders include:

1. Issuance of Licences for Planted Forests (LPFs) with tenure of 60 years as to enable four to six (4 – 6) rotation cycles.

2. Exemption of annual land rent (ALR) payment of up to 6 years from the date of issuance of the licence but depending on the actual ground situation of the residual standing timber of the natural forests in the licence.

3. Exemption of royalty and cess payments during the initial trial harvesting.

4. Policy of allowing 20% of the plantable area inside a LPF to be developed with oil palm plantation for one rotation cycle of 25 years only.

5. Rights to salvage standing timber of natural forests prior to land clearing and planting.

On top of all these, the Federal Government also provides incentives like:

1. Tax exemption and rebate on forest plantation investment.

2. Soft loan provided by the Ministry of Plantation Industries and Commodities (MoPIC) for new forest plantation establishment and is implemented through Forest Plantation Development Sdn Bhd (FPDSB), a subsidiary company of MTIB under the same Ministry.

   A few LPF holders in Sarawak have benefited from this soft loan facility. The loan carries low interest rate of 3% and repayment is to start after 15 years.

   All these incentives are meant for temporary short-term measures to relief of the financial burden of the LPF holders as forest plantation projects involve huge capital investment with return on the investment is only after the commencement of harvesting of the mature tree plantations.

5.0 ISSUES & CHALLENGES IN FOREST PLANTATIONS

The major issues and challenges faced by the LPF holders are:

i. Manpower Shortage.
ii. Land disputes or conflicts with local inhabitants.
iii. Natural Calamities (Pest and Diseases, Forest Fire and Wind Thrown).
iv. Investment Risk and Opportunity Foregone.
v. Lack of co-ordinated Industrial Research & Development Programmes.

5.1 Manpower Shortage

All the forest plantations in Sarawak are facing manpower shortage especially the tree planters. Local workers are generally reluctant to work in forest plantations because of unattractive wages, remoteness of the plantations and poor working conditions with limited basic amenities and utility facilities. Majority of the general workers in forest plantations are foreign workers from the neighbouring country Indonesia because of the current State Foreign Labour Policy allowing only workers from Indonesia to work in the forest plantations.

As Indonesia has undergone tremendous pace of economic activities and development in the past decade, it is no longer easy to recruit them. Besides, Indonesian Government is imposing more stringent conditions to protect the interest and livelihood of their citizens who work outside their own country. This is on top of the stiff competition for workers from other local industry sectors like oil palm plantation and manufacturing industries. Furthermore, the State is also in short of local expertise in forest plantation management due to uncertainty of career prospects.

5.2 Land Disputes

Land disputes or conflicts with the local inhabitants are common and teething issues which are considered sensitive and not easy to solve. Among the issues are land claims by the local inhabitants that cannot be

confirmed as Native Customary Land (NCL) by the land authority. All the genuine NCL are to be excluded from the licence.
Unless amicable solutions are reached with the claimants, the LPF holders cannot just enter the disputed areas either by force or threat. Currently there are several instances whereby LPFs are facing land disputes involving the local communities in and around the vicinity of their licensed areas. This has undeniably affected and delayed the establishment of their respective forest plantations.

5.3 Natural Calamities

Natural calamities refer to the destructions of plantation forests caused by widespread pest and diseases outbreak, forest fire and windthrow.

5.3.1 Pests and Diseases

Forest Plantation holders are worried about the possibility of having serious pest and disease outbreak in view of the huge capital investment and long gestation period. At the moment, the situations are still under control with only certain isolated cases of occurrence have been reported (Table 8).

Table 8: Summary of reported cases of Pest & Diseases.

No.	Plantations	Pest and Disease/ symptoms
1.	Acacia species	Cavatocystis (*Ceratocystis*), Red Root Rot (*Ganorderma*), Termite, Shoot Dieback (*Helopeltis*), Skeletonising of leaves (Cricket, *Nisitrus vittatus*).
2.	Batai (*P. falcataria*)	Defoliator (Bagworm, Yellow Butterflies, *Eurema* spp.), Chewing (Deer).
3.	*Eucalyptus deglupta*	Stem canker, Frass/turnelling, Stem boring (*Endoclita hosei*) Ring Borer, Trunk Breakage, Tips Cut-off (Cricket), Termites.
4.	*Eucalyptus pellita*	Termite attack *(Odontotermes denticulatus*), sap sucking (*Helopeltis* spp.), Dieback/tips cut-off (crickets & Katydids), Root rot, Herbivores (deer).
5.	Kelampayan/Laran (*N. cadamba*)	Leave Roller/Eater (*Margaronia hilaralis*) - Skeletonising, Rolling of Leave, Chewing (Deer & Wild Boar), Borer (*Endocita aroura*).
6.	Rubber (TLC)	Root decay.

It has been found that pruning may have induced fungi infection and therefore it has to be done with great care.

5.3.2 Forest Fire

In Sarawak, fire forests have destroyed some of the planted forest experimental plots in Sabal Forest Reserve and Oya Road Forest Reserve. However, no serious incidence of fire outbreak has been reported in LPF plantation since its first inception in 1998. They should not be complacent with the current situation and should take necessary precautionary measures to prevent it from happening and develop a standard operation procedure (SOP) in forest fire fighting.

Forest Fires could be started by lightning and carelessness of mankind. During the dry seasons especially from May to September of each year, frequency or risk of forest fire occurrence increases. This definitely poses serious threat to our tropical forests, especially the homogeneous stand of the plantation forests which are having abundant flammable dry leaves and plant debris on both the standing trees and forest floors.

Appropriate preventive measures including creation of ground forest fire breaks or barriers (road networks & corridor of natural forests), acquisition of adequate firefighting equipment and facilities, and availability of sufficient water through creation of ponds and reservoirs are recommended to combat forest fires. Besides, all forest plantations have to train their own team of firefighting staff who should be ever ready for immediate deployment in case of a forest fire outbreak. These are crucial because solely depending on Fire and Rescue Department could prove disappointing and inadequate as it may take few hours at the least for the firemen to reach the interior remote forest plantation areas.

5.3.3 Windthrow

There are incidences of damages in our forest plantation caused by windthrow**.** Unexpected strong wind turbulences could cause serious damage to our forest plantation. Big patches of trees in planted forests could be uprooted, broken or tilted because of strong winds. Although not so common in this part of the world, it does cause unimaginable sum of investment loss to the LPF holders.

5.4 High Investment Risk and Commitment

Forest Plantation projects are known to carry high investment risk because of their long gestation period. The plantation owners can only expect to realize their return of investment at the time when the mature trees are harvested for sale. It normally takes seven (7) years for pulp and paper forest plantation and ten to fifteen (10 – 15) years for timber utility forest plantation. Couples with the high establishment cost, not many investors are willing to take part in this long gestation period investment projects. Besides, the investors have to face the risks of unpredictable global timber market and risk of destructions by natural disasters such as forest fire, windthrow, and pest and disease infections apart from the opportunity foregone.

By and large, the real commitment of the LPF holders may have been shaken to certain extent by all these associated risks. Without the full commitment of LPF holders or stakeholders, it is practically impossible to realize the success of the forest plantation business development.

5.5 Uncoordinated Research & Development (R&D) Programmes

At the moment, the industry is still lagging behind in having co-ordinated industrial R&D programmes**.** It appears that most of the plantation holders are conducting their own independent R&D and their findings are normally not shared but instead confined to own use. It is timely that a coordinating body be formed among all the forest plantation developers to spearhead all the forest plantation R&D programmes and activities so that the research findings can be shared among all the members for the benefits of the forest plantation industry.
Their immediate tasks should focus on:

i. R&D on high quality planting materials (tree breeding to produce fast growing, disease and pest resistance, and high quality timber individuals or varieties, species, hybrids or clones);

ii. Availability of sufficient high quality planting materials (expanding scale of producing high quality planting materials, more nurseries and seed banks);

iii. Tree improvement and silviculture research programmes for selected plantation species.

iv. Pest, diseases and natural disasters control.

6.0 THE WAY FORWARD

Both the timber industry players and regulators in the State recognize the fact that there is a real need for forest plantation development to ensure sufficient sustainable wood supply to meet the future demands of our wood-based industry. Hence, to ensure the success of forest plantations in the State, it is suggested that the way forward should include:

i. Monitoring closely the achievement of annual planting target of each LPFs based on the approved Tree Planting Plan (TPP).

ii. Accelerating forest plantation establishment by the LPF holders to clear their backlogs.

iii. Salvaging of standing timber in natural forests shall strictly be confined to plantable area and should not be too far ahead of planting.

iv. Excluding unplantable areas from the Licences.

v. Intensifying R&D on quality planting materials and to ensure that they are readily available for tree plantation development.

vi. Enhancing control of pest and diseases, plantation harvesting and optimum wood utilization from forest plantations.

vii. Developing sound management system on land disputes or conflicts.

viii. Sustainable Forest Plantation Management Certification.

All forest plantations in the State are encouraged to undertake forest plantation management certification known as the Malaysia Criteria and Indicators (MC&I) for Sustainable Forest Management (Forest Plantation). Recently, Samling Timber Sdn Bhd's industrial tree plantation (ITP) in Segan, Bintulu has been granted this forest management certification by Sirim QAS International. The same certification also goes to another forest plantation owned by Shin Yang Group of Companies located at Kuala Baram in Miri.

The State Government hopes that more Forest Plantations would follow this footstep to have their respective plantations certified as the certification is recognized globally. This will gain international customers confidence as the certified plantations could also use the Programme for the Endorsement of Forest Certification (PEFC) Logo on marketing their eco-friendly timber products.

7.0 CONCLUSION

To conclude, the log production from our natural forests is expected to decrease further. The roles of forest plantation towards sustainability of wood production and wood-based industries in Sarawak are becoming more essential and relevant. Several primary processing mills especially sawmills have stopped operations or are not operating in full installed capacities as raw timber materials are no longer readily available at affordable prices. To ensure that forest and timber-related business activities remain sustainable, and serve as one of the mainstay of the State economy and revenue contributors to the State coffer, there is no choice but to embark on forest plantation development to supplement the supply of raw materials at feasible and competitive prices.

However, the most crucial factor in deciding the success of our forest plantation development is the real full commitment from all the stakeholders and in particular the LPF holders. LPF holders should start embarking on sustainable forest management certification of the forest plantations in order to gain access to the future international markets requiring certified eco-friendly timber products from the producing nations.

Finally, we are optimistic that in the years to come the forest plantation will play increasingly significant prominent roles in ensuring the sustainability of the wood production for the wood-based industries in Sarawak.

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PAPER 4: 6

PROGRESS AND ISSUES OF FOREST PLANTATION DEVELOPMENT IN SABAH

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ABSTRACT

Emphasis on log production has shifted from natural forest to forest plantations due to the declining timber resources from the natural forest. In Sabah, forest plantations are generally considered to be area planted with fast-growing or high-quality monocultures that produce high-yielding and short rotation (< 15 years) tree crops. This paper deliberates briefly on the history and progress of forest plantation development in Sabah since its inception. Important statistics of forest plantation development, i.e. plantation acreage, species planted, production by year and species, current utilization aspects, etc, are reported. Some of the impending and critical issues that affect the further progress of forest plantation development are also highlighted and discussed.

INTRODUCTION

The timber industry has been an important source of revenue for Sabah since the early years of independence, and continues to play a vital role in the development of the state. The harvesting of timber has been carried out as early as in the late 1890s'. Sabah saw a peak in log production in the 1970s' through 1980s' with an average of 11 million cubic meters per annum (Figure 1). This figure reflects a period of rapid land-use conversion of natural forests to the cultivation of permanent agricultural crops. At the same time, it also reflects a harvesting rate which exceeded the natural growth rate and regeneration capacity of the forest. This has led to the present decline in timber production from the state's production forests. Log production from natural forests in 2013 reached an all time low of at 2.1 million cubic meters which is comparable to the log production in the early 1960s'. As timber production from Sabah's natural forests declines, the shift of emphasis of production forestry to forest plantations is imminent.

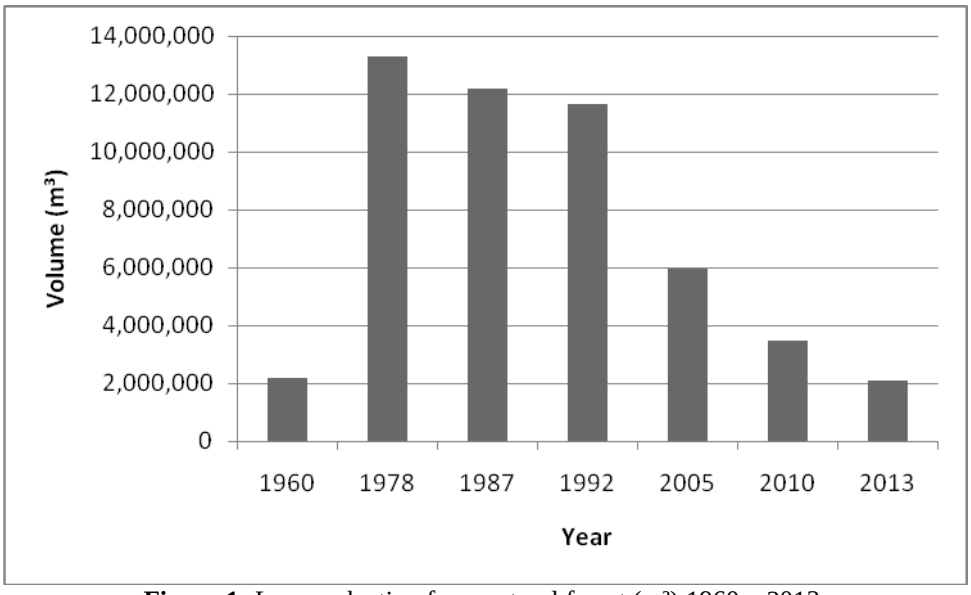

Figure 1: Log production from natural forest (m³) 1960 – 2013.

FOREST PLANTATION DEVELOPMENT IN SABAH

A Brief History

Sabah Softwoods Sdn. Bhd. was the first (1974) company to venture into commercial forest plantations in a logged over forest of 60,000 hectares in Brumas, Tawau. Subsequently, Sabah Forestry Development Authority (SAFODA) was established in 1976 to reforest some 200,000 hectares of degraded land. Later in 1982, an extensive tree plantation was initiated by the then wholly owned company of the State Government – Sabah Forest Industries Sdn. Bhd. (SFI) – as a source of raw material supply for its pulp and paper mill in Sipitang. Subsequently, in 1987, Innoprise Corporation Sdn. Bhd., the commercial arm of Yayasan Sabah, initiated the planting of high value timber species and rattan in 40,000 hectares of its concession in Luasong in the Tawau District. In the early 1980s', Jeroco Plantation Sdn. Bhd., Sejati Sdn. Bhd., and Koprasa Sdn. Bhd. were among the earliest private companies which were involved in forest plantation development on privately-owned land.

Current Status

In 1997, the state government introduced long-term license agreements to pave way for the gradual implementation of sustainable forest management. Production forests were then divided into management units (covering an area of approximately 2.55 million hectares) and licensed to private companies under long-term license agreements (100 year concessions), known as Sustainable Forest Management License Agreement (SFMLA). These SFMLAs requires licensees to be accountable for the development and management of the forest in accordance to approved forest management plans (FMPs), following the principles of sustained forest resource utilization. One important component of most FMPs is the establishment of industrial tree plantations (ITP) on degraded areas. The idea of establishing ITPs is to produce high volume of timber within a short time to fulfil the demands from the wood-based industry.

As of 2013, the Rakyat Berjaya Sdn. Bhd. group has a total of 3,502.7 hectares of forest plantations. Sabah Forest Industries Sdn. Bhd., on the other hand plays an important role in forest plantations with a total area of 57,042.5 hectares. By the end of 2013, an estimated 239,169.7 hectares (including rattan and rubber on private lands) of forest plantations had been established in Sabah. Of these, 77,018.1 hectares are rubber plantations owned by smallholders (Table 1). To date, some 660,000 hectares have been designated for forest plantations in the state.

Table 1: Forest plantation in Sabah (ha) as of 31st December 2013.

No.	SFMLA Holder/Agency/Company/Smallholder	Forest Plantation (ha)			
		Fast Growing Species	High Value Species	Gaharu	Total Forest Plantation Area (ha)
A.	**Yayasan Sabah/ Rakyat Berjaya Sdn. Bhd. (RBJ)**				
1	Rakyat Berjaya Sdn. Bhd. [Nicohandal Sdn Bhd (FMU 26]	-	2,008.0	-	2,008.0
2	Rakyat Berjaya Sdn. Bhd. (FMU 24 & 26)	1,439.8	54.9	-	1,494.7
	Sub-Total	**1,439.8**	**2,062.9**	**-**	**3,502.7**
B.	**SFMLA/LTL Holder**				
1	Sabah Forest Industries Sdn. Bhd. (FMU 7)	57,042.5	-	-	57,042.5
2	KTS Plantation Sdn. Bhd. (FMU 19B)	81.0	2,198.0	-	2,279.0
3	TSH Resources Bhd. (FMU 4)	4,783.0	3,946.0	-	8,729.0
4	Sapulut Forest Development Sdn. Bhd. (FMU 14)	4,750.2	9,854.4	-	14,604.6
5	Bornion Timber Sdn. Bhd. (FMU 11)	669.3	15,437.4	-	16,106.7
6	KM Hybrid Plantation Sdn. Bhd. (FMU 11)	513.5	68.2	-	581.7
7	Timberwell Bhd. (FMU 3)	63.8	3,548.5	-	3,612.3
8	Lebihasil Sdn. Bhd. (FMU 17A & 17B)	594.2	533.6	-	1,127.8
9	Total Degree Sdn. Bhd. (FMU 18B)	-	2,220.7	-	2,220.7
10	Lembaga Tabung Haji (FMU 18A)	-	5,007.0	-	5,007.0
11	Anika Desiran Sdn. Bhd. (FMU 5)	-	173.0	-	173.0
12	Eco-Plantations Sdn Bhd (FMU 2)	-	579.0	-	579.0
13	Jayakuik Sdn. Bhd. (FMU 2)	878.3	-	-	878.3
14	Asian Forestry Company (Sabah) Sdn. Bhd.	535.1	-	-	535.1

	(Begaraya Sdn. Bhd.)				
15	Lagenda Aktif Sdn. Bhd. (FMU 11)	-	475.0	-	475.0
16	Warisan Majuria Sdn. Bhd.	-	81.0	-	81.0
	Sub-Total	**69,910.9**	**44,121.8**	**-**	**114,032.7**
C.	**Agency/Company/Smallholder**				
1	SAFODA (Sabah Forest Develoment Authority)	4,941.0	1,185.0	-	16,126.0
2	Sabah Softwoods Bhd.	6,026.7	-	-	26,026.7
3	Ladang Jati Keningau Sdn. Bhd.	15.2	1,462.8	-	1,478.0
4	Boonrich Sdn. Bhd .	13.4	627.5	51.0	691.9
5	Kebun Rimau Sdn. Bhd.				
	(a) Kebun Sg. Balung	-	168.4	47.6	216.0
	(b) Kebun Rimau Estate	-	6.8	21.8	28.6
6	Woodlots in Lahad Datu	13.0	-	-	13.0
7	Woodlots in Sandakan	5.2	-	-	5.2
	Sub Total	**41,014.5**	**3,450.5**	**120.4**	**44,585.4**
	Total	**112,365.2**	**49,635.2**	**120.4**	**162,120.8**
D.	**Lembaga Industri Getah Sabah (LIGS)**	**-**	**77,018.1**	**-**	**77,018.1**
Grand Total		**112,365.2**	**126,653.3**	**120.4**	**239,138.9**

TIMBER PRODUCTION FROM FOREST PLANTATIONS

The production of plantation logs has been steadily increasing over the years, and plantation production in 2013 was at 1,277,046.01 m³ or 37.8% of the total log production (Figure 2). *Acacia mangium* was the main contributor to this figure with a volume of 940,513.88 m³ or 73.65% of the total production, followed by *Eucalyptus grandis* (276,248.66 m³), *Falcataria moluccana* (36,094.42 m³), and *Hevea* spp. (14,279.2 5m³).

Acacia was initially planted for woodchips and pulp. Due to their greater value, larger trees (> 20 cm DBH) are either processed locally for garden furniture, or exported to Vietnam for furniture making. *F. moluccana* on the other hand is used by the local industry in the manufacture of plywood and block boards. *Eucalyptus* is mainly produced by Sabah Forestry Industries Sdn. Bhd. for both plywood and sawntimber. Rubber wood is mostly used in the production of furniture.

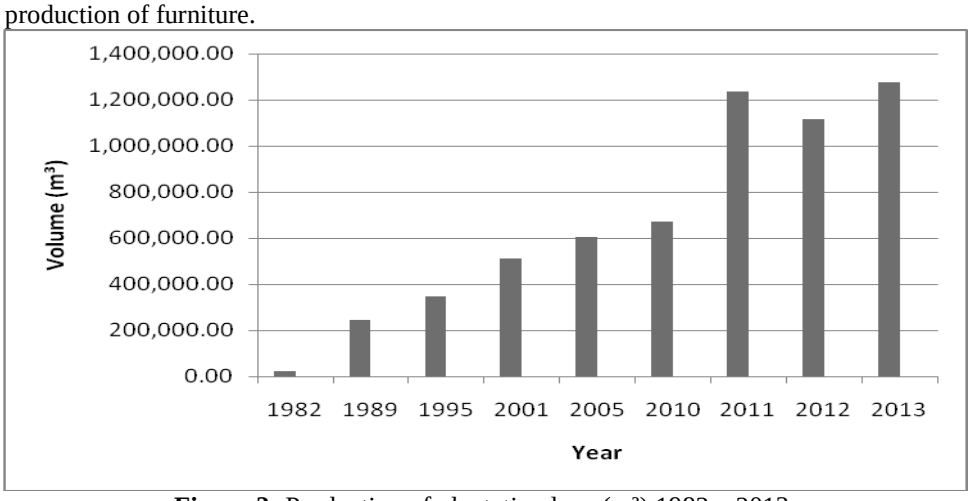

Figure 2: Production of plantation logs (m³) 1982 – 2013.

At present, most log production from the state still comes from natural forests (Figure 3). There are a few reasons for this. Firstly, most log production from natural forests is from the clearing of land for industrial tree plantations (ITP) within forest reserves, as well as the conversion of forested statelands to other land uses. Another reason is that most plantations in Sabah are relatively new and it will take years before these plantations can achieve optimum log production. As of 2013, the main contributors to the production of plantation logs are Sabah Forest Industries Sdn. Bhd. (SFI), Hijauan Bengkoka Plantation, and Sabah Softwoods which produced 759,210.54 m³, 283,156.0 m³, and 98,823.32 m³ respectively.

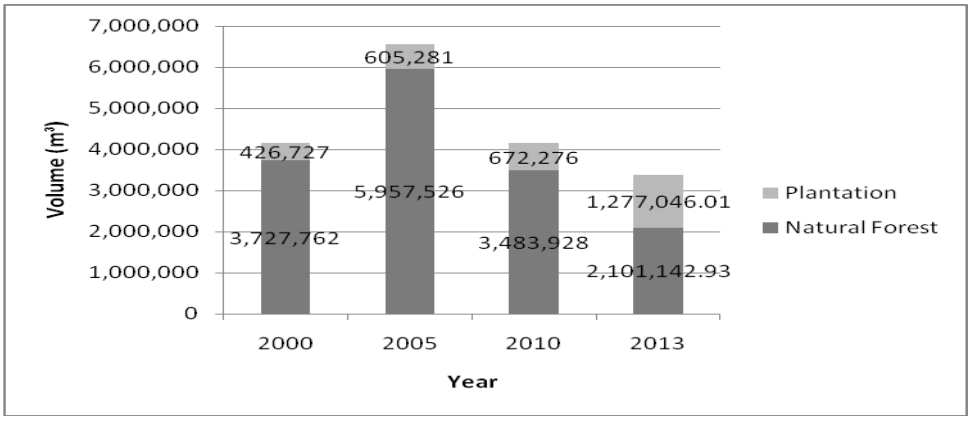

Figure 3: Log production from natural forests and plantations (m^3) 2000 – 2013.

FOREST PLANTATION SPECIES

In terms of area planted, *Acacia mangium* is the most important plantation species in Sabah. This is followed by *Eucalyptus grandis* and *Falcataria moluccana* (Batai). *E. grandis* is planted at higher elevations within the SFI concession. There has been an increasing interest in planting *Eucalyptus hybrids* and *E. pellita* in the last few years due to their impressive early growth performance. *A. mangium* is largely planted for woodchips and pulp. However, in anticipation of a possible outbreak of *Ceratocystis* fungus in Acacia plantations, some plantations have shifted their focus to *Eucalytus* and *Falcataria*. Native species make up less than 5 % of forest plantations. *Neolamarckia cadamba* (Laran) and *Octomeles sumatrana* (Binuang) are two native species that are increasingly grown on suitable sites. *Terminalia copelandii* is another native species that have shown promising results in field trials. Research continues in order to identify more species with potential for commercial cultivation.

CERTIFICATION OF FOREST PLANTATIONS

Currently about 51,000 hectares of planted forests are Forest Stewardship Council (FSC)-certified in Sabah (Table 2). While the government encourages forest certification, the FSC certification scheme pose difficulties to many new plantations due to the constraint imposed that forest plantations developed by clearing natural forests after 1994 are not certifiable.

Table 2: FSC certified forest plantation in Sabah (ha) as of 31st December 2013.

Company	**Area**
Hijauan Bengkoka	18,240 ha (FSC certified)
Sabah Softwoods	27,374 ha (FSC certified)
Sabah Softwoods	5,616 ha (FSC controlled wood area)
Total	**51,230 ha**

CHALLENGES AND ISSUES IN FOREST PLANTATIONS

1. CERATOCYSTIS SPP.

The genus *Ceratocystis* is a group of fungus which is reported to cause wilting in *Acacia*. *Ceratocystis* spp. has infected large areas of Acacia plantations in Vietnam. This disease has been reported in some plantations in Sabah recently and it may cause a serious outbreak in the near future (Wingfield, 2013).

2. FINANCIAL CONSTRAINTS

As the establishment of forest plantations is a costly undertaking and requires high capital investment, the main players in this sector, i.e. the SFMLA Holders and forest plantation companies and agencies, need financial assistance for them to move forward. However, local financial institutions and banks are reluctant to provide loans to them due to the long gestation period and high economic risks associated with forest plantations. In order to encourage the establishment of forest plantations, the Federal Government, through Malaysian Timber Industry Board (MTIB), has allocated RM 317 million in the form of soft loans to the private sector in Sabah. This form of financial assistance has proven extremely helpful, but the amount is limited and is insufficient for forest plantation development throughout the country. Therefore, more financial resources are still needed.

3. SHORTAGE OF LABOUR

Plantation establishment is labour intensive at the early stages of development. The shortage of labour is a common issue in the plantation sector. This is even more challenging because the forest plantation sector has to compete with other industries for the recruitment of local and foreign labour. The locals preferred to work in other industries such as in factories where the working conditions are usually more favourable. In this connection, the forest plantation sector is still depending heavily on foreign workers. Therefore, government intervention and assistance is crucial to facilitate the recruitment of foreign workers in this sector.

4. INADEQUATE SUPPLY OF QUALITY PLANTING MATERIAL

It is a known fact that quality planting material has a tremendous impact on growth and yield, and ultimately productivity of forest plantations. However, in most forest plantations, shortage of good planting material is a common issue. The forest plantations that have benefited from research in tree improvement are still small. Therefore, research and development on tree improvement and breeding programmes need to be intensified, and cover both exotic and indigenous species. Collaboration between the SFMLA Holders and research institutions need to be strengthened in order to address this issue.

5. LACK OF INTEGRATION BETWEEN THE MANUFACTURING SECTOR (downstream processing) & FOREST CONCESSIONAIRES

The wood-based industry in Sabah generally does not have forest concessions to ensure a regular and secure supply of logs. They depend on procuring logs from the FMU licensees or private forest plantations owners. This creates inefficiencies in the wood supply chain, thus leading to higher production costs low profit margins for suppliers and high cost of wood supply procurement for the manufacturing sector.

CONCLUSION

At present, the supply of timber from forest plantations is insufficient to meet the demand of both the local and international markets. The issues mentioned above need to be addressed to ensure that forest plantations in Sabah can achieve its goal as a primary source for timber in the future and remain relevant.

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WORKSHOP SESSION V

FOREST ECOSYSTEM SERVICES: FOOD, WATER, ENERGY, CLIMATE AND RECREATION

PAPER 5: 1

A STUDY ON TOURISM POTENTIAL AND DEVELOPMENT IN TONGOD, SABAH

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ABSTRACT

Sabah is blessed with many wonderful assets that can be promoted as tourist attractions. Places like Mount Kinabalu, Sepilok Orang Utan Rehablilitation Centre and Pulau Sipadan are some of the interesting places that have become the main attractions for tourists who come to Sabah. In the year 2013 alone, 3,383,243 tourists visited Sabah. With the increase of tourists to Sabah, new products have to be introduced as alternatives to the readily available tourism products. The objective of this study was to investigate attractions that can be developed into tourism products in the area of Tongod in Sabah. In addition, the survey also evaluated the current situation in Tongod so that the advantages and disadvantages of the elements related to tourism in this area can be identified. Tongod District is situated in the centre of Sabah with an area of 10,051.75 square kilometres of mainly hilly terrain. This strategic location gives Tongod an advantage to be developed as the hub of nature tourism in the heart of Sabah. Natural beauty and cultural values, interesting and significant flora, fauna, landscapes, communities, tradition and lifestyles, were observed and recorded. Interviews with stakeholders on tourism development in Tongod were also conducted. The results are presented in this paper.

1. INTRODUCTION

1.1. Background of the study

The United Nations World Tourism Organization (UNWTO) has defined tourism as "the activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business, and other purposes".

Benefits of tourism:

i. Provides employment opportunities, both skilled and unskilled.
ii. Generates needed foreign exchange.
iii. Increases income.
iv. Increases gross domestic product
v. Can build on existing infrastructure.
vi. Develops an infrastructure that will also help stimulate local commerce and industry
vii. Can contribute to development of local products and resources
viii. Helps to diversify the economy
ix. Tends to be one of the most compatible economic development activities available in an area, complementing other economic activities
x. Has a high multiplier impact
xi. Increases governmental revenue
xii. Broadens educational and cultural horizons, and improves feeling of self-worth
xiii. Improves the quality of life related to a higher level of income and improved standard of living
xiv. Reinforces preservation of heritage and tradition
xv. Justifies environmental protection and improvement
xvi. Provides employment for artists, musicians, and others because of visitor's interest in local culture, thereby enhancing cultural heritage
xvii. Provides tourist and recreational facilities that may be used by local people
xviii. Breaks down language barriers, sociocultural barriers, racial barriers, political barriers and religious barriers
xix. Creates a favorable image for a destination
xx. Promotes a global community
xxi. Promotes international understanding and peace

The International Ecotourism Society (TIES) defines ecotourism as "responsible travel to natural areas that conserves the environment and improves the well-being of local people".

Benefits of ecotourism:

i. Provides jobs and income for local people.

ii. Provides funds for purchasing and improving protected or natural areas to attract more ecotourists in the future.
iii. Provides environmental education for visitors.
iv. Encourages heritage preservation and environmental preservation and enhancement (the creation of new or enlarged national and state parks, forest reserves, biosphere reserves).

Destination development begins with an idea and the selection of a site. Some sites are natural and some are built. Some sites have existed for millennia, such as the Egyptian pyramids and the Grand Canyon. But they need facilities or access roads before the sites have the potential to attract and handle large numbers of visitors (Chon & Maier, 2010).

In general the tourism sector in an area is developed for various reasons, such as to generate economic benefits and to provide job opportunities for the local residents who live in the area. Next, tourism may help in the preservation of the environment and cultural heritage. From the social perspective, tourism provides facilities and trading services as well as recreation, for tourists and local residents, which cannot be developed without the tourism itself (Inskeep, 1991).

1.2. Justification

Sabah is blessed with many wonderful assets that can be promoted as tourist attractions. Places like Mount Kinabalu, Sepilok Orang Utan Rehablilitation Centre and Sipadan Island are some of the interesting places that have become the main attractions among tourists who come to Sabah.
In the year 2013 alone, 3,383,243 tourists visited Sabah. With the increase of tourists to Sabah, new products have to be introduced as an alternative to the readily available tourism products.
The aim of this study was to investigate attractions that can be developed into tourism products in the area of Tongod in Sabah. In addition, the survey also evaluated the current situation in Tongod so that the advantages and disadvantages of the elements related to tourism in this area can be identified.

1.3. Objectives

i. To investigate attractions that can be developed into tourism products in the area of Tongod in Sabah.
ii. To evaluate the current situation in Tongod so that the advantages and disadvantages of the elements related to tourism in this area can be identified.

2. STUDY AREA AND PURPOSE OF STUDY

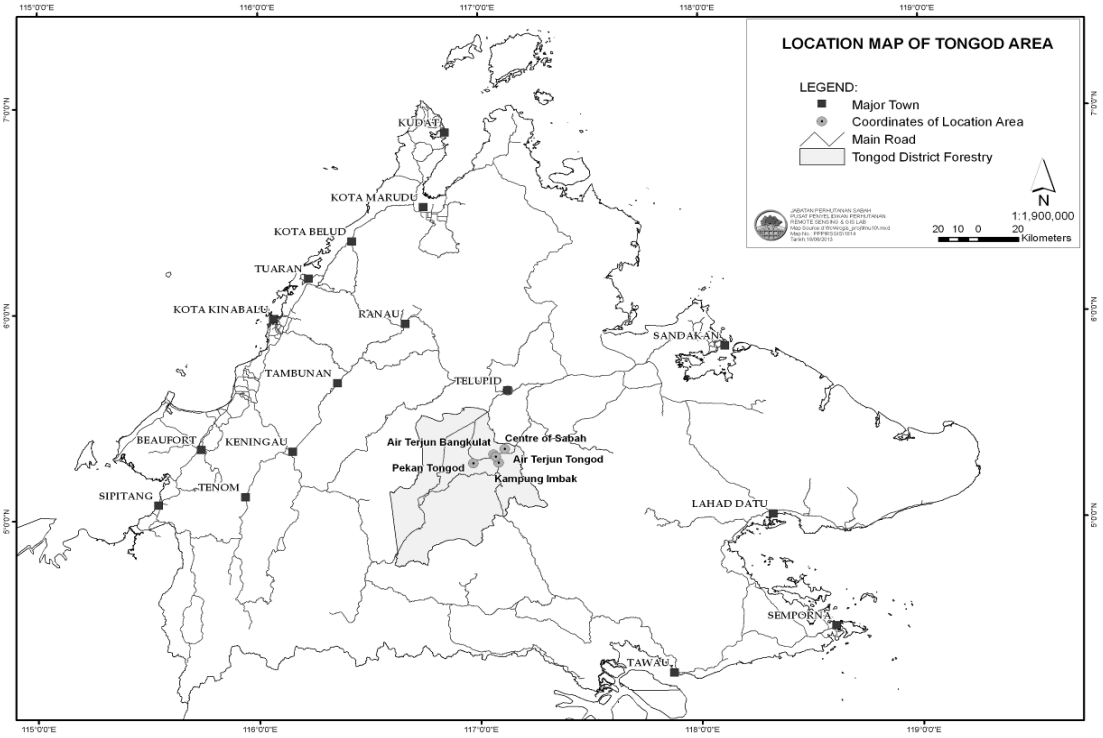

Figure 1: Tongod District in pale green.

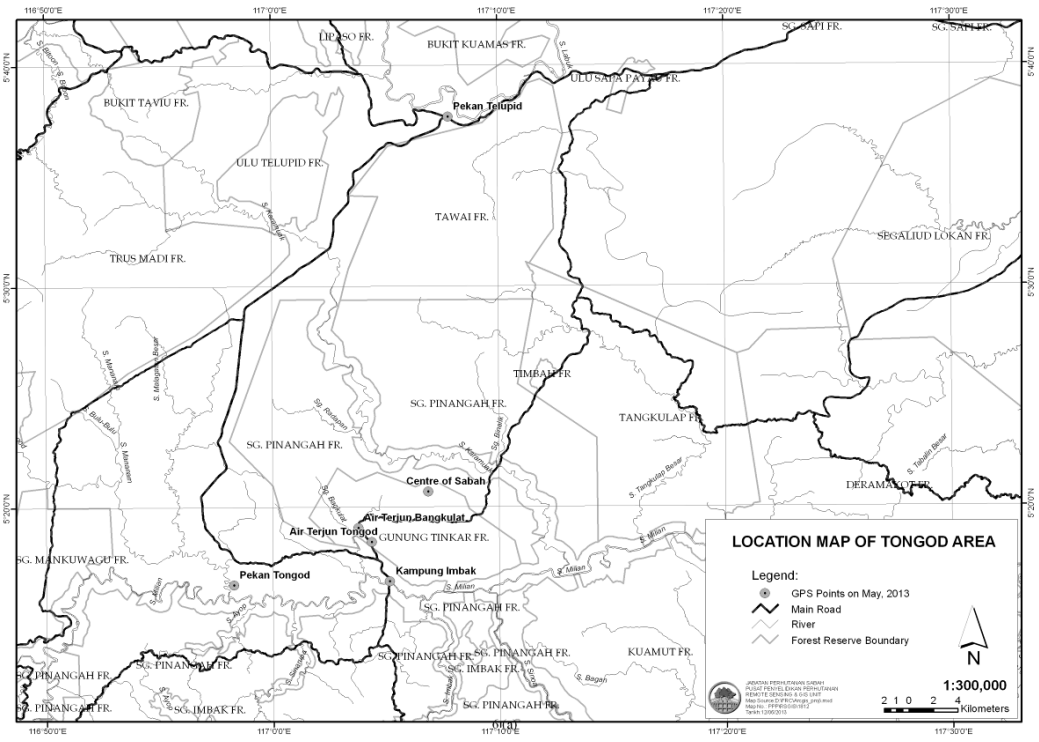

Figure 2: Location of the surveyed area in Tongod.

The study was conducted to investigate tourism attractions that can be developed into tourism products in the area of Tongod, Sabah, Malaysia (Figure 1 & Figure 2). In addition, the survey also evaluated the current situation in Tongod so that the advantages and disadvantages of the elements regarding the tourism sector in this area can be identified. The recorded suggestions would be reviewed and recommended for potential tourism development programme in Tongod.

Tongod District is located about 250 kilometres from Kota Kinabalu and 180 kilometres from Sandakan (two major towns in Sabah). The district is situated in the centre of Sabah, surrounded by eight other districts, i.e. Ranau, Beluran, Kota Kinabatangan, Lahad Datu, Tawau, Nabawan, Keningau and Tambunan, with an area of 10,051.75 square kilometres of mainly hilly terrain (www.Pejabat Daerah Tongod.htm). Therefore, this strategic location that lies in the heart of Sabah gives Tongod area an advantage to be developed as the hub of nature tourism in the heart of Sabah.

It is hoped that the concerned governmental agencies, such as the Tongod District Office, Sabah Forestry Department, Tourism Ministery and other related agencies will use this report as a supplementary reference material for planning development in Tongod. It is also anticipated that tourism development will improve the social and economic status of the community living in Tongod.

3. MATERIALS AND METHODS

The natural aesthetic and cultural values, interesting and significant flora, fauna, landscape, caves, waterfalls, communities, tradition and lifestyles were observed and recorded. The methods used in this study were basically exploring the potential tourism product in order to get the current information and by interviews with the parties related to tourism development in the area (Figures 3 & 4). Photos were taken for reporting.

4. RESULTS AND DISCUSSION

The definition of tourism products has always been focused on something tangible, such as handicrafts or waterfalls. In fact, the definition of tourism products includes all the elements which influence the experience of a person to the destination that has been visited. Tourism products not only consist of tourist attractions but also include facilities and infrastructure which support the systems of tourism (Mohamed & Nordin, 2007).

The tourism product development plan should be supported by the availability of resources which can serve as attractions to the tourists. In order to identify the resources that can serve as tourist attractions, inventories of these resources must be assembled at a site so that they could be developed into a tourism spot.

The following section describes some of the potential tourist attractions in the area. However, the study was conducted in a very short period and might likely have missed other potential products. Therefore, there should be an elaborate study to inventory all tourism sources found in this area.

4.1. TOURIST ATTRACTIONS IN TONGOD AREA

4.1.1. Gunung Tingkar

Gunung Tingkar Forest Reserve (Figure 5) is a Class I Forest Reserve with an area of 10,150 hectares with moderately disturbed forest. Visitors can climb to Gunung Tingkar's summit and enjoy the breathtaking natural scenery. One may encounter some interesting and unique flora and fauna too.

4.1.2. The Centre of Sabah

The Centre of Sabah is a point situated in the middle of Sabah that was measured and identified by Sabah Forestry Department, Malaysia Mapping and Survey Department (JUPEM) Sabah Branch, Sabah Lands and Surveys Department and the Institution of Surveyors Malaysia, Sabah Branch (Figure 6). One can walk to the Centre of Sabah from the main road and it would take about 3 hours to reach the place. The centre of Sabah is situated about 572 metres above sea level at one of the peaks. At this high elevation, the air is fresh and cool, and one can enjoy a breathtaking misty mountain view (Figure 7).

4.1.3. Bangkulat waterfall

Bangkulat waterfall is also known as the flat rock area by the local people. At this site, river water flows through the flat rock and forms numerous cascading waterfalls. With the existing main road located about 100 metres away and breathtaking view of the waterfalls, this area has great potential to be developed for nature tourism in Tongod (Figure 8).

4.1.4. Flora and Fauna

i. Flora

Tongod District posesses a vast forest area that has abundant flora that can be an attraction to tourists.

ii. Orang-utan

Orang-utans are Sabah iconic red apes, classified as Great Apes, large primates which lack tail and have a large brain (Huton, 2013), like other great apes, and have long been a source of major fascination for mankind (Bennett, 2006). The Orang-utan is the world's largest tree-climbing mammal. Pleistocene fossil records show that the orang-utan was once widespread throughout Southeast Asia. Today, they are only found in Sumatra and Borneo (Thet, 2013). During the survey, an Orang-utan nest was spotted in Gunung Tingkar Forest Reserve (Figure 9).

iii. Other fauna – Deer, barking deer, mouse deer, etc.

The quality of these wildlife attractions is of an international standard. The images of Sabah wildlife are very strong features of the public and private sectors' tourism marketing materials, both in Sabah and Malaysia (Ministry of Tourism and Environmental Development, 1996).

4.1.5. Handicrafts

There is undoubtedly a good market for a range of Sabah handicrafts. Handicrafts were consistently highly rated as amongst the most popular items purchased by tourists in Malaysia (Ministry of Tourism and Environmental Development, 1996). Small scale handicraft production by the local community in Tongod will be a viable economic activity.

4.1.6. Traditional costumes of the locals

Tradition and custom have long been part of our lives. Some survived for aeons; others have barely endured, touched by influences that have led others to be forgotten altogether. Traditions survived because they were handed down through generations (Charuruks & Padasian, 1993). The culture, custom and tradition of the local communities in Tongod area can also be introduced as part of the cultural tourism product. It is anticipated that tourists may have the chance to learn about the life style of the local communities residing in Tongod.

4.1.7. Local history

Historical site has to be preserved for remembering the historic event that happened there, apart from being a interesting place to visit. In Tongod Bakong Memorial was built as a remembrance for an event that happened during the Second World War (Figures 11 & 12). It was a base camp of the Japanese soldiers during the war.

4.1.8. Tamu / Market place

The tamu provides an opportunity to meet the local people and experience the way they live, the people from different cultures, living in harmony with one another and with nature. Noisy, crowded, humid and, at the same time, bustling and intriguing, the tamu provides an authentic encounter with the rich cultural, culinary and traditional aspects of the lives of Sabah's many ethnic groups (Chong & Low, 2008). During the survey, the team explored a local market or 'Tamu' situated next to the Tongod Township (Figure 12).

4.2. TOURISM ACTIVITIES THAT CAN BE EXPLORED IN TONGOD

4.2.1. Jungle trekking

Tourists who are more interested in adventurous activities can go for jungle trekking into the forest. Interesting permanent trails can be developed and maintained for this purpose. At the iconic site at Tongod, trails in Gunung Tingkar Forest Reserve and the trail to the Centre of Sabah as described earlier can be developed for jungle trekking. Developing a well managed and marketed trekking trip in Sabah would provide additional opportunities for the activity-based tourists, and could bring significant benefits to rural communities (Ministry of Tourism and Environmental Development, 1996).

4.2.2. Visiting the Centre of Sabah

The point at the heart of Sabah has it own sentimental value to visit as described earlier. Upon reaching at the site, it will make one filled with satisfaction to be at the centre of the 'Land Below the Wind' and surrounded with beautiful breathtaking scenery, thus making one feels greater appreciation and love for nature.

4.2.3. Visiting / Picnicking at the Bangkulat waterfall

The breathtaking scenery of the Bangkulat waterfall area can be the main tourism attraction and it has the potential to be a picnic spot for visitors. Besides Bangkulat waterfall, there are other rivers / waterfalls which are suitable picnic spots in Tongod, such as Gunung Tingkar waterfall.

4.2.4. Night walk

The jungle trails can also be used as trails for night walks and tourists can experience the nocturnal wildlife in the forest.

4.2.5. Bird watching

Bird watching can be organized by taking tourists to the locations that have the potential to watch birds of different species, especially at sites where there are fruits trees because they are the main source of food for the birds.

4.2.6. Homestay

Homestay programme provides accommodation and other relevant facilities for tourists. Traditional food and beverages can also be served to tourists who spend the night at the homestay.

4.2.7. Photography

Breathtaking sceneries and interesting nature in Tongod are 'gems' to tourists who love photography. Photography helps tourists to enjoy the beauty of nature. Nature photography can also educate the community to appreciate and protect nature. This makes photography a useful and beneficial activity (Abu Bakar, 2012).

4.2.8. Camping activity

There are suitable areas for camping activity in Tongod.

4.3. IMPORTANT MATTERS THAT SHOULD BE CONSIDERED IN TOURISM PLANNING IN TONGOD

4.3.1. Safety and security

Safety measures should be given due attention. Basically, tourists usually travel to places they think are safe to venture and they will avoid going to places that are not safe. Tourism investors should give top priority to safety alongside with other factors before they decide to invest. Well-staffed clinics should be set up. These can offer immediate treatment to tourists who are in need and to the local residents as well.

4.3.2. Cleanliness

Cleanliness of the area is critical and should be given due attention. This is the basic requirement in any tourism area. A clean environment will provide comfort and beautiful atmosphere to the tourists as well to the local residents.

4.3.3. Carrying Capacity

The influx of tourists should be controlled so that the elements and ecosystem of the tourism spots are preserved and the assets and facilities provided can be well maintained. This can be done by determining the carrying capacity of an area. Carrying capacity is defined as that level of tourist presence which creates impacts on the host community, environment and economy that are acceptable to both tourists and hosts and is sustainable over future time periods (Cooper, 1993).

4.3.4. Supporting logistic and infrastructure

The tourism product should include services, such as shelters, restaurants and vehicles. To create value for customers and build meaningful relationships with them, marketers must first gain deep insights into what customers need and want. Companies use such customer insights to develop competitive advantages (Kotler *et al.*, 2010).

4.4. TONGOD TOURISM MASTER PLAN

The development of tourism industry in Tongod will be more systematic and well-organized with the availability and guidance of a Tongod Tourism Master Plan. Prior to this, a complete inventory for the tourism assets in Tongod should be carried out in order to identify the tourism products that can be introduced and developed.

Zoning is the process of applying different management objectives and regulations to different parts of private lands and permanent forest estates. This basic step of establishing management zones is taken to provide proper recognition and protection for park resources and greatly facilitate their proper administration, including tourism aspects (Kementerian Pembangunan Pelancongan, Alam Sekitar, Sains dan Teknologi Sabah, Malaysia, 1999).

There should be a tourism coordinator in Tongod to coordinate and promote tourism development, and overcome problems that can affect tourism development in Tongod. In the Tongod Tourism Master Plan, there should be strategic planning for short, medium and long term. The Tongod Tourism Master Plan should be revised from time to time to keep abreast with the current situation.

Ideally, ecotourism management plans are developed in a co-ordinated effort by local indigenous residents, park managers, government planners, conservation organizations, commercial entities and expert consultants (Hill, 1994). With this plan, the marketing of tourism products in Tongod can be planned and implemented systematically.

4.5. STRENGTH OF TOURISM DEVELOPMENT IN TONGOD

4.5.1 Administration

There are existing government offices, for example District office, hospital (Figure 13) and Public Defence Department.

4.5.2. Location

Tongod is located in the vicinity of Imbak Canyon, a famous tourist attraction spot and this provides a stepping stone to expand tourism activities in Tongod. Parties responsible for developing tourism in Tongod can establish cooperation with the management authority of Imbak Canyon, Sabah Foundation, by providing tourism packages which include both Imbak Canyon and Tongod. This will bring tourists who are visiting Imbak Canyon to visit interesting places in Tongod. Other natural assets of Tongod, such as the Gunung Tingkar, and Bangkulat waterfall, could attract tourists and help to promote Tongod as a place to visit.

Tongod area could be developed as a potential tourist destination that connects Ranau and Sandakan areas, the two famous regions for eco-tourism in Sabah. The upgrading of gravel road to sealed road from Telupid town to Tongod town, has made the travel between these two towns a lot easier for the local communities and tourists.

4.6. WEAKNESSES OF TOURISM DEVELOPMENT IN TONGOD

4.6.1. Remoteness

Tongod is located in a rural area, 50 km away from Telupid. Due to the distance, tourists who plan to go there must have a certain interest and willingness to explore Tongod because it will take approximately 3 hours by road from Sandakan, the nearest major town, to reach Tongod.

4.6.2. Infrastructure

The main infrastructure is still basic, for example, part of the road which connects Tongod to the other area around it, is still gravelled. The tourism facilities provided are very basic. The accommodation is limited. There is only one small eatery in Tongod. The accommodation becomes the core of tourist activities as they proceed to interact with other services in the area (Cooper *et al*., 1993). The coverage of telecommunication is not comprehensive in Tongod. This gives problem in connecting people or parties who are involved in tourism activities when they are in Tongod (Figure 14).

4.6.3. Publicity and marketing

Tourism in Tongod is not well advertised. There is no news or advertisement on tourism in Tongod in any media, for example newspaper, television or radio.

4.7. SUGGESTIONS ON IMPROVEMENT IN TONGOD TO ENHANCE TOURISM

In order to create a better environment in Tongod, efforts to improve the infrastructure and tourism facilities in Tongod, have to be made.
The suggestions on improving the tourism facilities and services in Tongod are listed below:

4.7.1. Enhance infrastructure and communication development

4.7.1.1. The condition of the road which connects Tongod town with its surrounding should be upgraded. For the time being, there is only a gravelled road that connects these areas (Figure 15). Upgrading the road to paved road will not only bring much comfort to tourists but also will bring many benefits to the local residents in Tongod too.

4.7.1.2. The transportation facilities have to be made readily available. For example, buses especially from Telupid will facilitate tourists and local residents to travel in and out of Tongod.

4.7.1.3. Electricity and clean water supplies must be provided for the comfort of tourists. These are the basic requirements which are important in order to develop an area.

4.7.1.4. A stage for cultural show should be provided for tourists to learn and experience the local culture without having to wait for the actual traditional festivities to be organized. For example, the ceremony practised during a local community's wedding can be demonstrated on the stage.

4.7.1.5. Any plan to build tourism infrastructure or facilities should take into account the safety of visitors and also the environmental condition. For example, it is not advisable to build a jetty at an unsuitable site prone to flood and the need to take extra precaution on buildings situated next to big trees.

4.7.1.6. The nature trail to the Centre of Sabah should have several resting points furnished with hut and toilet.

4.7.2. Upgrade and develop existing facilities

4.7.2.1. Other facilities, such as accommodation (Figure 16), boat services and eateries that support tourism activities need to be upgraded,.

4.7.2.2. Well equipped grocery stores or shops should be provided to tourists and local residents.

4.7.2.3. More manpower for tourism activities, e.g. workers for sanitation services, receptionists, waiters and tour guides should be engaged. This will eventually upgrade the standard of the tourism industry in Tongod.

4.7.2.4. Basic infrastructure and facilities, such as public toilets, trails, jetties, gazebos, changing rooms as well as dustbins should be provided adequately for tourists.

4.7.2.5. Souvenir shops should be opened.

4.7.2.6. A tourism information centre should be set up in Tongod to disseminate information and to promote tourism development in Tongod.

4.7.3. Involvement of local community and other agencies

4.7.3.1. The local residents in Tongod should be involved, and formally trained to contribute to the tourism development in their area. This can be achieved through the school education system and also through various tourism courses for the adults (Figure 17).

4.7.3.2. Organisations in Tongod, such as the Sabah Forestry Department, the Sabah Foundation, the local residents, and other parties should be committed to develop tourism in the Tongod area.

4.7.3.3. Cleanliness should be the main concern and priority for everyone in the tourism industry. The local residents should be educated on the importance of keeping the area clean, as this will have a positive impact on them leading to a healthy lifestyle as well as improving their living standard in Tongod.

4.7.3.4. The relevant authorities who are experienced with the situation in Tongod should promote tourism activities in Tongod.

4.7.4. Human resource development

4.7.4.1. Competent tourist guides will provide better services and interaction with the tourists. Training programmes may be conducted by various governmental and non-governmental, commercial and academic bodies. All training programmes have the same general objectives: improving skills, developing understanding, improving motivation and helping to ensure that limited resources for conservation and enjoyment of the natural environment are used more effectively (Kementerian Pembangunan Pelancongan, Alam Sekitar, Sains dan Teknologi Sabah, Malaysia, 1999).

4.7.4.2. The communication skill among the local residents should be improved, especially in mastering the English language. It is a bonus if they can speak other foreign languages like Japanese and Mandarin. Tourism business will be facilitated with wide knowledge of other languages.

4.7.4.3. The tourist guides, porters and the local residents should have good understanding of cultural disposition among tourists so they can give better services based on the tourist's culture and background.

4.8. SUGGESTIONS FOR PROMOTING TOURISM

In order to introduce tourist attractions in Tongod and to attract more tourists to visit Tongod, the tourism products should be promoted widely. Below are some promotional channels for tourism marketing:

4.8.1. Public sector support

4.8.1.1. Seeking support from relevant parties / agencies, for example from the Federal and state Ministries of Tourism, Sabah Forestry Department and other relevant tourism agencies.

4.8.1.2. Organizing activities related to tourism promotion, such as Tongod Jogathon.

4.8.1.3. Placing signboards at strategic locations to advertise interesting tourist spots in Tongod.

4.8.1.4. Setting up of Tongod tourism promotion team. The purpose of this team is to promote tourism in Tongod. In addition, the team could participate in various tourism programmes. As an example, the Tongod tourism promotional team could participate in the Sabah state level Harvest Festival. The tourism management team of Tongod can cooperate with the Sabah Foundation that manages Imbak Canyon. The cooperation can help to promote Tongod besides Imbak Canyon (Figure 18).

4.8.2. News and media

4.8.2.1. The media, such as the internet (with websites promoting Tongod), television and radio should be fully made use of. The advancement in information technology has contributed positively to the tourism sector in Malaysia. By surfing the internet, information on various exciting tourism activities are accessible easily and fast. Indirectly, it can influence the needs and choice of tourists.

4.8.2.2. Articles on the interesting tourist spots in Tongod can be sent to the newspaper or magazine for dissemination of information.

4.8.2.3. Books related with tourism in Tongod can be published.

4.8.2.4. Attractive and mesmerizing photos of Tongod can be used as postcards.

4.8.2.5. Brochures on Tongod, to be given to the tourism ministry, tourism agencies, hotels, airports, and other tourism centres. They can also be sent to other countries. The brochures may contain the following information;

i. Places of attraction in Tongod
ii. Accommodation, transportation and facilities provided in Tongod

iii. Maps
iv. Price of tours
v. Contact number / contact person / information centre
vi. Information on how to get to Tongod
vii. Travelling tips
viii. The do's and don'ts, including the local taboos.
ix. Attractive photos of Tongod.

4.8.2.6. Tourism theme: Conservation including heart of Sabah, can be used to attract tourists to Tongod. Slogan can be used as a means of attraction, for example; Tongod, The Centre of Sabah or Heart of the Land Below the Wind. This type of tourism promotion will help to increase the value in promoting tourism in Tongod.

4.9. ADDITIONAL SUGGESTIONS ON TOURISM DEVELOPMENT IN TONGOD

4.9.1. Local Rules and Regulations

4.9.1.1. Rules and regulations should be enforced and should be always updated. For example, business license, guide license, tourist operator license and other relevant permit / licenses.

4.9.1.2. Land title and ownership need to be identified. Land issues should be settled before starting any development on the site. If the site belongs to any parties, such as the forest reserves under the control of Sabah Forestry Department, a permit should be obtained from the department before starting any development within the forest reserve.

4.9.2. Public sector support

4.9.2.1. Effort should be made to obtain financial resources for the development of tourism in Tongod. Financial support can be sought from the government and local or foreign investors.

4.9.2.2. To develop tourism infrastructure and facilities in Tongod, support from the government, such as Tongod Assemblyman, Member of Parliament, local leaders and agencies related to the tourism development is essential.

4.9.2.3. To gain more information on Tongod, more research on eco-tourism should be conducted in Tongod, as well as research in applied and social sciences. This can be achieved by inviting agencies or related parties, such as Universiti Malaysia Sabah, Forest Research Centre of Sabah Forestry Department, Ministry of Tourism and others.

4.9.2.4. The mentality of the locals has to be changed and broadened towards a tourism mentality through education, especially among the youths in Tongod. Education encourages development of human propensity to continuously invent, promotes innovation and co-operation as well as encourages dissemination of knowledge throughout the organization.

4.9.2.5. There must be a suitable package to offer tourists visiting Tongod, with appropriate number of days and activities spent in Tongod, so that the tourists will enjoy and appreciate their stay in Tongod.

4.9.2.6. Tourist's religions need to be taken into consideration. Surau, chapel and temple should be built for the convenience of the tourists.

4.9.2.7. Rich wildlife is found within forest reserves. The flora and fauna have the potential to be eco-tourist attractions. In addition, environmental education and *in-situ* conservation can be practised (Hassan, 2008). Hunting activities must be limited. The locals are only allowed to hunt a small number of animals for food; this is to prevent the deterioration of the breeding populations of any fauna in the forest. Some of the examples are the threatened species of fauna, such as Orang Utan, elephant, deer and others.

4.9.2.8. Observation tower cum security surveillance tower can be built for tourism purpose.

4.9.2.9. Tourists going to the Centre of Sabah should be provided with relevant information.

4.9.2.10. Facilities, such as toilets, changing rooms, gazebos should be provided at the Bangkulat waterfall.

4.9.2.11. Signboards showing directions to Tongod, should be erected at strategic locations to guide tourists to get to Tongod.

4.9.2.12. Signboards showing tourism activities in Tongod have to be placed at strategic locations, for example at airports.

4.9.2.13. More dustbins should be placed at strategic locations to minimise littering (Figure 19).

4.9.2.14. An expert that has calibre, wide experience and knowledge in tourism can be hired as tourism manager and planner in Tongod with the help of others from government and private agencies and local representatives.

4.9.3. Environmental impact

4.9.3.1. Change of ecosystem will definitely occur due to the development of tourism. For example, the building of a cottage needs clearance, including cutting of plants and bushes. Guidelines must be followed to minimize the impact to the ecosystem. Each ecosystem is unique and appropriate measures should be taken to suit the business requirement and environmental needs. Minimizing the environmental impacts will lead to reduces damages to the ecosystem (Kementerian Pembangunan Pelancongan Alam Sekitar, Sains dan Teknologi Sabah, Malaysia – 1999).

4.9.3.2. Effort should be made to work in harmony with nature by minimizing impact on the existing natural state as much as possible (Abdul Wahed, 2009). Environmental Impact Assesment (EIA) should be conducted.

4.9.4. Community and private sector participation

4.9.4.1. Halal food and beverages need to be made available to Muslim tourists. Unique local food should be featured as one of the tourism products. When it comes to traditional food, Sabah has many simple yet delicious dishes which are mainly pickled or preserved, due to the absence of refrigerators and gas kitchens until recently. Nonetheless, traditional cuisine continues to be favoured by the younger generations. For visitors, a trip to Sabah will not be complete without sampling the traditional Sabahan dishes, for example, Bambangan, Hinava, Tuhau and Bosou (Leong, 2012).

4.9.4.2. Services offered to tourists should be friendly and any actions that can hurt the feeling of any tourist should be avoided.

4.9.4.3. Vandalism must be avoided because it will be costly to rebuild or clean up the assets which have been vandalised and it will give a negative image on the local residents. Visitors and local residents should not disturb any plants or animals and avoid writing graffiti, carving initials or otherwise vandalizing rock surface, trees or park facilities. To prevent vandalism at tourist spots, 24 hours security surveillance should be conducted either by having a contract with a security company or using the existing manpower from the place, for example, at the Gunung Tingkar waterfall recreational station, the Forestry Department should assign its staff to carry out work related to tourism and at the same time to help in the security surveillance of the place (Figure 20).

4.9.4.4. Shifting cultivation by the local resident should be controlled to prevent damages to the forest. Zoning system can be implemented in Tongod and particular zones can be used for specific purposes.

4.9.4.5. The ‘Tagal’ system can be implemented in a suitable river, in order to provide fish for the local and also to attract tourists. One example of the success of the ‘Tagal’ system is at the village of Luanti in Ranau.

4.9.4.6. Forest surveillance team has to be formed to monitor the forest area. This is to ensure that illegal activities, such as forest encroachment, forest open burning and illegal hunting can be eradicated.

4.9.4.7. To carry out business activity in the tourism sector, the villagers in Tongod District, for example, Imbak village, can set up a cooperative. With this cooperative, they can apply for loan or financial assistance from related parties, such as the Ministry of Tourism, as this is for the purpose of financing the development activities that are planned by the cooperative. Next, the local residents can play their role through the cooperative by contributing their ideas and support for tourism development in Tongod. Besides that, the cooperative can carry out other activities which can generate income to its members, for example by producing local handicrafts for sale. In addition, any suggestions or ideas can be discussed among the cooperative members to find the best option. By participating in the cooperative, members can also learn more about the tourism activities in Tongod.

4.9.4.8. The villagers in Tongod District can support the tourism development programme in Tongod District area by doing some small scale or medium scale businesses to help diversify tourism activities in Tongod, such as honeybee farming, planting of herbal plants, local fruit farming and other related businesses. In Sabah, honeybee farming is still rare in spite of the availability of experience and skill as well as the suitable environment for producing this product. Apart from the nutrition value of honey for promoting good health, honeybee farming could also help in the pollination of crops. Honeybee is one of the best pollination agents. Many plants in Sabah have been reported to have medicinal values, but only a small number are planted and have undergone scientific research (Yaacob *et al*., 2011).

4.9.4.9. The villagers in Tongod District area who are interested to venture into tourism businesses, could organize study field trips to the tourism sites that are well established. This enables the participants to study, experience and learn the practices and adapt them for use in Tongod.

5. CONCLUSIONS

Tourism development in Tongod requires a careful planning approach supported with natural and cultural tourism products. The tourism development process should be monitored thoroughly with harmonious and active participation of the local communities, the public and private sectors. Co-operation of all stakeholders is crucial for the development of the tourism sector in Tongod. Sustainable funding should also be secured along with the effort to promote tourism in Tongod. Tourism development may become one of the sustainable economic activities for the people in Tongod who are presently very much depending on agricultural activities, such as oil palm and rubber cultivations.

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Figure 3: Discussion with villagers from Kg. Imbak about tourism potential in Tongod.

Figure 4: Discussion about the tourism potential in Tongod with the District Forestry Officer of Tongod,

Figure 5: Gunung Tingkar Forest Reserve.

Figure 6: The heart of Sabah monument.

Figure 7: Majestic view at the Centre of Sabah.

Figure 8: Beautiful Bangkulat waterfall.

Figure 9: Orang-utan nest that proved the presence of Orang-utan in the Tongod forest.

Figure 10: Traditional custom of the Makiang ethnic from Tongod Sabah (http://maruwiah.com/2012/06/10/pakaian-tradisional-etnik-etnik-di-sabah/makiang-tongod/).

Figure 11: Bakong Memorial.

Figure 12: Local market in Tongod.

Figure 13: Tongod Hospital.

Figure 14: The construction of a telecomunication tower at Tongod.

Figure 15: Road condition (gravelled) in Tongod has to be upgraded to ease the journey around Tongod.

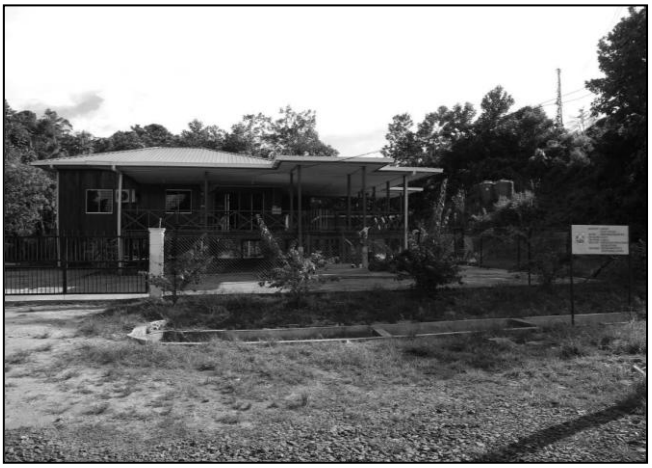

Figure 16: Government rest house in Tongod.

Figure 17: Pupils learning at SK Pekan Tongod. Education is a vital tool to improve the community's perception towards tourism.

Figure 18: The construction of Sabah Foundation guide and porter house in Kampung Imbak, Tongod.

Figure 19: Rubbish bins should be provided.

Figure 20: Forestry recreational site at Gunung Tingkar Tongod.

PAPER 5: 2

QUANTIFICATION AND ECONOMIC VALUATION OF CARBON STOCK IN THE MATANG MANGROVE FOREST RESERVE IN PERAK

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ABSTRACT

A better understanding of the valuation of environmental resources such as carbon storage in the Matang Mangrove Forest Reserve will lead to good management practices and generate revenue for the economy. Having a complete data of forest structure through forest inventory is essential in estimating forest productivity especially in quantifying biomass production and carbon stock. For the quantification of carbon stock, forest inventory and harvesting, measuring, weighing as well as sampling of trees were conducted in Compartment 37, Pulau Sangga Besar Forest Reserve within the Kuala Sepetang range and Compartment 69, Pulau Trong Selatan Forest Reserve within the Kuala Trong range. Meanwhile, work on drying, grinding and analysis of samples collected from the field were conducted in the laboratory. *Rhizophora apiculata*, *Bruguiera parviflora*, *Rhizophora mucronata*, *Bruguiera gymnorrhiza* and *Xylocarpus moluccensis* are the five (5) species of trees found in these two (2) plots of 1 ha each. Total standing biomass production was estimated using the locally established equations through destructive sampling measurements. The Kuala Sepetang and Kuala Trong Mangrove Forest Reserve store an average total of 154.78 t C ha-¹ or 567.53 tCO² ha-¹. Based on the estimated amount and price of carbon at RM48.30, the economic value of carbon is RM7,475.87 per ha. The estimated value of CO² is RM12,485.66 per ha using the Carbon TradeXchange Golden Standard CER trading price of RM22.00.

1. INTRODUCTION

A carbon dioxide (CO^2) sink is a carbon reservoir that is increasing in size, and is the opposite of a carbon dioxide "source". The main natural sinks are (1) the oceans and (2) plants and other organisms that use photosynthesis to remove carbon from the atmosphere by incorporating it into biomass and release oxygen into the atmosphere. This concept of CO² sinks has become more widely known because the Kyoto Protocol allows the use of carbon dioxide sinks as a form of carbon offset.

Carbon sequestration is the term describing processes that remove carbon dioxide from the atmosphere. To help mitigate global warming, a variety of means of artificially capturing and storing carbon as well as of enhancing natural sequestration processes are being explored. CO² is incorporated into forests and forest soils by trees and other plants. Through photosynthesis, plants absorb carbon dioxide from the atmosphere; store the carbon in sugars, starch and cellulose, and release the oxygen into the atmosphere. However, the patterns of carbon storage, which we really didn't know before, depend on climate, soil, topography and the history of human or natural disturbance of the forests.

Forests store large amounts of carbon in the wood and roots of their trees. In the tropic, the rainforests prominently function as bedrock in ameliorating and maintaining global climate change by reducing the accumulation of greenhouse gases (Shukla *et al*., 1990). However, they are fragile habitats and being destroyed at unprecedented rates through deforestation. Deforestation has been blamed as one of the main agents for the increasing of global warming, deteriorating site quality, alteration of carbon stocks, and losses of biodiversity. This drastic removal of biomass may have implications on the regional climate, biodiversity, the global carbon cycle and the large scale of atmospheric circulation. Deforestation and forest degradation contribute about 15% to 20% of global carbon emissions, and most of that contribution comes from tropical regions.

Previous studies had estimated the carbon stored in forests on local and large scales within a single continent, but no systematic way of looking at all tropical forests existed. Scientists typically use a ground-based technique (tree census) to measure the size of the trees, which gives a good estimate of how much carbon they contain. The estimation of the carbon storage or stocks mostly comes from the biomass estimation of the forests.

Recently, biomass and carbon sequestration function of forests is of great concern due to the global warming phenomenon, and hence managing forests with a proper system would play a vital role in mitigating global warming in the future. Estimation of biomass in stands provides the basic data for forest ecosystem management. Research on biomass not only focuses on trees, but it also extends to other strata, such as understory vegetation, the litter layer, and soils, which can affect nutrient cycling (André and Ponette, 2003; Huet *et al*., 2004; Ponette *et al*., 2001). From this, scientists can estimate the total of carbon pool from different land cover types.

From the total ecosystem carbon pools (aboveground and belowground) worldwide, the mangrove carbon pools are the highest of any other major land cover types. Ecosystem carbon pools of mangrove in Indo-Pacific region are more than double those of most upland tropical and temperate forests (Donato *et al*., 2012; Kauffman *et al*., 2011; Laffoley and Grimsditch, 2009). The great proportion of this pool is in belowground area which is highly susceptible for releasing substantial amount of greenhouse gases if disturbed by land-use or climate change.

The carbon numbers, along with information about the uncertainty of the measurements, are important for countries planning to participate in the Reducing Emissions from Deforestation and Degradation (REDD+) program. REDD+ is an international effort to create a financial value for the carbon stored in forests including mangrove forest. It offers incentives for countries to preserve their forestland in the interest of reducing carbon emissions and investing in low-carbon paths of development.

Mangrove forests are keystone for coastal ecosystems serving numerous environmental services and ecological functions. Mangrove forests are also among the major carbon sinks of the tropics (Bouillon *et al*., 2008; Cahoon *et al*., 2003). The published data on biomass production of mangrove forests in Malaysia were done by Gong and Ong (1990) and Putz and Chan (1986) on *Rhizophora apiculata* and by Juliana and Nizam (2004) on *Rhizophora mucronata*. Those studies were carried out in Larut Matang Forest Reserve but none of them include carbon measurement.

Hence, this study is carried out to quantify the aboveground carbon stock by determining the aboveground biomass production and other necromass in a mature age of mangrove forest in Kuala Sepetang and Kuala Trong Forest Reserves, as well as valuing the economic potential of the carbon stock.

2. OBJECTIVES

The documentation of the quantity and economic value of carbon stock relied on two main objectives in order for this research to be completed:

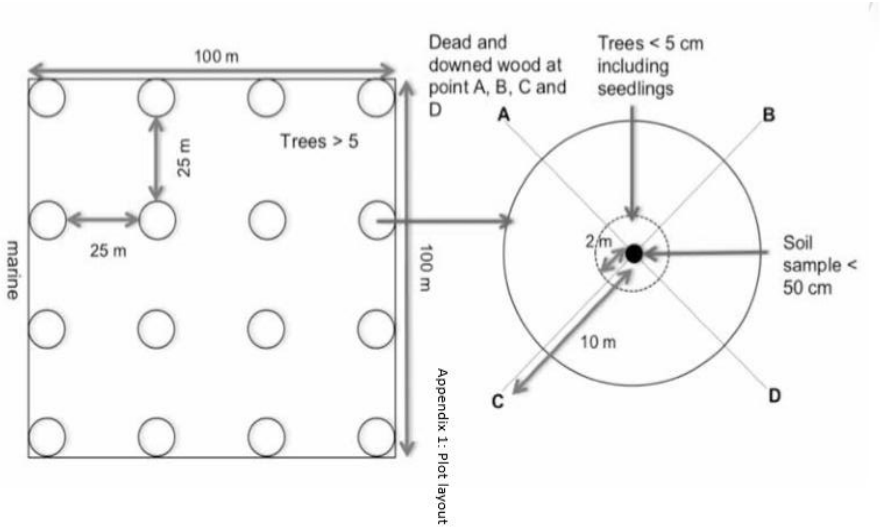
i. To determine the carbon stock of mangrove forest aged over 30 year-old by estimating biomass production and assessing carbon content of every aboveground component.
ii. To assess the economic value of aboveground carbon stock derived from the above objective.

3. MATERIALS AND METHODS

3.1 Study area

Study areas are identified in two locations, Compartment 37 Pulau Sangga Besar Permanent Forest Reserve and Compartment 69, Pulau Trong Selatan Permanent Forest Reserve. Both study areas represent mixed mangrove species stands. Since biomass and carbon are being assessed, similar stand age at 30 year-old was selected in order to reduce spatial variability and also to better estimate the carbon stock and value the economic potential.

3.2 Plot setting and census



3.2.1 Trees

One hectare plot was established at each range of Kuala Sepetang in Pulau Sangga Besar Permanent Forest Reserve and Kuala Trong in Pulau Trong Selatan Permanent Forest Reserve. Stem diameter at breast height (D; 1.3 above grounds or just above the highest stilt root especially *Rhizophora* spp.) and tree height (H) of all trees with diameter >5 cm in the plots were measured to evaluate tree growth characteristics and to estimate the total stand biomass. Only big tree a measures as smaller trees often constitute a relatively insignificant proportion of total ecosystem carbon stocks (Cummings *et al*., 2002). However, to maximize sampling efficiency, smaller trees were also measured in smaller nested subplots. Dead and standing trees were also measured.

3.2.2 Shrubs and dwarf mangroves

Small plots with 2-m radius, circle plots were established in a nested plot design. An average of dry mass per seedling/sapling/dwarf/shrubs was utilized to determine plot-level biomass. About 5 to 10 samples were collected in small plots and oven dried to obtain dry mass. Samples biomass was then calculated as the product of sample density multiplied by average mass.

3.2.3 Dead and downed wood

These components can be a significant component of aboveground biomass. A series of a vertical sampling plane (transect) was established to measure this component. Any downed dead woody materials such as detached trunk, branches, prop roots or stem of trees and shrubs that have fallen and lies within 2 m of the ground surface were measured using the non-destructive line intersect technique (Waddell, 2002).

3.2.4 Litter

Litter in most biomass studies was destructively sampled through collection from microplots. A common microplot sized 50 X 50 cm was used. The samples were collected and mixed in a bag, and wet weight was determined in the field. The subsamples were extracted and dried to a constant weight in the laboratory. The ratio between the wet and dry mass of the subsample was determined. Whole litter samples were then calculated by multiplying with the ratio value obtained.

3.2.5 Soil

Soil samples were also taken for preliminary assessment of carbon in the laboratory. Carbon assessment of this forest will follow the upland forests, which have limited sampling to the top 30 cm even though the best sampling depth for mangrove area is up to 2 m. However, the data may provide useful information in mangrove forest management perspective.

4. RESULTS AND DISCUSSION

4.1 Tree census above 5 cm diameter

Table 1 shows the descriptive statistics of tree inventory carried out in Kuala Sepatang and Kuala Trong for trees with diameter above 5 cm. The diameter measurement was taken at 1.3 m above the ground (DBH) or 30 cm above the highest stilt roots. The total of five species were found in both study plots with only one individual of *Xylocarpus moluccensis* was found in Kuala Trong study plot. The total number of trees (stems) in both study plots was 1802 and 1084 respectively. Trees with multiple leaders were also included. *Rhizophora apiculata* species dominated the area with a total number of trees of 1073 and 1072 in Kuala Sepetang and Kuala Trong plots respectively.

Table 1: Summary of descriptive statistic for both study areas for trees above 5 cm dbh.

			DBH (cm)		Height (m)		Count	
Species	**DBH (cm)**	**Height (m)**	**Min**	**Max**	**Min**	**Max**	**DBH**	**Height**
KUALA SEPETANG								
Bruguiera gymnorrhiza	11.95±0.88	8.57±0.52	6	20	4	14.1	26	26
Bruguiera parviflora	7.73±0.16	7.38±0.09	3.6	28.9	3	20.84	544	544
Rhizophora apiculata	14.90±0.15	11.25±0.09	4.1	28.6	2	21.77	1073	1073
Rhizophora mucronata	16.28±0.28	12.28±0.24	5.8	30.9	2	23.85	159	159
KUALA TRONG								
Bruguiera gymnorrhiza	8.80±1.27	8.45±1.00	5.3	16.2	5	13	11	11
Rhizophora apiculata	18.43±0.19	12.81±0.09	5	35.3	2	24.8	1072	1072
Xylocarpus moluccensis	5.2	4.5					1	1

Note: 1. ± represents standard error.
2. the minimum value for *Bruguiera parviflora* and *Rhizophora apiculata* below 5 cm diameter due to the data taken from multiple leader trees.

4.2 Tree census below than 5 cm diameter

Sixteen subplots with a total area of 200.96 m² were established in 1 ha study plot in both Kuala Sepetang and Kuala Trong areas. Shrubs, dwarf mangroves (including saplings and seedlings) measuring below than 5 cm diameter were measured. These subplots were separated about 25 m each other from the radius center. The results were summarized in Table 2. Trees below 5 cm were dominated by *Bruguiera parvifolia*, followed by *Rhizophora apiculata*, *Rhizophora mucronata* and *Bruguiera gymnorrhiza* in Compartment 37, Kuala Sepetang, totaling 237 individuals. Meanwhile, only 22 individuals from two species were found subplots established in Kuala Trong.

Based on the results, we estimated about 11,793 and 1,095 individuals comprising mostly saplings and seedlings in a hectare in both Kuala Sepetang and Kuala Trong. The huge difference in the number of individuals between these two areas might be due to tree density. Kuala Sepetang was more dense with 1,802 trees (stems) compared to Kuala Trong with 1,084 trees (stems).

The mean of DBH and height of mangrove trees in Kuala Sepetang plot ranged from 7.73 cm to 16.28 cm and 7.38 m to 12.28 m, respectively, these mean values ranged from 5.2 cm to 18.43 cm and 4.5 m to 12.81 m in Kuala Trong plot. However, the minimum values given in Table 1 were below 5 cm for *Bruguiera parviflora* and *Rhizophora apiculata* since stems with multiple leaders were included in the measurement.

Table 2: Summary of descriptive statistic for both study areas for trees below 5 cm diameter in 16 two-meter-radius subplots.

			Diam (cm)		Height (m)		Count	
Species	Diam (cm)	Height (m)	Min	Max	Min	Max	Diam	Height
			KUALA SEPETANG					
Bruguiera gymnorrhiza	2.13±0.14	2.69±0.37	0.5	4.1	0.5	11	39	39
Bruguiera parviflora	2.54±0.11	4.58±0.23	0.3	4.8	0.5	12	103	103
Rhizophora apiculata	1.76±0.09	2.46±0.21	0.3	4.1	0.8	8	54	54
Rhizophora mucronata	2.53±0.11	3.11±0.19	1.1	4.5	0.7	5.1	40	40
Xylocarpus granatum	3.9	4.2					1	1
			KUALA TRONG					
Bruguiera gymnorrhiza	0.3	0.3					1	1
Rhizophora apiculata	0.61±0.18	0.64±0.17	0.2	2.8	0.15	3	21	21

4.3.1 Biomass proportion

Table 3 shows the biomass values measured destructively in both sites. Total aboveground biomass for selected trees (N=30) ranged from 23.37 kg to 523.98 kg and 11.95 kg to 1069.94 kg in Kuala Sepetang and Kuala Trong sampling plots respectively. The biomass storage in different tree components of mixed mangrove species calculated from destructive sampling measurement from both sites is shown in Figure 1. The proportion of stem and branch biomass was higher in Kuala Trong compared to Kuala Sepetang except for leaf biomass. The values contributed to the total aboveground biomass in the order of stem>branch>leaf.

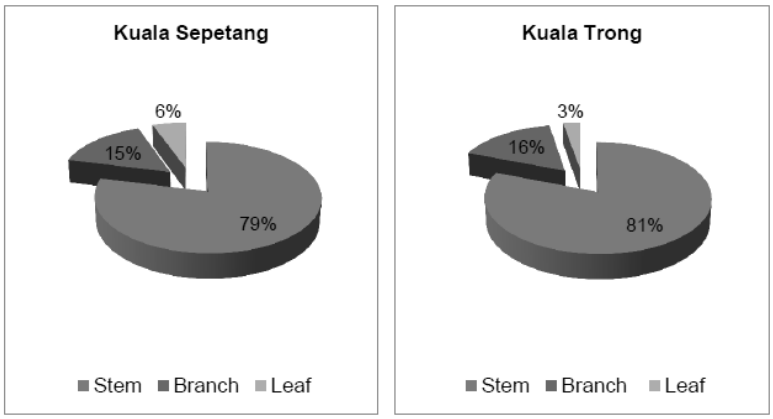
Table 3: Biomass values for each tree component and total aboveground measured in both sites.

No	Species	Height (m)	DBH (cm)	Stem Biomass (kg)	Branch Biomass (kg)	Leaf Biomass (kg)	Total Aboveground Biomass (kg)
				Kuala Sepetang			
1	*RM*	13.2	10.1	47.69	5.99	1.67	55.35
2	*RM*	15.3	12	71.93	6.10	2.99	81.02
3	*BP*	10.2	6.4	22.6	1.68	0.59	24.87
4	*RA*	9.2	6.8	17.51	4.20	1.65	23.37
5	*RA*	11.5	7.9	31.77	6.50	1.75	40.02
6	*RM*	9.65	6.6	24.76	1.66	1.18	27.60
7	*RA*	17.1	12.8	104.02	10.35	3.93	118.30
8	*RA*	19.52	15.8	150.61	25.87	14.45	190.93
9	*RA*	20	17.3	190.56	31.03	17.01	238.60
10	*BP*	16.8	16.2	143.67	33.03	12.45	189.15
11	*RM*	18.1	16.8	146.26	25.61	6.24	178.11
12	*RA*	19.9	20.2	281.79	55.03	21.23	358.04
13	*RA*	22.7	22	381.59	105.00	36.09	522.68
14	*RA*	24.3	21	319.89	76.88	28.35	425.12
15	*RA*	24.2	23.5	432.06	75.60	16.32	523.98

No	Species	Height (m)	DBH (cm)	Stem Biomass (kg)	Branch Biomass (kg)	Leaf Biomass (kg)	Total Aboveground Biomass (kg)
				Kuala Trong			
1	*RA*	25.6	22.3	238.62	41.44	2.59	282.65
2	*RA*	24.6	18.1	184.8	34.41	1.03	35.44
3	*RA*	26.3	20.1	261.97	35.37	3.43	300.77
4	*RA*	6.65	5.1	6.64	3.34	1.96	11.95
5	*RA*	25.8	27.1	505.7	146.34	26.79	678.83
6	*RA*	12.4	8.4	27.3	10.08	3.74	41.13
7	*RA*	25.45	17.6	204.02	19.27	1.19	224.48
8	*RA*	27.4	19.3	274.05	25.88	3.43	303.36
9	*RA*	22.1	16.9	169.06	24.30	3.20	196.56
10	*BP*	12.7	9.2	38.89	6.95	3.50	49.34
11	*BP*	16.7	10	59.76	6.71	3.51	69.98
12	*RA*	29.3	35	785.14	240.61	44.19	1069.94
13	*RA*	19.85	14.5	147.35	17.15	5.84	170.34
14	*RA*	18.75	10.5	80.52	11.52	3.63	95.67
15	*RA*	29.3	24	463.89	70.16	9.28	543.33

Note: *RA - Rhizophora apiculata, RM - Rhizophora mucronata, BP - Bruguirea parviflora*

Figure 1: Biomass proportion calculated in both sites.



4.3.2 Allometric equations

Allometric equations were derived from analyses of the regression between tree growth parameters and tree biomass components. The relationships between these parameters were illustrated in Figure 2 and 3, and were regressed using power function to fit the values based on two models, i.e. D and D^2H. Coefficient of determination (R^2) ranged between 0.9035 to 0.9862 for model using D and 0.8979 to 0.988 for model using D^2H recorded in Kuala Sepetang. Meanwhile R^2 values ranged between 0.2656 to 0.9862 for model using D and 0.2145 to 0.988 for model using D^2H recorded in Kuala Trong. Lower values of this coefficient were recorded for leaf biomass especially in Kuala Trong showing that stand density plays an important role in biomass allocation. However, each formulation was well fitted and the model using D was generally found to be a better model for estimating aboveground biomass.

Figure 2: Comparison between using D and D2H in determining the biomass equations for different tree components in Kuala Sepetang.

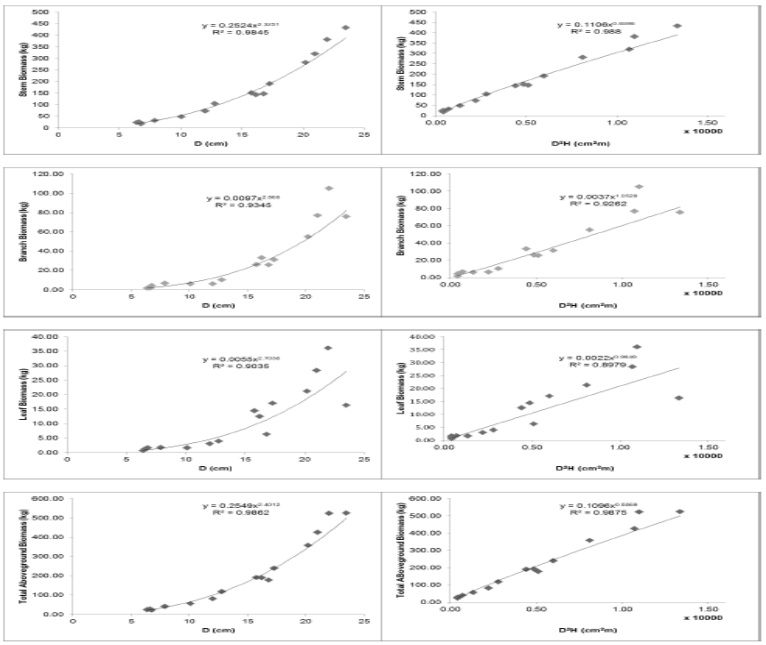
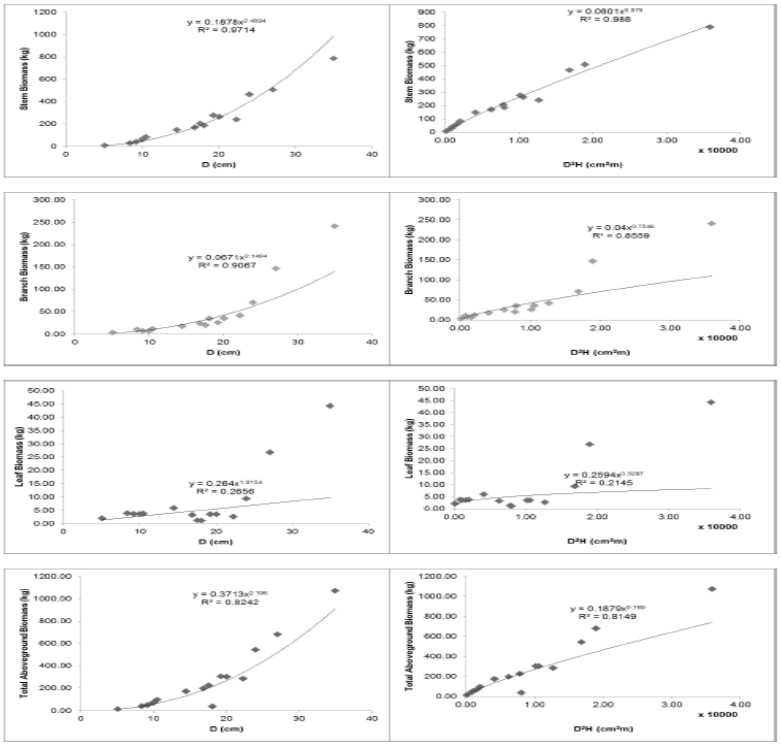
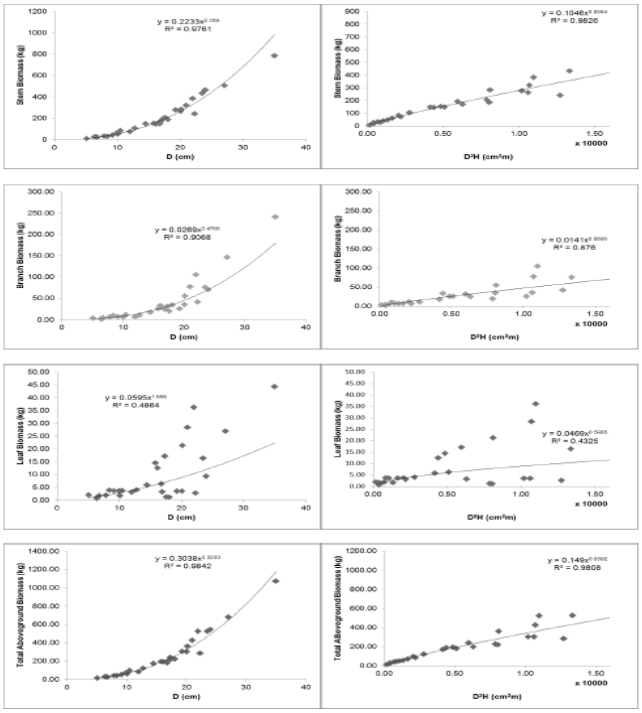


Figure 3: Comparison between using D and D2H in determining the biomass equations for different tree components in Kuala Trong.



The generic equations combining sampled trees (N=30) in both sites were also developed for better estimation of aboveground biomass in Larut Matang area (Figure 4). The highest coefficient of determination (0.9842) was found for model using total aboveground biomass and DBH (D).

Figure 4: Generic equations derived from combined data of Kuala Sepetang and Kuala Trong.



4.3.3 Tree biomass production and tree carbon stock

Tree components biomass was calculated from established allometric equations using D based on the inventory data (trees >5 cm diameter). These values were then summed to determine the total standing aboveground biomass (Model A). Total standing aboveground biomass was also estimated directly from total allometric equations (Model B) and combined equations (Model C). Total aboveground biomass was found to be higher in Kuala Trong compared to Kuala Sepetang when estimated using tree component equations (Model A) and combined equations (Model C) but the values were about similar when total aboveground equations were used (Table 4).

Table 4: Tree component and total aboveground biomass production in Kuala Sepetang and Kuala Trong using parameter DBH (D).

Component	Kuala Sepetang			Kuala Trong		
	Mass (t ha^{-1})	CC (%)	CS (t ha^{-1})	Mass (t ha^{-1})	CC (%)	CS (t ha^{-1})
Trees > 5 cm						
Stem (1)	223.11	55.25	123.27	269.85	53.49	144.34
Branch (2)	40.00	45.29	18.11	43.23	46.23	19.99
Leaf (3)	14.28	46.70	6.67	5.49	45.14	2.48
(A) Total aboveground (1+2+3)	**277.39**	-	**148.05**	**318.57**	-	**166.81**
(B) Total aboveground	**279.53**	49.08[a]	**137.19**	**276.13**	48.29[a]	**133.33**
(C) Total aboveground	**267.18**	48.68[b]	**130.06**	**334.54**	48.68[b]	**162.85**
Trees < 5 cm	**18.36**	47.21	**8.67**	**1.70**	45.33	**0.77**

Note: Values of (A) calculated from component biomass equations (1, 2 and 3), (B) values calculated directly from total aboveground biomass equations (Figure 5 and 6), and (C) values calculated from total aboveground biomass using combined equation. CC – carbon content where [a] was an average of CC of (1), (2) and (3), and [b] was an average of all CC obtained for all sampled trees, CS – carbon storage.

4.4 Dead and downed wood

Tables 5 and 6 show data of dead and downed wood collected in 200.96 m2 of total subplot area (16 subplots) in both study sites. The total dead and downed wood was found to be higher in Kuala Sepetang plot (8.46 t ha-1) compared to Kuala Trong plot (5.74 t ha-1). These results concerned with the results obtained for tree density. The value of carbon content of dead and downed woody ranged from 43.34% to 49.44% and 43.44% to 49.24% with an average of 46.25% and 46.52% in Kuala Sepetang and Kuala Trong, respectively. These values made up the carbon storage in dead and downed woody with a total of 4.04 t C ha-1 and 2.68 t C ha-1 in Kuala Sepetang and Kuala Trong, respectively.

Table 5: Total dry weight and carbon storage of dead and downed wood obtained in Compartment 37 Kuala Sepetang.

No. of Plot	Dead and downed woody										
	Point				SFW (g)	SDW (g)	TFW (kg)	TDW (kg)	Total (kg ha^{-1})	C content (%)	C Stock (kg ha^{-1})
	A	B	C	D							
1	3.00	2.50	2.00	4.45	170.00	66.80	11.95	4.70	233.66	45.94	107.33
2	1.00	4.25	1.50	2.50	110.00	42.65	9.25	3.59	178.47	45.44	81.09
3	1.50	2.50	1.50	2.75	180.00	82.20	8.25	3.77	187.48	45.24	84.81
4	0.50	60.50	2.00	1.00	210.00	147.05	64.00	44.82	2230.06	49.44	1102.43
5	2.00	51.50	5.65	0.46	160.00	108.80	59.61	40.53	2017.06	48.84	985.03
6	0.29	4.50	2.00	1.16	150.00	36.05	7.95	1.91	95.08	45.54	43.29
7	13.50	0.14	2.60	7.20	140.00	74.45	23.44	12.46	620.14	47.84	296.64
8	5.50	10.00	1.00	12.50	110.00	49.05	29.00	12.93	643.48	46.44	298.80
9	2.00	6.00	5.50	1.00	140.00	90.60	14.50	9.38	466.94	48.24	225.23
10	2.50	2.00	3.00	3.00	190.00	90.75	10.50	5.02	249.56	48.64	121.37
11	3.00	3.70	2.50	3.00	250.00	63.80	12.20	3.11	154.93	44.84	69.46
12	2.00	1.50	2.50	6.00	150.00	39.20	12.00	3.14	156.05	43.94	68.56
13	1.50	2.50	0.45	0.30	110.00	45.45	4.75	1.96	97.66	43.34	42.32
14	10.00	1.00	2.50	0.50	130.00	87.50	14.00	9.42	468.90	47.24	221.48
15	4.00	2.50	3.50	3.50	160.00	75.15	13.50	6.34	315.52	45.04	142.09
16	7.00	5.50	1.00	2.50	140.00	60.30	16.00	6.89	342.93	44.14	151.35
						TOTAL		169.97	8457.91		4041.30

Note: TFW-Total fresh weight, TDW-Total dry weight, SFW-Sample fresh weight, SDW-Sample dry weight

Table 6: Total dry weight and carbon storage of dead and downed wood obtained in Compartment 69 Kuala Trong.

No. of Plot	Dead and downed woody										
	Point				SFW (g)	SDW (g)	TFW (kg)	TDW (kg)	Total (kg ha^{-1})	C content (%)	C Stock (kg ha^{-1})
	A	B	C	D							
1	1.50	1.00	4.00	2.50	110.00	63.70	9.00	5.21	259.35	47.34	122.76
2	2.00	4.50	0.50	7.00	140.00	74.15	14.00	7.42	368.98	49.24	181.67
3	9.50	6.00	2.50	0.19	190.00	70.85	18.19	6.78	337.53	45.34	153.02
4	2.50	3.00	1.50	1.00	150.00	73.25	8.00	3.91	194.40	46.64	90.66
5	5.00	2.50	3.50	8.00	140.00	73.45	19.00	9.97	496.03	47.44	235.29
6	5.00	2.00	2.50	6.50	150.00	60.80	16.00	6.49	322.72	47.04	151.79
7	3.00	5.00	2.00	3.50	210.00	79.25	13.50	5.09	253.52	46.74	118.48
8	3.50	6.00	3.50	7.00	120.00	37.50	20.00	6.25	311.01	47.54	147.84
9	3.50	10.00	3.00	18.00	160.00	86.90	34.50	18.74	932.42	44.74	417.12
10	1.50	0.50	0.00	5.00	150.00	58.40	7.00	2.73	135.62	45.84	62.16
11	4.00	5.00	3.50	4.00	150.00	64.05	16.50	7.05	350.59	45.94	161.04
12	6.00	8.00	16.00	0.50	160.00	62.25	30.50	11.87	590.49	47.64	281.28
13	2.50	1.00	0.00	0.00	150.00	30.30	3.50	0.71	35.18	43.44	15.28
14	3.50	5.00	7.00	4.50	150.00	65.05	20.00	8.67	431.60	45.64	196.96
15	3.00	7.00	5.00	5.50	150.00	80.95	20.50	11.06	550.52	48.24	265.54
16	3.50	0.30	3.00	1.50	150.00	62.45	8.30	3.46	171.95	45.64	78.47
						TOTAL			5741.88		2679.37

Note: TFW-Total fresh weight, TDW-Total dry weight, SFW-Sample fresh weight, SDW-Sample dry weight

4.5 Litter

Tables 7 and 8 show data of litter collected in 200.96 m2 of total subplot area (16 subplots) in both study sites. Total dry weight per hectare for each subplot ranged from 8.96 kg to 63.07 and 21.80 kg to 56.22 kg in Kuala Sepetang and Kuala Trong respectively. The overall total of dry weight was found slightly higher in Kuala Trong (0.57 t ha-1) compared to Kuala Sepetang (0.5 t ha-1). For carbon content, the values were found ranging from 34.74% to 48.04% in Kuala Sepetang and 40.04% to 47.54% in Kuala Trong. The total carbon stocks for litter was 0.21 t C ha-1 and 0.26 t C ha-1 in in Kuala Sepetang and Kuala Trong, respectively.

Table 7: Total dry weight and carbon storage of litter obtained in Compartment 37 Kuala Sepetang.

No. of Plot	Litter										
	Point				SFW (g)	SDW (g)	TFW (kg)	TDW (kg)	Total (kg ha^{-1})	C content (%)	C Stock (kg ha^{-1})
	A	B	C	D							
1	0.50	1.00	0.71	1.00	135.00	51.00	3.21	1.21	60.34	35.44	21.38
2	1.00	0.70	0.66	0.71	100.00	33.90	3.07	1.04	51.79	34.74	17.99
3	0.40	0.25	0.53	0.60	110.00	46.90	1.78	0.76	37.77	38.14	14.40
4	0.75	0.34	0.26	0.70	120.00	53.65	2.05	0.92	45.61	41.14	18.76
5	0.82	0.35	0.74	0.37	150.00	46.10	2.28	0.70	34.87	35.94	12.53
6	0.68	1.16	0.81	0.62	105.00	40.70	3.27	1.27	63.07	48.04	30.30
7	0.45	0.40	0.37	0.35	190.00	58.55	1.57	0.48	24.07	42.34	10.19
8	0.15	0.30	0.27	0.43	110.00	51.20	1.15	0.54	26.64	37.14	9.89
9	0.43	0.15	0.37	0.23	160.00	53.60	1.18	0.40	19.67	42.94	8.45
10	0.28	0.18	0.20	0.43	110.00	32.20	1.09	0.32	15.88	43.64	6.93
11	0.20	0.50	0.55	0.45	110.00	31.75	1.70	0.49	24.42	45.94	11.22
12	0.23	0.22	0.32	0.37	110.00	29.85	1.14	0.31	15.39	45.04	6.93
13	0.25	0.16	0.22	0.27	180.00	36.00	0.90	0.18	8.96	39.94	3.58
14	0.30	0.42	0.34	0.28	130.00	51.40	1.34	0.53	26.36	47.64	12.56
15	0.45	0.28	0.37	0.32	150.00	49.70	1.42	0.47	23.41	39.34	9.21
16	0.37	0.47	0.27	0.42	140.00	46.10	1.53	0.50	25.07	42.14	10.56
						TOTAL		10.11	503.32		204.87

Note: TFW-Total fresh weight, TDW-Total dry weight, SFW-Sample fresh weight, SDW-Sample dry weight

Table 8: Total dry weight and carbon storage of litter obtained in Compartment 69 Kuala Trong.

No. Plot	Litter										
	Point				SFW (g)	SDW (g)	TFW (kg)	TDW (kg)	Total (kg ha^{-1})	C content (%)	C Stock (kg ha^{-1})
	A	B	C	D							
1	0.87	0.65	0.55	0.72	180.00	38.35	2.79	0.59	29.58	42.84	12.67
2	0.58	0.47	0.69	0.58	140.00	33.95	2.32	0.56	28.00	43.64	12.22
3	0.50	0.44	0.67	0.48	130.00	27.4	2.09	0.44	21.92	40.04	8.78
4	0.57	0.45	0.60	0.53	120.00	26.8	2.15	0.48	23.89	41.94	10.02
5	0.62	0.55	0.58	0.65	120.00	35.1	2.40	0.70	34.93	45.54	15.91
6	0.62	0.52	0.58	0.47	120.00	41.9	2.19	0.76	38.05	46.04	17.52
7	0.54	0.65	0.49	0.62	130.00	43.1	2.30	0.76	37.94	46.44	17.62
8	0.54	0.66	0.67	0.72	130.00	52.45	2.59	1.04	52.00	45.64	23.73
9	0.67	0.72	0.68	0.74	130.00	44.35	2.81	0.96	47.70	46.54	22.20
10	0.74	0.69	0.72	0.82	130.00	49.45	2.97	1.13	56.22	47.14	26.50
11	0.66	0.68	0.69	0.73	120.00	46.6	2.76	1.07	53.33	44.44	23.70
12	0.59	0.56	0.44	0.33	140.00	40.45	1.92	0.55	27.60	46.64	12.87
13	0.74	0.42	0.28	0.22	150.00	41.9	1.66	0.46	23.07	45.14	10.41
14	0.64	0.58	0.49	0.67	160.00	29.45	2.38	0.44	21.80	46.64	10.17
15	0.64	0.54	0.66	0.74	140.00	48.4	2.58	0.89	44.38	47.54	21.10
16	0.72	0.67	0.58	0.69	170.00	42.4	2.66	0.66	33.01	45.34	14.97
						TOTAL		11.52	573.44		260.36

Note: TFW-Total fresh weight, TDW-Total dry weight, SFW-Sample fresh weight, SDW-Sample dry weight

4.6 Total aboveground carbon

The total aboveground carbon comprising each aboveground component where values from Model C were used for standing biomass is shown in Table 9. The total mean value is 154.78 t C ha-1 and it is within the range values reported by Donato *et al.* (2012) for islands in Micronesia.

Table 9: Total aboveground carbon stock in both sites.

Component	Kuala Sepetang	Kuala Trong	Mean
	CS	CS	CS
	(t C ha^{-1})	(t C ha^{-1})	(t C ha^{-1})
Trees > 5 cm	130.06	162.85	**146.46**
Trees < 5 cm	8.67	0.77	**4.72**
Dead and downed woody	4.04	2.68	**3.36**
Litter	0.21	0.26	**0.24**
		TOTAL	**154.78**

Note: Value of trees > 5 cm were taken from Model C

4.7 Estimated economic value of carbon

In this study, two estimation of carbon value were used. The first estimation is based on studies by Tschakert (2002); where the price of carbon is equal to $15 per Mg C. This study applied the price of carbon $15 per Mg C and it is based on the scenarios in Southeast Asian countries with the same socio-economics condition. The second estimation uses the current price of carbon based on the trading price of t CO2 equivalent in the Carbon TradeXchange, Golden Standard CER prices at €5 (MYR22.00).

The Kuala Sepetang and Kuala Trong Mangrove Forest Reserves store a total of 154.78 t C ha-1 on average or equivalent to 567.53 t CO2 ha-1. Based on this estimated amount, the economic value of carbon is MYR7,475.87 per ha using the price of carbon MYR48.30 (Table 10). On the other hand, by using the market price of MYR22.00, the value of CO2 equivalent is estimated at MYR12,485.66 per ha.

Table 10: Estimated value of stored carbon for Kuala Sepetang and Kuala Trong Mangrove Forest Reserves.

Value of Carbon based on Carbon TradeXchange, Golden Standard CER trading price at MYR22.00 (€5) for 154.78 t C ha^{-1}/ 567.53 t CO_2 ha^{-1}	Value of Carbon based on estimated price by Tschakert (2002) at MYR48.30 ($15 per Mg C) for 154.78 t ha^{-1}
567.53 t CO_2 ha^{-1} x MYR22.00 = MYR12,485.66 per ha	154.78 t C ha^{-1} x MYR48.30 = MYR7,475.87 per ha

Note: Exhange rate for Euro1=MYR4.40, USD1=RM3.22

5. Conclusion

A better understanding of valuation of environmental resources such as carbon storage in the Matang Mangrove Forest Reserve will lead to good management practice and better revenue for the economy. The quantification of carbon also acts as a guideline to the government and other policy makers who emphasize the ability of natural resources in generating carbon credits and also reducing the problem of global warming. In addition, it is essential to sustain the health, diversity, and productivity of the nation's forests to meet the needs of present and future generations.

Gathering a complete data of forest structure through forest inventory is essential for accurately estimating forest productivity especially in quantifying biomass production and carbon stock/ storage. Among the major carbon pools in a forest ecosystem include aboveground carbon from standing live and dead trees, belowground carbon (soil and root), dead and downed wood, and also litter.
In our inventory works carried out in Compartment 37 Kuala Sepetang and Compartment 69 Kuala Trong, there were huge differences in tree density for tree with diameter above and below 5 cm between both sites. Most of individual found below 5 cm were saplings and seedlings. Similar result was also found for dead and downed wood. For litter, there was slightly difference between these two sites.

Total standing biomass production was successfully estimated by using locally established equations through destructive sampling measurements. Even though the values were slightly different between the three developed models, these values were found to be still within the range reported by other researchers. Overall, the standing biomass production (tree biomass) was found higher in Kuala Trong compared to Kuala Sepetang reflecting the size of trees but for Kuala Sepetang, the value was found to be contributed by the stand density. Higher biomass production was found for shrubs and dwarf mangrove (dominated by seedling and sapling) in Kuala Sepetang. However, contrasting patterns were observed for aboveground carbon stock by using total aboveground biomass component values (Model A) and total aboveground biomass values (Model B and C). Nevertheless, the values of carbon stock derived from this study was found to be within the range of high carbon level eventhough the age of stand is only about 30 year-old.

Meanwhile, the economic valuations based on the carbon stock values of this mangrove forest were estimated to be around MYR12,485.66 per ha and MYR7,475.87 per ha based on the estimation methods used.

Overall, this research findings can be used by forest and plantation managers towards the establishment and managing natural and planted forest in the future. The information gathered from this study is useful in depicting the vital role of planted mangrove forest in improving carbon stocking as well as increasing economic and environmental values. The allometric models derived in this study can be potential equations for estimating standing biomass production as well as carbon sequestration in this specific mangrove area of Larut Matang. General equation can also be established by combining destructive data from both sites in the future.

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PAPER 5: 3

SUCCESS STORIES OF URBAN FOREST PARKS IN SARAWAK

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ABSTRACT

Nine Nature Reserves have been established in Sarawak. Five of these are urban forest parks. Two of these parks, namely Sama Jaya Nature Reserve and Bukit Lima Nature Reserve are considered as "success stories" based on achievement of the stated objectives of their establishment as well as other measurements such as visitation and utilization. The natural attributes and other factors contributing to these success stories are also discussed.

1.0 INTRODUCTION

A total of nine nature reserves have been established in Sarawak. Under Section 2 of the National Parks and Nature Reserves Ordinance, 1998, "nature reserve" refers to the area of land, inland water area; or area within the territorial waters of the State that has been constituted for:

i. Preservation of specific natural features, landscape and site for archaeological, recreational, educational or conservation purposes;

ii. The preservation and protection of any particular historical site or historical monument on account of their unique natural beauty or interest; and

iii. Enhancing public appreciation, interest and education in the features, landscape, historical site or historical monument mentioned in paragraphs (i) and (ii).

A good definition of "urban forest park" is provided by Miller (1997) who defined the urban forest concept as the art, science and technology of managing urban tree resources for economic, sociological, physiological and aesthetic benefits. In the Sarawak context, urban forest parks are established to promote multiple uses and benefits of forest through encouraging outdoor recreation, nature conservation, education and nature-based tourism as well as to create a reserve and refuge for urban wildlife. These parks also serve as "Green Lung" for city dwellers.

Five of the nine nature reserves in Sarawak are urban forest parks. Two of these parks are considered as "success stories" based on achievement of the stated objectives of their establishment as well as other measurements such as visitation and utilization. These are Sama Jaya Nature Reserve and Bukit Lima Nature Reserve.

2.0 BACKGROUND OF SAMA JAYA NR AND BUKIT LIMA NR

2.1 Sama Jaya Nature Reserve

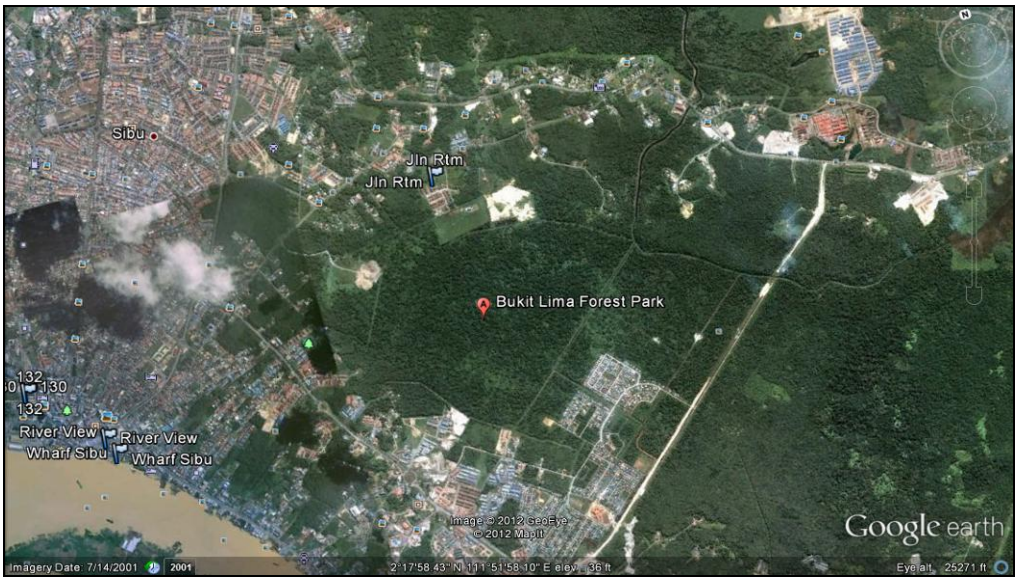
Sama Jaya Nature Reserve (SJNR) covers an area of 37.916 hectares situated within Kuching's city limits in the suburb of Tabuan Jaya (Figure 1). It was formerly known as Stutong Protected Forest, one of the oldest protected areas in Sarawak, constituted in 1950s. SJNR is Sarawak's first urban park gazetted in 2000. This park was designed along the theme of "urban wilderness" while complemented with modern facilities integrated into a natural forest environment.

Figure 1: Bird's eye view map of Sama Jaya Nature Reserve.

2.2 Bukit Lima Nature Reserve

Bukit Lima Nature Reserve (BLNR) covers an area of 219.22 hectares of mostly secondary peat swamp forest surrounded by residential estates in Sibu, Sarawak. The park was first opened to the public on 23rd July 2001. It was later gazetted as a nature reserve on 15th December 2011 with the purposes to conserve, protect and preserve natural environment as well as to provide a forested urban park for the local community.

Figure 2: Map of Bukit Lima Nature Reserve.



3.0 THE "SUCCESS STORIES"

The success of SJNR and BLNR are measured not only based on the achievement of stated objectives but also through the level of visitation, customer satisfaction and utilization of facilities.

3.1 Objectives and expectations met

Both SJNR and BLNR are very well-known by city dwellers in Kuching and Sibu respectively as venues for recreational activities, jogging, exercising and walking. They are also patronized by nature lovers, conservationists and nature photographers. The heath forest landscape has been preserved and in fact enhanced in SJNR through enrichment plantings. Various Conservation, Education, Promotion and Awareness (CEPA) programs have also been organized by different stakeholders. As such, the primary objectives for establishment of both SJNR and BLNR have been achieved.

3.2 Level and frequency of visitation

3.2.1 Sama Jaya Nature Reserve

Despite Kuching being only a small city (population: ~ 600,000), SJNR consistently received 8,000 to 10,000 visitors monthly. This positive trend is reflected in the increase of revenue generated from entrance fees from RM76,000 in 2009 to RM116,000 in 2013.

Based on interview of visitors, 27% are daily visitors while more than 49% come in on a regular basis of at least 2 or 3 times in a week as shown in Table 1.

Table 1: Frequency of visitation at Sama Jaya Nature Reserve.

Frequency of visitation	Percentage
Daily	27
Weekly	49
Monthly	10
Rarely	8
Occasionally	6

From the same interview exercise, it was found that visitors are mostly young and middle aged adults as shown in Table 2.

Table 2: Age range of visitor at Sama Jaya Nature Reserve.

Age Range	Percentage
20 and below	9
21 - 34 years old	35
35 - 44 years old	16
45 - 54 years old	19
55 - 64 years old	14
Above 65	7

3.2.2 Bukit Lima Nature Reserve

Despite Sibu being a small town (population: ~ 250,000), BLNR receives an estimated 6,000 visitors monthly.

Based on interview of visitors, 41% are daily visitors and 38% come in on a weekly basis as shown in Table 3.

Table 3: Frequency of visitation at Bukit Lima Nature Reserve.

Frequency of visitation	Percentage
Daily	41
Weekly	38
Monthly	5
Rarely	0
Occasionally	16

It is also found that visitors' age ranges from middle aged adults to young adults as shown in Table 4.

Table 4: Age Range of visitor at Bukit Lima Nature Reserve.

Age Range	Percentage
20 and below	21
21 - 34 years old	10
35 - 44 years old	24
45 - 54 years old	24
55 - 64 years old	18
Above 65	3

3.3 Customer satisfaction level

Based on interviews of visitors conducted, both SJNR and BLNR scored relatively high level of customer satisfaction towards staff services and park facilities at 84% and 91% respectively as shown in Table 5.

Table 5: Customer satisfaction level in Sama Jaya Nature Reserve and Bukit Lima Nature Reserve.

Customer satisfaction level	Sama Jaya Nature Reserve (%)	Bukit Lima Nature Reserve (%)
Satisfied	84	91
Neutral	15	9
Not satisfied	1	0

3.4 Utilization of facilities

The outdoor facilities particularly the jogging tracks, foot reflexology path and lookout tower are the most utilized at SJNR. These are used by visitors for jogging, walking, exercising, photography and wildlife watching as shown in Table 6 as well as photos below.

Table 6: Major outdoor activities in Sama Jaya Nature Reserve.

Major Outdoor Activities	Percentage
Jogging	68
Exercise	54
Walking	44
Sightseeing	11
Photography	7
Fitness / Aerobic training	3
Others	6

(Note: The respondents could indicate more than 1 activity)

At BLNR, the most used facility is the plank walk as shown in Table 7.

Table 7: Major Outdoor Activities in Bukit Lima Nature Reserve.

Major Outdoor Activities	Percentage
Jogging (plank walk)	43
Exercising (plank walk)	36
Walking (plank walk)	60
Sightseeing	5
Photography	2
Fitness / Aerobic training	24
Others	3

(Note: The respondents could indicate more than 1 activity)

4.0 ATTRIBUTES CONTRIBUTING TO THE "SUCCESS STORIES"

4.1 Accessibility and proximity to residential areas

Both SJNR and BLNR are adjacent to the residential areas. SJNR is about 15 minutes away from downtown Kuching while BLNR is only 10 minutes away from Sibu town centre. From interviews conducted, it is found that most of SJNR's regular visitors (~72%) reside within 6 km as shown in Table 8. As for BLNR, more than half of the visitors reside within 3 km of the park. It goes without saying that both of these parks are easily accessible by road and public transportation.

Table 8: Proximity to residential areas.

Distance (km)	Sama Jaya Nature Reserve (%)	Bukit Lima Nature Reserve (%)
1 – 3 km	36	54
4 – 6 km	36	15
7 – 9 km	15	19
10 km and above	13	12

4.2 Variety of facilities

4.2.1 Sama Jaya Nature Reserve

There is a variety of facilities available to both outdoor recreation and education/social activities. The outdoor activities facilities are jogging tracks, physical fitness trail, foot reflexology path, lookout tower, Baruk shelter and rest day shelter. For the less physically inclined visitors, SJNR provides Biology Museum, Timber and Bamboo Museum, Ethno-botanical Garden, Japanese Tea House, conference room and activity center.

4.2.2 Bukit Lima Nature Reserve

There are less facilities at BLNR as compared to SJNR. However, visitors to BLNR could still choose between jungle trekking, foot-reflexology exercise, nature walking, photography, jogging and running.

5.0 OTHER ATTRIBUTES

5.1 Sense of security

Both SJNR and BLNR are gated and well guarded by full time staff/security guards. This provides a sense of security for visitors who patronized the parks.

5.2 Availability of parking space

Both SJNR and BLNR are provided with ample parking space for all types of vehicles.

5.3 Forest environment

Both parks are in natural forest settings wherein the forest canopy provides shade, fresh air, and cooling effect. This encourages visitors to come throughout the day.

5.4 Wildlife

SJNR comprises 95% Kerangas forest and 5% peat swamp forest inhabited by a wide variety of mammals, bird, reptiles and amphibians. These include primates, squirrels, shrews, rats, fruit bats, tarsiers, birds, lizards, tortoises, snakes and frog.

BLNR is entirely a peat swamp forest inhabited by bats, primates, rodents, long-tailed macaque, squirrels, sambar deer, mouse deer, tree shrew, birds, fishes and plants.

These abundances of wildlife attract not only nature lovers but also photographers and bird watchers.

5.5 CEPA and CSR programs

SARAWAK FORESTRY has regularly conducted CEPA programs for mainly school students at both parks. Various private companies and NGOs have also made used of the parks to carry out Corporate Social Responsibility (CSR) activities such as tree planting, improvement and maintenance of facilities.

6.0 ISSUES AND CHALLENGES

6.1 Limited funding

The facility development and maintenance of the parks are limited by shortage of funding. Deteriorating and dilapidated facilities would have implications on the safety of the visitors and image of the parks.

6.2 Protection from natural and man-made disasters

Both parks are prone to flooding and forest fire. For example, SJNR experienced bad flooding in 2004 while BLNR was badly damaged by forest fire in 2014.

6.3 Encroachment and vandalism

Both parks are threatened by encroachment and vandalism although the risk is under control.

7.0 RECOMMENDATIONS

- More urban forest parks should be established in other towns of Sarawak to emulate the "success stories" of SJNR and BLNR.
- Adequate funding should be provided for both operational and development purposes to ensure that the "success stories" of SJNR and BLNR are continued.
- Park management should take up both protective and preventive measures against flooding and forest fire.

ACKNOWLEDGEMENT

We wish to take this opportunity to convey our thanks and gratitude to Regional Manager Sibu, Regional Manager Kuching, Park Warden of Sama Jaya Nature Reserve, Park Warden of Bukit Lima Nature Reserve, Park Warden of Lanjak Entimau Wild Life Sanctuary and their staff for the assistance and information rendered in the preparation of this paper. This paper would not be completed without the contribution of the park staff and also the visitors who shared their experiences at the parks.

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Figure 3: Visitor walking on the tracks at Sama Jaya Nature Reserve.

Figure 4: Visitor walking on reflexology pathway at Sama Jaya Nature Reserve.

Figure 5: CEPA program in Sama Jaya Nature Reserve.

Figure 6: Tree planting program in Bukit Lima Nature Reserve.

Figure 7: Fitness trail.

Figure 8: Foot reflexology path.

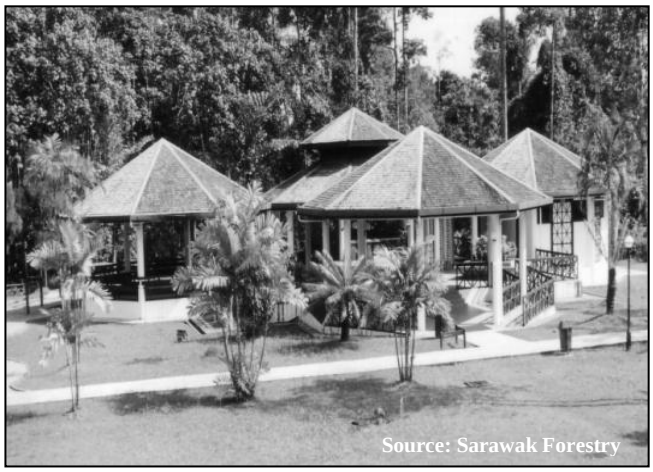

Figure 9: Activity centre.

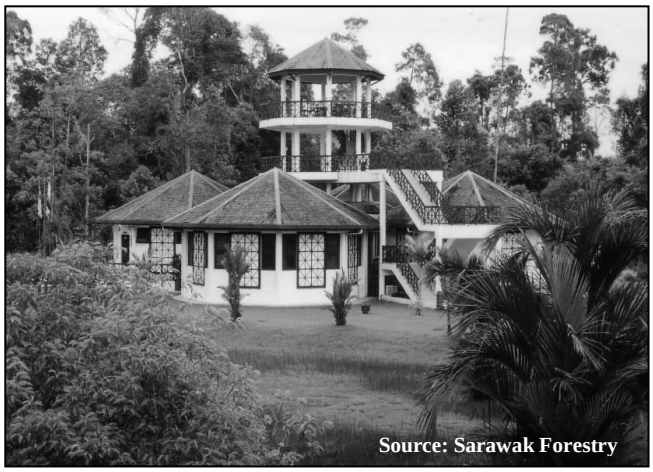

Figure 10: Conference room and viewing tower.

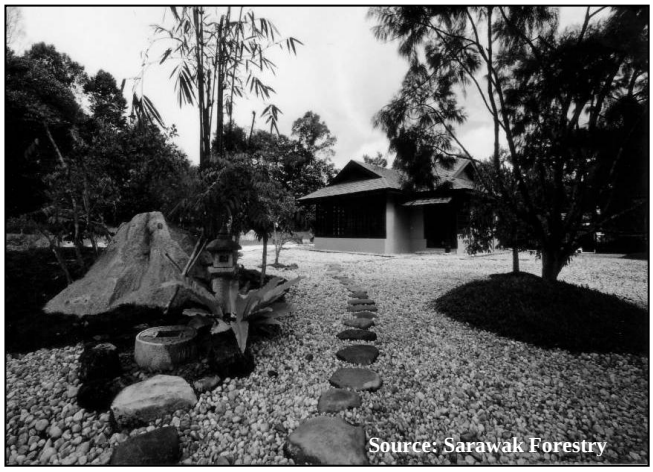

Figure 11: Hiroshima-Sarawak Friendship Garden.

Figure 12: Resting shelter.

Figure 13: Plank walk.

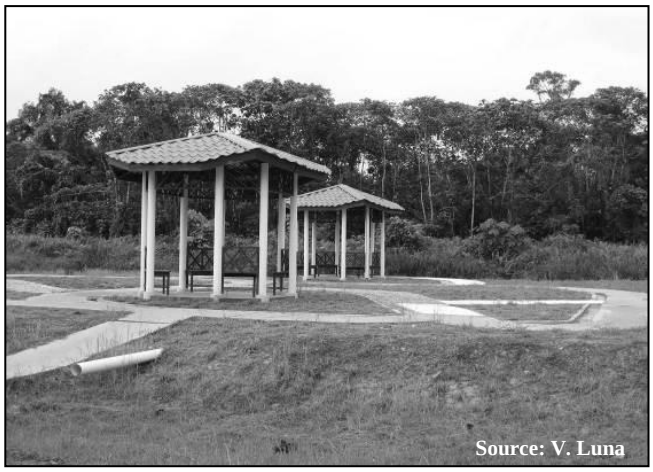

Figure 14: Reflexology path.

Figure 15: Lookout tower.

Figure 16: Forest canopy in Bukit Lima Nature Reserve.

Figure 17: Plantain squirrel in Sama Jaya Nature Reserve.

Figure 18: Long-tailed macaque in Sama Jaya Nature Reserve.

Figure 19: Bird in Bukit Lima Nature Reserve.

Figure 20: Fungi in Bukit Lima Nature Reserve.

PAPER 5: 4

BOLEH (BIODIVERSITY OBSERVATION FOR LAND AND ECOSYSTEM HEALTH) APPROACH FOR QUANTITATIVELY EVALUATING SPATIO-TEMPORAL PATTERNS OF ECOSYSTEM HEALTH IN BORNEAN FMUS

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ABSTRACT

Sustainable management of production forests is crucial for maintaining the human welfare within and beyond Borneo because production forests have a range of ecosystem services including provisioning of water and regulation of climate. The value of provisioning of ecosystem services in production forests in addition to timber needs to be properly evaluated. We have developed a robust biodiversity indicator to evaluate spatio-temporal changes of ecosystem health in Bornean production forests, which is also a surrogate of provisioning of ecosystem services. We have also developed a rapid cost-effective method to demonstrate landscape-level patterns of the indicator for Forest Management Units (FMU) to be undertaken by FMU holders, that is BOLEH (Biodiversity Observation for Land and Ecosystem Health). Our BOLEH approach consists of three steps; 1) stratification of the forests in a given FMU, 2) count-plot measurements (60 plots) in the field, and 3) statistical analyses and extrapolation using remote sensing and Geographical Information System (GIS). In this procedure, composition of canopy-tree species/genera is calculated for each plot and composition values derived from a multivariate analysis are extrapolated to the areas outside the plots using remote sensing and GIS. In this paper, we present the principle, methodology and benefits of our approach.

EXTENDED ABSTRACT

It is estimated that natural production forests, from which timber is legally harvested, cover approximately one half of entire Borneo. Sustainable management of such production forests is crucial for maintaining the human welfare within and beyond Borneo because production forests have a range of ecosystem services including securing headwater and sequestering carbon to mitigate climate change other than timber. The value of provisioning of ecosystem services in production forests in addition to producing timber needs to be properly evaluated; this is crucial to provide foresters with additional financial incentives to maintain sustainable forest management with reduced-impact logging, which commonly reduces yield per unit area. With this background, we aim to develop a valid index for the provisioning of ecosystem services, and its rapid measurement, reporting and verification (MRV) system.

In the past eight years, we investigated the relationships between the residual biomass after logging (as an index of forest degradation) and ecological metrics including the number of species/genera/families, abundance and community composition for tree communities in Sabah (Kitayama, 2013). Our results consistently indicate that community composition (combination of species/genera) but not taxonomic richness (number of species/genera/families) is a robust indicator for residual biomass; this pattern was later confirmed to occur also in East Kalimantan (Imai *et al*. 2014).

Under a given environmental condition, specific tree-species communities are ecologically and evolutionarily assembled in tropical rain forests in equilibrium with the environment. Such tree communities have a maximum biomass (i.e. maximum carbon stock) as a result of competition for light, a maximum water-use efficiency (i.e. water holding capacity at ecosystem level), and a maximum ecosystem resilience against disturbances. Such an ecological principle together with our past studies suggests that tree-species composition is the most robust generic indicator to indicate the magnitude of forest degradation as well as the provisioning of ecosystem services (hereafter defined as ecosystem health). We, therefore, developed a rapid method to evaluate community composition of tree species/genera in an entire forest management unit (FMU, commonly ranging from 50,000 to 100,000 ha in size), that is the BOLEH (Biodiversity Observation for Land and Ecosystem Health) approach.

Our BOLEH approach consists of three steps; 1) stratification of the forests in a given FMU, 2) count-plot measurements in the field, and 3) statistical analyses and extrapolation using remote sensing and GIS. Stratification is a step to place a total of 60 plots based on a stratified random design. The stratification step first classifies the entire forests into six degradation classes ranging from a (near) pristine class to a mildly disturbed

class to a highly disturbed class to a class devoid of forests and subsequently generates random points in each class as the targets of establishing plots. The classification of forests into six degradation classes is conducted by level-slicing band-7 reflectance values of Landsat data. A total of 100 random points are generated in each class; a great care must be paid at this step to avoid any areas in the vicinity of logging roads, swamps, rivers and etc. Count-plot measurements are conducted in a total of ten random plots for each class (i.e. 60 plots per FMU). We use circular plots of 20-m radius and measure all trees greater than 10-cm diameter at breast height (dbh) within the established plots. Subsequently, species/genera are identified. Statistical analyses involve the conversion of raw data to relative abundance values based on relative basal area for species/genera in each plot and the application of a multivariate analysis (such as NMDS). Axis-1 values derived from the multivariate analysis have consistently demonstrated a statistically highly significant correlation with the residual biomass of those plots in each of the four FMUs in Sabah and East Kalimantan (Imai *et al*. 2014). Axis-1 values can serve as the indicator for the provisioning of ecosystem services. The last step is the extrapolation of the results of the multivariate analysis into the entire landscape in each FMU. In this step, a multiple regression model is first developed between axis-1 values of the plots and reflectance values of the pixels where the plots are located on a Landsat imagery. The model that has been developed is applied to the pixels outside of the plots to derive their axis-1 values and a map of ecosystem health is produced for each FMU. The cost of the BOLEH approach is nominal because of a team of 4 - 5 workers can finish sampling 60 plots in approximately 20 - 30 days and Landsat data are available for free. A map derived using the BOLEH approach can demonstrate spatial patterns of ecosystem health within and across FMU. If the BOLEH approach is applied twice during a REDD+ project, once in the beginning and the other in the end of the project, it can demonstrate temporal changes of ecosystem heath during the REDD+ project. Thus, our BOLEH approach can serve as a verifier of biodiversity safeguard for REDD+. Apart from REDD+ projects, many FMUs in Sabah will naturally demonstrate increments of biodiversity and ecosystem health if our BOLEH approach is applied, because FMUs in Sabah are now at re-building stage recovering from the past intensive logging. Our BOLEH approach can legitimately quantify ecosystem health as an index of the provisioning of ecosystem services in a large area with a minimal cost to invite a wider support to maintain natural production forests.

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PAPER 5: 5

COST-BENEFIT ANALYSIS ON THE DEVELOPMENT OF BELUM-TEMENGGOR ECOLOGICAL CORRIDOR IN GERIK, PERAK

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ABSTRACT

The Central Forest Spine (CFS) project has the mission to protect the nation's biodiversity by connecting CFS complex key to making it a vast area of forests stretching from north to south and East to the West of Peninsular Malaysia which involves the creation of 37 ecological corridors in Peninsular Malaysia. The CFS is estimated to cover a total area of 5.3 million hectares or 40% of Peninsular Malaysia's land area, of which 80% is Permanent Reserved Forest. To initiate the CFS Programme, the government has selected Primary Linkage 2 (PL2) Belum-Temengor Ecological Corridor (BTEC), Gerik, Perak as the first CFS project in Peninsular Malaysia. An initial allocation of RM 60 million was approved in April 2011 for the implementation of this project over the period 2012-2015. This study includes the evaluation of goods and services of forest resources as well as the intangible values of forests in ecological corridors CFS in Hulu Perak, the effects of the cost will be accepted by the state government in the event of the destruction of the environment, natural disasters and economic activities downstream as a result of not maintaining the ecological corridors and to analyse in terms of finance and economics in order to see the importance of the area to either maintain as preservation or developed for the commercial projects, and getting the net present value (NPV) in order to see the importance of land use for the project is needed to make this study successful. The objectives of the study are: (i) to analyse the information obtained by using scientific and econometrics methods to get the net present value (NPV), incremental net present value (INPV); (ii) to make a summary and an assessment of the study area based on the result analysis and the BTEC is already a popular tourism destination. Even without the Ecological Corridor project, the BTEC is already providing a benefit stream of RM21,562,311 per year. Eco-tourism and recreational services provided 7.9%, while the avoidance of human-wildlife conflicts and local communities dependence on NTFPs collection contributed another 2.5% and 2.4% respectively. The local businesses from tourism provided 87.3% of the total annual contributions of economic values. Non-use values of biodiversity conservation contributed 17.9%. The above benefits reported earlier are not realised now only but far into the future and these benefits could be accumulated by discounting the future values into the current period and summing them up to obtain the NPV_{WoP}. Using a discounting rate of 5% and analysing a cash flow over 10 years, the NPV_{WoP} of current status quo situation is MYR 294,975,034. The cost and benefit analysis showed that if the Forestry Department is capable of generating incomes through obtaining international interests to set carbon offset projects or through the REDD PLUS initiatives, the ecological corridor project is viable. The Forestry Department would have to seek international interests to obtain the carbon offset projects and REDD Plus to compensate for the cost of implementing conservation efforts undertaken.

1.0 INTRODUCTION

The Central Forest Spine (CFS) project has a mission to protect the nation's biodiversity by connecting a vast area of forests stretching from north to south and east to the west of Peninsular Malaysia. The implementation is significant for forest conservation and protection of biodiversity.

1.1 Scope

The study of cost benefit analysis covers the following:

i. Evaluation of goods and services of forest resources as well as the intangible values of forests in ecological corridors CFS in Hulu Perak.
ii. The calculation of the Net Present Value (NPV).

1.2 Objective of the study

The main objective of the study is to create the appropriate methodology in order to obtain the information that more accurate related to cost benefits analysis for the establishment of the project CFS as preservation area against development area. The specific objectives are:

i. To analyse the information obtained by using scientific and econometrics methods to get the IRR and NPV;
ii. To make a summary and an assessment of the study area based on the result analysis; and

1.3 Study Site

1.3.1 Location and Size

Temenggor Forest Reserve and Royal Belum State Park are situated in the Gerik district, north of Perak. This area borders with Thailand on the north, Kelantan forest on the east and Ulu Muda forest reserve, Kedah on the west. It is known as a forest complex (Belum Temenggor Forest Complex-BTFC) as it is a huge piece of land that comprises of Temengor permanent forest reserve (148,870 hectares) (including Lower Belum forest reserve) and the Royal Belum State park (117,500 hectares). The lower Belum forest reserve changed its name to Banding forest reserve after being gazetted by the state government. On its northern boundary, BTFC is contiguous with both the Hala-Bala Wildlife Sanctuary and the Bang Lang National Park in southern Thailand. In the 1970s, two major developments brought changes to the enforced isolation which is the construction of the East-West Highway, 124 km road cuts across BTFC, dividing what was essentially a single area into two parts, Belum in the north and Temengor in the south, in 1975 and Temenggor Dam establishment in 1978. BTFC is one of the primary linkages identified in the Central Forest Spine (CFS), as defined in National Physical Plan (NPP) by National Physical Plan Council chaired by the Prime Minister in 2011 (Figure 1).

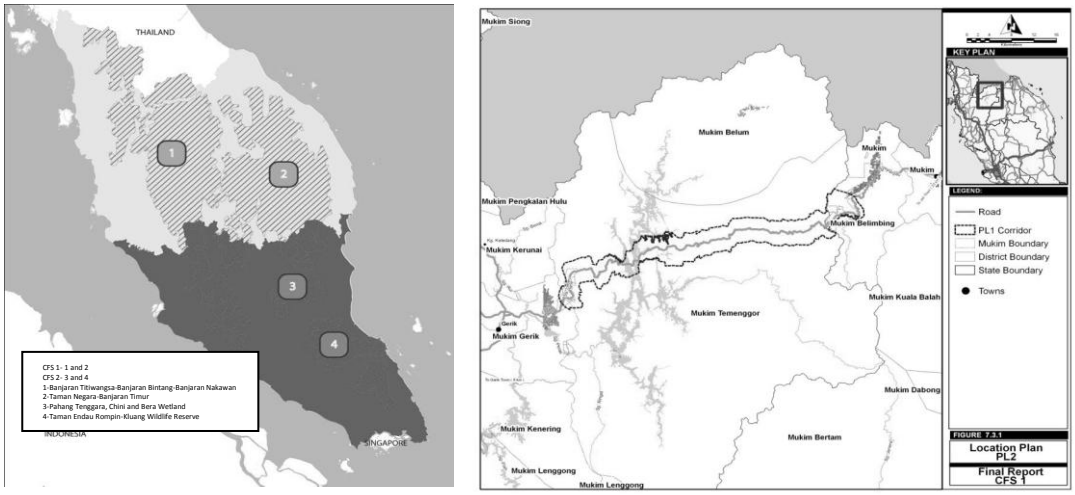


Figure 1: The location of BTFC within the Central Forest Spine 1 (part of CFS) in Peninsular Malaysia as defined in National Physical Plan (NPP) (Source: JPSM, 2013).

2.0 THEORETICAL FRAMEWORK AND COST-BENEFIT ANALYSIS METHODOLOGY

2.1 Theoretical Model of Cost-Benefit Analysis

Cost-benefit analysis (CBA) is a decision-making tool based on an economic analysis that judges the viability of projects, policies or actions by comparing their economic costs and benefits. Economic benefits are defined as anything that increases human satisfaction (or wellbeing) and economic costs are anything that reduces wellbeing. CBA has the objective of economic efficiency and therefore the favoured option is the one where net benefits are maximised. CBA differs from a financial analysis in that it is taken from the perspective of society as a whole. A financial analysis is undertaken from the perspective of the individual investor, who uses market prices to estimate returns on his or her investment but ignoring impacts to the rest of society and nation. It does not take into account changes to environmental goods and services caused by the projects, policies or actions.

A key aspect of CBA is the definition of the baseline reflecting the conditions that would occur without the project. This allows the changes brought about by the alternative scenarios to be compared with what would have happened if they were not introduced. The CFSEC project of protecting an existing forested area and of connecting them by re-establishing new tracts of forest comprises the following:

i. The environmental benefit would be the additional benefits from greater protection of wildlife, tourism, local businesses, increased carbon sequestration, maintained clean water quality to run hydro-electric power generations and
ii. The economic cost would be the cost of planting trees and constructing the viaduct, and on a loss in opportunities to produce additional agricultural crops.

Costs and benefits occur over different time periods. There is no basic rule for setting the time horizon for the appraisal, but it is important to include all the relevant costs and benefits. Since the project must be appraised over an agreed upon project life, costs and benefits occurring in the future need to be converted into present value terms by discounting to the current period.

The discount rate is the interest rate used to reduce future costs and benefits to their present day equivalent. In most situations, analysts are given a specific discount rate used by public authorities for all public investment decisions. Discounting allows the stream of costs and benefits to be compared over the project life, and to arrive at a single figure – the net present value (NPV). This is the sum of the discounted annual total benefits minus the sum of the discounted total annual costs.

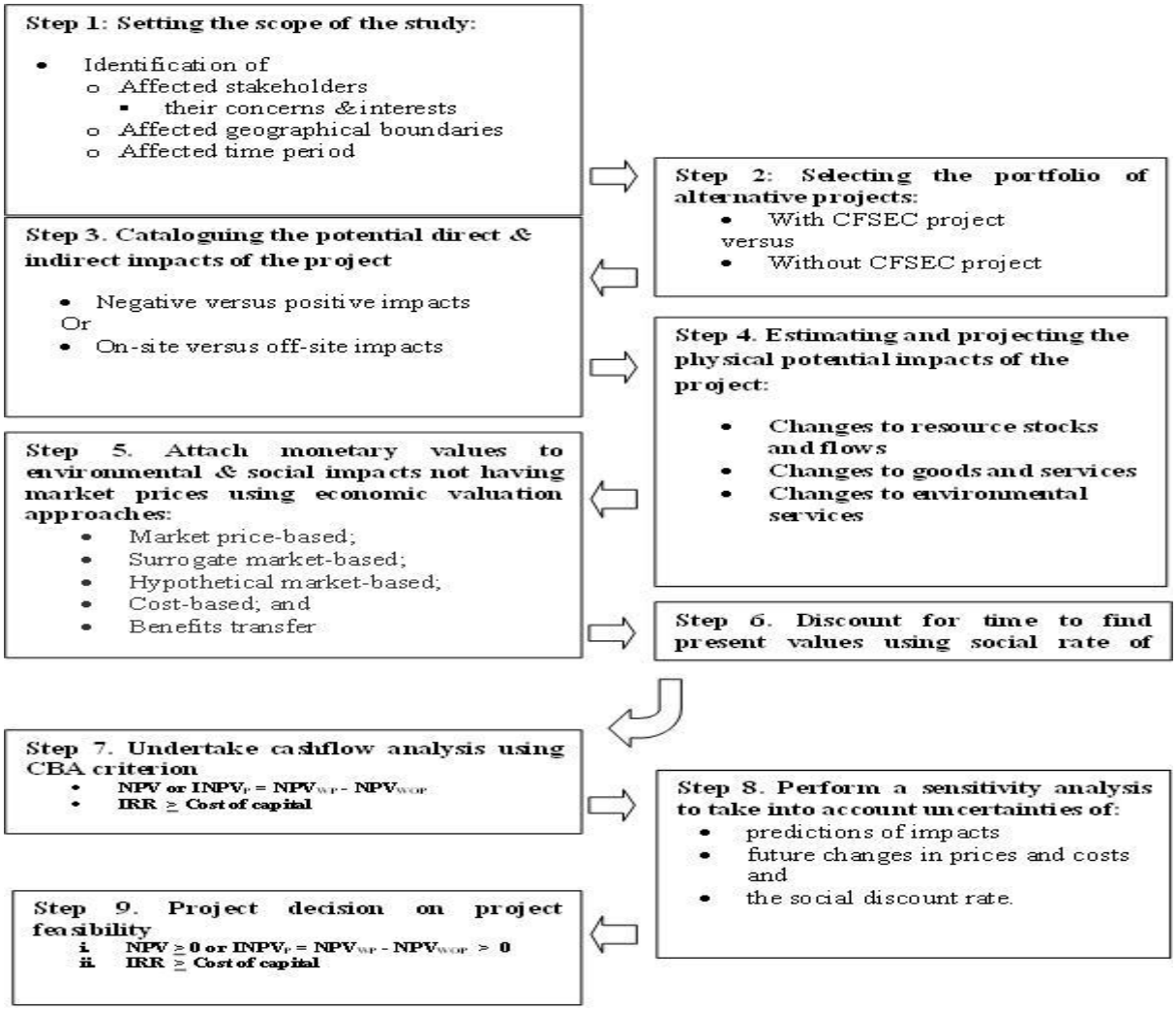
The project is economically viable so long as economic benefits exceed the economic costs. The project is economically superior to the status quo current situation – the without project option – when:

i. The incremental net present value (INPV) is positive. The INPV is the difference between the NPV from the CFSEC project and the NPV of the 'without project'.
ii. The internal rate of return (IRR) of the CFSEC project is higher than the cost of capital, or a predetermined rate of interest. The IRR is the discount rate at which the stream of discounted costs and benefits are equal to zero.

Despite the popularity of CBA as a decision-making tool, analysts must also recognise its limitations, particularly when applying it to decisions pertaining to the environment.

2.2 Empirical CBA Framework

A framework is provided to illustrate the steps for carrying out a CBA for the CFSEC:



3.0 COST BENEFIT ANALYSIS

3.1 Cost Benefit Analysis

3.1.1 Net Present Value without Project (NPV_{WoP})

The above benefits reported earlier are not realised now only but far into the future and these benefits could be accumulated by discounting the future values into the current period and summing them up to obtain the NPV_{WoP}. Using a discounting rate of 5% and analysing a cashflow over 10 years, the NPV_{WoP} of current status quo situation is MYR 294,975,034. The discounted cashflows is provided in Table 1.

Table 1: Discounted cash flows for the 'Without Project" Option of the ECCSF at Gerik.

Year	A	B	C	D	E	Discounted total inflows
1	542,314	1,693,023	512,129	18,814,845	3,864,000	25,426,311
2	516,490	1,773,643	487,742	19,710,790	3,680,000	26,168,665
3	491,895	1,858,103	464,516	20,649,399	3,504,762	26,968,674
4	468,471	1,946,584	442,396	21,632,704	3,337,868	27,828,023
5	446,163	2,039,278	421,330	22,662,833	3,178,922	28,748,526
6	424,917	2,136,387	401,266	23,742,015	3,027,545	29,732,130
7	404,683	2,238,119	382,159	24,872,587	2,883,376	30,780,924
8	385,412	2,344,696	363,961	26,056,996	2,746,073	31,897,138
9	367,059	2,456,349	346,629	27,297,805	2,615,307	33,083,150
10	349,580	2,573,318	330,123	28,597,701	2,490,769	34,341,491
Total						294,975,034

A refers to Avoidance of Human Wildlife Conflicts
B refers to Eco-tourism and recreational services
C refers to Local communities dependence on NTFPs collection
D refers to Local businesses from tourism
E refers to Non-use values of biodiversity conservation
It is assumed that pathway trend of wildlife habitat functions and local communities dependence on NTFPs collection are unclear. The local tourism businesses and tourist values and arrivals would be raised by 10%.

The rate of selected discount is 5%.

3.1.2 Net Present Value with Project (NPV_{WP})

With the implementation of the Ecological Corridor, there will be

a. new cost items mainly on the
   - R&D on the scientific and socio-economics of the existing forest habitat and determination of locations of strategic infra structures such as the viaduct
   - Construction of the viaduct
   - Additional staffing and vehicles

And

ii. New benefit streams
   - changes to the benefits streams in comparison to that obtained under the 'Without Project' scenario that included:
   - potential increments in the value of tourism benefits from 10% increase per annum to 20% increase per annum
   - potential increments in the local economic revenue generations of 10% per annum by tourism related businesses

- potential benefits from the capture of carbon sequestration functions of the protected forests (subject to the ability of the Forestry Department to capture these values via carbon Offset projects or REDD Plus

3.2.1 Costs of implementing ECECSR at Gerik

A total allocation of RM10,470,060 is prepared for biodiversity conservation programmes at the ECCSF, Gerik for various activities (Table 2):

- Development of database system for the Ecological Corridor
- Establishment of the Ecological Corridor
- Research on the implementation of the Ecological Corridor

Table 2: Budget allocation for Biodiversity conservation programmes.

No.	Scope/Component/Activity		Allocation (RM)
1	Biodiversity Conservation Programme		
	A	Development of database system for the Ecological Corridor	1,700,060
	B	Establishment of the Ecological Corridor	3,510,000
	C	Research on the implementation of the Ecological Corridor	5,260,000
Total Biodiversity Conservation effort			RM10,470,060

Viaduct construction

Initial cost of the whole project is RM45, 800,000.00; however this has been reduced due to the reduction of the width of viaduct from 60m to 40m through discussion during re-evaluation of the costing for this project at the "Lab Pengurusan Nilai Projek Central Forest Spine (Ecological Corridor), Gerik, Perak" on 10-14 September 2012. In the meeting, it was agreed that the width of the viaduct be reduced from 60m (2 spans, 3-tiers) to 40m (1 span, 2 tiers) which equals to 300mx17m=5100m^2. Drainage construction and other structural cost is RM6000/m^2 with a total of RM30, 600,000. Additional lump sum site investigation cost was RM 200,000.00.

The construction will involve removal of existing road (40m), road diversion to enter and exit the viaduct and drainage according to the specification. In order to ensure wildlife to cross using this viaduct, sira salt lick will be provided to attract wildlife. In addition, the electric fence also will be installed to direct wildlife to the viaduct. The total cost is now RM36.6 million (Table 3).

Table 3: Detailed cost of viaduct construction at point B (km 157 from Jeli).

Item	Description	VE Cost Model (RM)
1	General Items	1,967,800.00
2	Site Clearance	1,021,000.00
3	Earthworks	132,400.00
4	Drainage Works	568,000.00
5	Pavement Works	1,124,300.00
6	Road Furnitures	85,000.00
7	Geotechnical Works	3,576,300.00
8	Structures	13,657,000.00
9	Environmental Protection Works	1,382,500.00
10	Routine Maintenance	960,000.00
11	Traffic Management & Temporary Road Diversion	5,795,000.00
12	Menara Tinjau	500,000.00
13	Provisional Sums	975,000.00
	Total Construction Cost	**31,744,300.00**
14	VOP	2,303,700.00
15	Soil Investigation (SI)	200,000.00
16	Advertisement & Documentation	20,000.00
17	Professional Fees	2,332,000.00
	Total Others Cost	**4,855,700.00**
	Total Project Cost	**36,600,000.00**

Detailed cost of tree planting

Tree planting to enhance the function of the ecological corridor was carried out by the Forestry Department of Peninsular Malaysia (FDPM) and the State Forestry Department of Perak (FDP) within the ecological corridor involving 54 acres of the Aman Jaya Forest Reserve (AJFR). The initiative by the FDPM is to replant the Block A of KM157 (Figure 2) from Kota Bharu-Gerik in the AJFR area. Landskap Malaysia also helped out in the tree planting programmes by their contribution in preparation and installation of service sign boards, clearing the border of replanting block, marking and clearing the planting line, supplying of seedlings for replanting, planting trees and treatment.

In implementing the ECCFS at Gerik, a number of activities have to be undertaken including the gazettement of AJFR, tree planting activities, conference and promotions on CFS, and integrated enforcement of the ECCFS by government agencies.

In 2013 some RM170,000 was allocated for tree planting activities at AJFR that included hosting a conference involving 4,500 participants. The conference coincided with the launching of the state's vision of planting 1 million trees in Perak. Four ambassadors from Singapore, Belgium, Finland, and Thailand were present. FDP received further allocations in 2013 for the ECCFS project implementation of which RM830, 000 was used to survey and measure the external boundary of AJFR. Another RM80,000 was used to upgrade the nursery at Air Ganda and RM50,000 for the purchase of tree seedling stocks and for the tree planting activities. Another RM23, 650 to undertake integrated enforcement between the Perhilitan, Forestry Department and Belum Forest State Park Authority.

Staffing Cost

Many agencies have to be involved in the establishment of ecological corridor. Several government agencies would be directly involved in implementing the ecological corridors. Forest resources being the domain of the Department of Forestry (DOF), it is anticipated that this department would have to play central role in this implementation phase. The DOF has made plans towards their role in the establishment of the ecological corridors by taking heed of the recommendations in the National Infra-Structural Plan. DOF has undertaken these responsibilities at two fronts: planning at the DOF headquarters in Kuala Lumpur and implementation at the relevant District DOF offices.

Department Staff Upgrading

The implementation of the ECCFS at Gerik would involve staff upgrading in at least three agencies – Forestry Department, PERHILITAN and Royal Belum State Park.

Forestry Department

The ECCFS would involve additional responsibilities of existing staff and also to engage additional staff. The State Forestry Department of Perak would see additional work tasks for officers at FDP headquarters at Ipoh and formation of a special ECCFS unit at Gerik.

For the additional tasks, travel allowances and additional costs on vehicle maintenance and fuel are involved (Table 4).

Table 4: Additional Budget at FDP headquarters, Ipoh and at FD District.

Expenditures	RM/year
Additional expenditures on staffing allowances by Forest Department Ipoh Headquarters	39,600
New staffing and allowance at District Forestry Department	10,100
Additional expenditures on vehicle operations by Forest Department Ipoh Headquarters	2,784
New expenditures on vehicle operations at District Forestry Department	90,828
Total	143,312

There will be new expenditure on a four-wheel-drive and three scrambler motorcycles to facilitate in the enforcement exercise (Table 5).

Table 5: Expenditure on assets at Perhilitan, Gerik.

No.	Item	Unit	Expenditure (RM)
1	4 Wheel Drive	1	170,000
2	Scrambler motor cycle	3	21,000
3	Total 4		191,000

Similarly, the District Wildlife Department (Perhilitan) would have to conduct frequent visits to monitor and prevent illegal poaching activities. These would require further extra budgeting (Table 6).

The District Wildlife Department would require further upgrading of its staff and support facilities with a budget of RM114,000. The breakdown of this budget request is shown in Table 7. The budget request for transportation covers 59.9% for a new four wheel drive vehicle but this amount would stretch until the next five years. The breakdown of the field staff salary and wages, and allowances is provided in Table 6.

Table 6: Budget request for ecological corridor maintenance and monitoring by the District Wildlife Department, Hulu Perak.

Annual Budget Required (RM)	RM	%
Salary & Wages	73,200	25.8
Allowances	40,800	14.4
Vehicle	170,000	59.9
Total	284,000	100.0

Computed based on discussion with the District Perhilitan Office

Table 7: Breakdown of budget for field staff upgrading, District Wildlife Department, Hulu Perak.

Staffing	Number of post	Salaries	Allowances	Total
upgrade current G32 level to G41*	1	1,200	1,680	2,880
Add one Assistant District Officer G27	1	24,000	5,400	29,400
Add 2 more G22 staff as Head of other units	2	36,000	9,480	45,480
Add 3 ranger G17	3	3,600	18,180	21,780
Add 1 driver (R3)	1	8,400	6,060	14,460
Total		73,200	40,800	114,000

* Incremental cost only

3.2.2 Additional Benefits from ECCSF Implementation

New benefit streams will be realised with the implementation of the ECCSF at Gerik. There will be changes to the benefits streams under the 'With Project' option in comparison to that obtained under the 'Without Project' scenario. Currently, it is anticipated that potential increment in the value of tourism benefits and local tourism related business sales is 10% per annum but 'With Project' the increment is expected to be 20% per annum.

With the proper implementation of Ecological Corridor, the Forestry Department would be able to showcase to the world that it is serious in conserving the tropical rainforest while tapping potential carbon sequestration functions of the protected and conserved forests from REDD PLUS and other carbon offset projects.

3. 2.3 Natural Forest Role in Carbon Sequestration

The amount of carbon emitted into or removed from the atmosphere was computed based on the default values from the IPCC Guidelines. The present forest type at the BTFC is mixed dipterocarp forest with 350 tons above-ground biomass dry matter per hectare.

(Table 4.7, page 4.53, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry and Other land Use). Since the forest is natural it is assumed that it is in a steady state and an **annual**

increment in biomass from natural regeneration is assumed as zero. The Carbon © fraction of biomass dry matter is 0.5 (IPCC default value). Hence a ha of the natural forest has 175 tonne of C or 642.25 tonne of Carbon Dioxide (CO_2).

The BTFC has a total area of 266,370 ha comprising 148,870 ha of TFR and 117,500 ha of the BSFP. This implies that the BTFC is capable of sequestering 171,076,133 CO_2 t per year.

The Carbon emission market came into existence following an international treaty in 1997 (known as the Kyoto Protocol) that in turn came into force in 2006. The treaty binds most developed countries to a cap and trade system for the six major greenhouse gases. Emission quotas were agreed by each participating country, with the intention of reducing their overall emissions by 5.2% of their 1990 levels by the end of 2012. Under the treaty, for the 5 year compliance period 2008-2012, countries discharging less than their quota can sell credits to others that go above their quota.

The treaty essentially sets up an emission system to control pollution by providing incentives to reduce emission of pollutants. Under the system a central authority sets up a cap on the amount of pollutant that can be emitted. Companies are issued emission permits and hold an equivalent number of credits which represent the right to emit a specific amount. Companies that need to increase their emission allowance must buy credits from those who pollute less. The transfer of allowances is referred as a trade. In effect, the buyer is paying a charge for polluting, while the seller is being rewarded for having reduced emission by more than was needed. In so doing, companies can reduce emissions most cheaply will do so, achieving the pollution reduction at the lowest possible cost to society.

There are currently active trading programs in greenhouse gases. The largest being the European Union Emission Trading Scheme. Historically the price per tonne of Carbon has been fluctuating at around RM45 to RM125 per CO_2 tonne. However, during the United States and European economic crises in early 2013, carbon emission prices fell to between RM12 to RM25 per CO_2 tonne. For the purpose of this report, an average price of RM18.50 per CO_2 tonne is used in order to assess the economic impact upon CO_2 emission.

Using the above average price, the economic value of CO_2 equivalent emission per year is estimated at RM31.16 billion comprising RM1.40 billion for BSFP and RM1.77 billion for TFR (Table 7). The above values are potential values that have not been realised. These potential values could be captured through carbon offset or REDD Plus programme.

Table 7: Carbon dioxide sequestered by BTFC.

Forest Reserves	Area (ha)	CO2 Emission (Tonne/year)	CO2 Sequestration (RM/year)
Belum State Forest Park	117,500	75,464,375	1,396,090,938
Temenggor Forest Reserve	148,870	95,611,758	1,768,817,514
BelumTemenggor Forest Complex	266,370	171,076,133	3,164,908,451

3.2.4 Estimated Net Present Value with Project (NPV_{WP})

The above benefits and costs reported earlier are not realised now only but far into the future and these benefits and costs could be accumulated by discounting the future values into the current period and summing them up to obtain the NPV_{WP}. Using a discounting rate of 5% and analysing a cashflow over 10 years, the NPV_{WP} of implementing the ecological corridor situation is as shown in Table A. The discounted cashflow is provided in Table B.

If the Forestry Department is capable of capturing the full potential values of the Carbon Sequestration function of the BTFC through a carbon Offset project or REDD PLUS, the incremental net present value (INPV) is estimated to be RM26.95 billion (Table A). The TFR, RBSP and AJFR cover 51%, 41% and 8.5% of the whole BTFC and AJFR together respectively. So if only the Carbon Sequestration function of TFR is captured then the INPV is RM13.61 billion while if only the function by RBSP is captured then the INPV is RM10.73 billion and if the function of AJFR is captured then the INPV is RM2.51 billion. As long as the INPV is positive, which means the NPV with project exceeds the NPV of without project, then the ecological corridor be supported on account of the higher net present values obtained. But if the Forestry Department is only able to obtain a Carbon

Offset project or REDD PLUS support of 0.187% of the area of the total BTFC and the AJFR, then the ecological corridor just breaks even.

Table A : NPVWP under various scenario of carbon sequestration value capture.

Scenario	NPV_{WP}	NPV_{WoP}	INPV*
100% capture of Carbon Sequestration Function	27,242,044,287	294,975,034	26,947,069,254
51% capture of Carbon Sequestration Function 1	13,902,891,291	294,975,034	13,607,916,257
41% capture of Carbon Sequestration Function 2	11,024,795,470	294,975,034	10,729,820,436
8.5% capture of Carbon Sequestration Function 3	2,803,460,168	294,975,034	2,508,485,134
5% capture of Carbon Sequestration Function	1,594,425,969	294,975,034	1,299,450,935
0.187% capture of Carbon Sequestration Function	295,036,632	295,036,632	0

- **INPV** = NPV_{WP}- NPV_{WoP}

1 proportion of TFR over BTFC

2 proportion of RBSP over BTFC

3 proportion of AJFR over BTFC

Table B: Discounted cash flows for the 'With Project" option of the ECCSF at Gerik.

Discounted Inflows

Year	A	B	C	D	E	F	Discounted total inflows
1	542,314	1,693,023	512,129	18,814,845	3,864,000	3,329,808,431	3,355,234,742
2	516,490	1,773,643	487,742	19,710,790	3,680,000	3,171,246,124	3,197,414,789
3	491,895	1,858,103	464,516	20,649,399	3,504,762	3,020,234,404	3,047,203,078
4	468,471	1,946,584	442,396	21,632,704	3,337,868	2,876,413,718	2,904,241,742
5	446,163	2,039,278	421,330	22,662,833	3,178,922	2,739,441,636	2,768,190,162
6	424,917	2,136,387	401,266	23,742,015	3,027,545	2,608,992,034	2,638,724,165
7	404,683	2,238,119	382,159	24,872,587	2,883,376	2,484,754,318	2,515,535,243
8	385,412	2,344,696	363,961	26,056,996	2,746,073	2,366,432,684	2,398,329,822
9	367,059	2,456,349	346,629	27,297,805	2,615,307	2,253,745,413	2,286,828,563
10	349,580	2,573,318	330,123	28,597,701	2,490,769	2,146,424,203	2,180,765,694
Total							27,292,468,001

Year	G	H	I	J	K	Discounted Outflows
1	10,470,060	36,600,000	170,000	361,000	307,312	47,908,372
2					301,458	301,458
3					295,716	295,716
4					290,084	290,084
5					284,558	284,558
6					279,138	279,138
7					273,821	273,821
8					268,606	268,606
9					263,489	263,489
10					258,470	258,470
						50,423,713

Functions of Ecological Corridor and Forest

Areas*
Avoidance of Human Wildlife Conflicts
Eco-tourism and recreational services
Local communities dependence on NTFPs collection
Local businesses from tourism
Non-use conservation values
Carbon sequestration
Cost of establishing Ecological Corridor and BioD Conservation
Cost of Viaduct construction
Cost Tree Planting programme
Expenditure on new Vehicles
Annual salaries and operational costs

It is assumed that the pathway trend of wildlife habitat functions and local communities dependence on NTFPs collection is unclear. The local tourism businesses and tourist value and arrival would be raised by 20%.

4.0 CONCLUSIONS

This section has highlighted the economic valuation of several environmental services provided by the establishment of ecological corridors and the conservation of natural forest in the District of Gerik. In establishing and monitoring these corridors, substantial infra-structural and operational activities have to be undertaken. These activities would require new financial resources and their estimates are provided. The CBA analysis showed that if the Forestry Department is capable of generating incomes through obtaining international interests to set Carbon Offset projects or through the REDD PLUS initiatives, the ecological corridor project is viable. The Forestry Department would have to seek international interests to obtain the Carbon offset projects and REDD Plus to compensate for the cost of implementing conservation efforts undertaken.

Further, potential benefits from the capture of environmental function of maintaining clean water quality (reduced sedimentations) that is used to turn the turbines in the Temenggor hydroelectric power generation plants may to be considered as alternative source of benefits to support the cost of implementing the ecological corridor.

5.0 IMPLICATIONS AND RECOMMENDATIONS

The key to success in implementing the ecological corridor program at Gerik is the integration of management from various stakeholders especially the governing bodies, local community as well the ecotourism operators. However, the management of the ecological corridor in general, should be administered by the governing bodies particularly the Forestry Department. In the context of BTFC, several governing bodies are involved, namely Natural Resource and Environment Ministry (NRE), Perak State Government, Royal Belum State Park (RBSP), National Wildlife Department (Perhilitan), Forestry Department, Agriculture Department and Ministry of Tourism and Culture. Thus, the integration of these bodies is critical so that the project can be successfully managed and sustained.

The success of the ecological corridor depends on sustainable financing. Considering how much investment has to be ploughed into the ecological corridor that is providing various ecological and economic benefits to the world, and to the Malaysian economy, the Forestry Department would have to work towards obtaining global financing through carbon offsets, REDD Plus and other international sponsors.

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PAPER 5: 6

VISITORS' ACTIVITIES ON-TRAIL AND ATTITUDES TOWARDS CONSERVATION OF PROBOSCIS MONKEYS IN BAKO NATIONAL PARK

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ABSTRACT

Visitors' activities were observed and their effects on foraging behaviour of proboscis monkeys in trees were recorded. Visitors were interviewed to seek their understanding of the importance of Proboscis Monkey (*Nasalis larvatus*) as a main attraction of the park. The off-trail activities and visitors engaged in laughing were the most disturbing effects on the foraging behaviour. Majority of visitors rated the survival of proboscis monkeys as very important to them. The presence of the monkeys heightened visitors' satisfaction and experience of the park.

Introduction

The increasing trend of visitors accessing national parks is partly due to the fact that they are more likely able to view wildlife in their natural environments (Donovan & Champ, 2009) and also have access to the range of different wildlife attractions that national parks can offer. These have emerged as an important indicator of quality of experience for visitors accessing national parks (Anderson, *et al.*, 2010). Wildlife viewing has been an effective mechanism for educating visitors about the conservation of wildlife and protection of biodiversity (Ballantyne, *et al.*, 2011), however long durations of wildlife viewing and unregulated tourist behaviour in pursuit of more successful wildlife-viewing opportunities affect not only the biodiversity in general, but also wildlife in particular (Mladenov *et al.*, 2007). These are dependent on the level of disturbance (Griffin, et al., 2007), types of activities either on-trail or off-trail (Higham & Shelton, 2011; Wolf & Croft, 2010), and distance between visitors and wildlife (McLennan & Hill, 2010) that triggers different responses of animals (Blanc, et al., 2006; Blom, et al., 2004; Knight, 2009; Werdenich *et al.*, 2003). Some animals reduce their food intake and/or shorten their foraging times, which result in an inferior visitor experience (Lynn & Brown, 2003).

The desire to view particular wildlife is fuelled by the image that people have developed through previous association (Duffus & Dearden, 1990). Visitors tend to feel more affiliation with an environment that they have previously experienced whereas first-time visitors have generally not formed strong opinions prior to their visit and appear to be more open-minded (Beeton, 2001). Individuals with higher levels of factual knowledge about the environment possess attitudes towards wildlife and their habitats that are consistent with their fundamental values, illustrating the moderating effect of knowledge (Tarrant, *et al.*,1997). The objectives of this study were to investigate how visitors' activities on-trail influence the foraging behaviour of Proboscis Monkey and the awareness and understanding of visitors regarding the conservation of wildlife in general and Proboscis Monkey in particular.

Study Site

Fieldwork was carried out in Bako National Park (NP), Sarawak, Malaysia. The park is small with an area slightly over 27 km². Most rainfall during the *landas* (monsoon) from November to February with a monthly average of 600 mm (average over 17 years). From May to September, average monthly rainfall is only 200 mm and sometimes no rainfall for a week at a time (Good, 1988; Hazebroek & Morshidi, 2000). Temperatures range between 20°C and 32°C.

The popularity of Bako NP to foreign visitors is partly due to Proboscis Monkey being promoted as the park's flagship or "iconic" species, besides having a number of other wildlife species and a diverse array of flora, and being easily accessible and close to Kuching City. The peak seasons for visitation to Bako NP are in the months of July and August (FDS, 2014). The peak period for foreign visitors in July and August mirrored the summer school holidays in Europe, the source of the highest number of foreign visitors. December and January recorded the lowest number of visitors accessing the park.

Materials and Methods

Observation process

Preliminary observation of trail users' activities on-trail were conducted prior to the actual field observation. From this preliminary study, observation site and vantage point at Paku Trail were identified. Eight trail users' activities on-trail, namely walking, talking, photographing, pointing, laughing, silent (normally standstill), binocular use and off-trail were identified and listed. Observations were undertaken from June 2011 to June 2012 at the vantage point which was about 20 m from the entry point. Each specific activity was observed and noted and thus avoided recording combinations of activities that happened concurrently (Treves & Brandon, 2005; van Krunkelsven, *et al.*, 1999).

A trail user for observation was randomly selected among those present on-trail but occasionally an on-trail user whose activity first triggered the Proboscis Monkey's response behaviour was observed (Blom, *et al.*, 2004; Treves & Brandon, 2005). If the observed trail user became invisible another who remained visible from the vantage point was quickly selected. All observations were maintained and grouped within time blocks recorded every fifteen minutes on the field sheets and the number of trail users present in the vicinity of those animals under observation was recorded (Granquist, 2009) and sorted according to gender.

One Proboscis Monkey was randomly selected from the group of proboscis monkeys present near the vantage point without selecting for either female or male (Treves & Brandon, 2005). If the observed Proboscis Monkey disappeared another one was randomly selected that was visible from the vantage point. An interaction was recorded when trail user and Proboscis Monkey were present at the same time at the entry point and observable from the vantage point (Ballantyne, *et al.*, 2007; McLennan & Hill, 2010).

The effects of trail users' activities on-trail were evident if Proboscis Monkey changed its behaviour, stopped foraging and moved away from the observation point to another location (Blanc, *et al.*, 2006). On a number of occasions, Proboscis Monkey that moved from the observation point to mangrove forest nearby due to trail user's activity was visible from the vantage point. The effects of each trail user's activity on Proboscis Monkey's foraging behaviour were recorded from which activity was first encountered (Treves & Brandon, 2005) that caused interruption in the monkeys' behaviour at the observation point. If more than one activity was performed concurrently by a trail user, only the more lasting activity was considered to affect Proboscis Monkey's foraging behaviour and recorded as such.

At the single vantage point trail users on-trail and the monkeys' responses to their presence and activities were recorded (Burger & Gochfeld, 1993; Gale & Jacobs, 1987; Schultz & Bailey, 1978; van der Zande, *et al.*, 1984). Responses were recorded for each individual animal from which a reaction was clearly observed due to interruption by trail users' activities (Burger & Gochfeld, 1993; McLennan & Hill, 2010). Proboscis Monkey's behaviour was continuously monitored for the effects of trail users' activities from the vantage point, changes in its behaviour were recorded until it disappeared from the vicinity of observation point (Griffin, *et al.*, 2007). This was to ensure that only changes in monkeys' behaviour due to visitors' activities on-trail were recorded.

Questionnaires

Pretesting and refining formalized structure and format of questionnaires were done prior to the actual field work (Sallant & Dillman, 1994). Visitor attitudes were measured using a 5-point attitudinal scale. The questions measured visitors' perceptions of the importance of wildlife and Proboscis Monkey to them, ranging from 'very important' (5), 'important' (4), 'not sure' (3), 'unimportant' (2) and 'very unimportant' (1). Measurement of visitors' perceptions of entrance fees and conservation of Proboscis Monkey ranged from 'too high' (3), 'about right' (2) to 'too low' (1). To the question asking whether seeing proboscis monkeys was a reason for their visit, visitors could tick 'yes', 'no' or 'not sure'.

The sample size was 700 day-only (DO) and overnight (ON) visitors. Surveys were undertaken on Saturday, Sunday and selected weekdays. On selected weekdays, the survey was conducted alternately on Monday and Friday because the influx of visitors was similar on those days. Visitors were asked whether they were willing to participate in an interview or to complete a questionnaire before departure. Before completing the questionnaires, visitors were asked whether they had been interviewed to avoid repetition in sampling. The refusal rate was one per cent and the number of lost questionnaires amounted to four per cent of the total number of visitors who agreed to participate.

Face-to-face interviews

Face-to-face interviews provided an opportunity to obtain more detailed information about people's attitudes and views. The questions in the face-to-face interviews were a guideline to find out visitors' specific views corresponding to some of questions asked in questionnaire. A tape recorder was used to record the visitors' comments. On a few occasions, people's responses to one question in face-to-face interviews provided information for several other questions in the questionnaire. From the answers given by visitors, some other related questions were asked to verify their answers. Only one visitor declined to participate in an interview, with the refusal rate being 4 per cent.

Data analysis

The cross-tabulation and chi-square test were used to test for differences in the correlation between trail users' activity on-trail and feeding activity and between DO and ON visitors. Categories were combined where expected frequencies were sufficiently low to compromise the validity of the chi-square test (viz. where the proportion of cells with expected frequencies less than 5 exceeded 12.5%). The test of significance of the difference in proportions for binary variables and the non-parametric Mann-Whitney *U*-test for two independent samples were also used to analyse relevant data. P-values of 0.05 or less were considered significant.

Results

Trail users' activities on-trail

The activity that the randomly selected and observed trail users (TUs) were most frequently engaged in was talking, representing 42.2 per cent of all activities observed (Table 1). Most visitors stayed about 20 minutes at or in the vicinity of the entry point. Photographing was the second most frequently observed activity (29.4%) performed on-trail during the period of study, followed by walking (20.7%). Silence and/or standing still at the entry point was not frequently observed (4.2%). Pointing to Proboscis Monkey represented 1.3 per cent of the observed activities of TUs, whereas laughing was rarely observed, at 1 per cent. TUs on-trail also rarely used binoculars, representing just 0.8 per cent of all the activities observed. The least observed activity was off-trail which represented 0.4 per cent of all the activities observed.

Table 1: Observed activities while under observation.

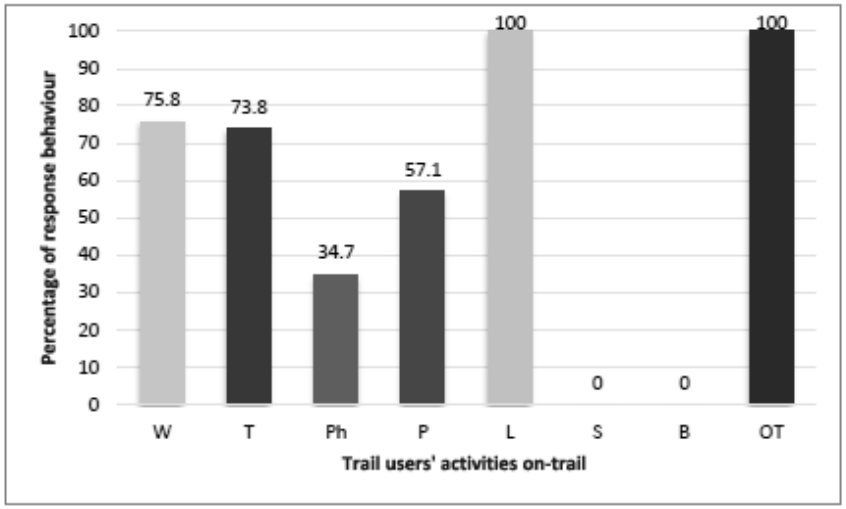
Activity on trail	Percentage
Walking in silence	20.7
Talking (either walking or standing still)	42.2
Photographing	29.4
Pointing	1.3
Laughing	1.0
Silent and/or standing still	4.2
Binocular	0.8
Off-trail	0.4
Total	**100.0**

Feeding-response behaviour

Proboscis Monkey's feeding-response behaviours differed in relation to TUs' activities in the vicinity of those animals under observation. Of these TUs' activities, laughing and off-trail triggered 100 per cent of the feeding-response behaviour (Figure 1). Although laughing and off-trail activities only represented 1.0 and 0.4 per cent of all the TUs' observed activities, they caused the most adverse effects on the Proboscis Monkey's feeding activity. A significant difference was evident in the occurrence of interrupted feeding activity in relation to laughing ($p < 0.001$) and off-trail activity ($p < 0.001$). Walking caused 75.8 per cent of Proboscis Monkey's feeding-response behaviour, which was 2.0 per cent higher than talking (73.8%). On a number of occasions, TUs under observation had to walk to obtain close contact with Proboscis Monkey before taking photographs. A significant difference was evident in the occurrence of interrupted feeding activity in relation to walking ($p < 0.001$). On the other hand, TUs who engaged in talking sometimes did not realize there was Proboscis Monkey in the trees in the vicinity of the entry point. A significant difference was evident in the occurrence of interrupted feeding activity in relation to talking ($p < 0.001$).

TUs that engaged in pointing at Proboscis Monkey triggered 57.1 per cent of feeding-response behaviour which was higher than the 34.7 per cent of feeding-response behaviour due to TUs photographing. A significant difference was evident in the occurrence of interrupted feeding activity in relation to pointing ($p < 0.001$). Referring to Table 1, photographing accounted for 29.4 per cent of all the TUs' observed activities, as opposed

to pointing (1.3%) and walking (20.7%). A significant difference was evident in the occurrence of interrupted feeding activity in relation to photographing (p = 0.001). Conversely, TUs who kept silent and standstill and engaged in binocular activity had no effect on Proboscis Monkey's feeding behaviour, such that no feeding-response behaviour was triggered in relation to these TUs' observed activities.

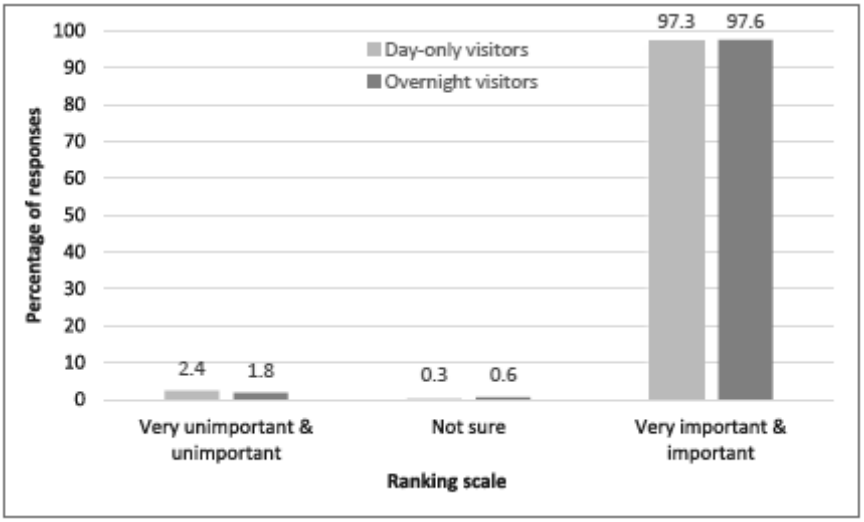


W-walking, T-talking, Ph-photographing, P-pointing, L-laughing, S-silent, B-binocular, OT-off-trail

Figure 1: Proboscis Monkey's feeding-response behavior.

Perceptions of wildlife conservation

The majority of visitors to Bako NP rated the conservation of wildlife habitat as very important or important (Figure 2). There was no statistically significant difference between DO and ON visitors in attitudes to wildlife habitat conservation (p = 0.7). DO and ON visitors, therefore, had similar levels of awareness of the importance of wildlife habitat conservation. That is, there appears to be no association between attitudes to wildlife habitat conservation and visitors' length of stay.



F s it to you that wildlife habitat be conserved in Bako National Park?"

The opportunity to see wildlife was one of the respondents' reasons for coming to Bako NP. A large number of DO and ON visitors rated the opportunity to see wildlife as very important in influencing their decision to come to Bako NP (Figure 3). Respondents who were interviewed also mentioned that the opportunity to see wildlife was important on their decision to visit Bako NP. However, there was no statistically significant difference between DO and ON visitors on their decision to see wildlife (p = 0.1). This suggests that there is no association between the importance of viewing wildlife as a motivation for visiting Bako NP and the length of stay at Bako NP.

Figure 3: Comparison of user groups' responses to the question: "How important was the opportunity to see wildlife in influencing your decision to come to Bako National Park?"

Most respondents intended to see Proboscis Monkey (Figure 4). There was no significant difference (p = 0.2) in the intentions of DO and ON visitors. This suggests that there is no association between the intention of viewing Proboscis Monkey and the length of stay at Bako NP.

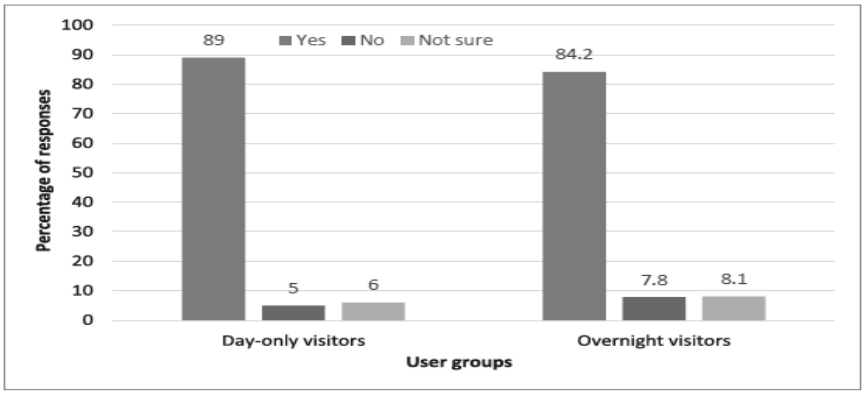


Figure 4: Comparison of user groups' responses to the question: "On your present visit, are you intending, or did you intend, to see Proboscis Monkey?"

The majority of visitors rated the survival of Proboscis Monkey as very important to them (Figure 5). Only a small proportion of visitors said that Proboscis Monkey survival was very unimportant and unimportant to them. Face-to-face interviews supported the finding that the presence of Proboscis Monkey heightens visitors' satisfaction and experience of Bako NP. There was no significant difference between DO and ON visitors in their views about the importance of the survival of Proboscis Monkey (p = 0.4). In other words, they had similar levels of awareness and understanding of the importance of Proboscis Monkey survival in Bako NP and there appears to be no association between the importance of Proboscis Monkey survival and length of stay at Bako NP.

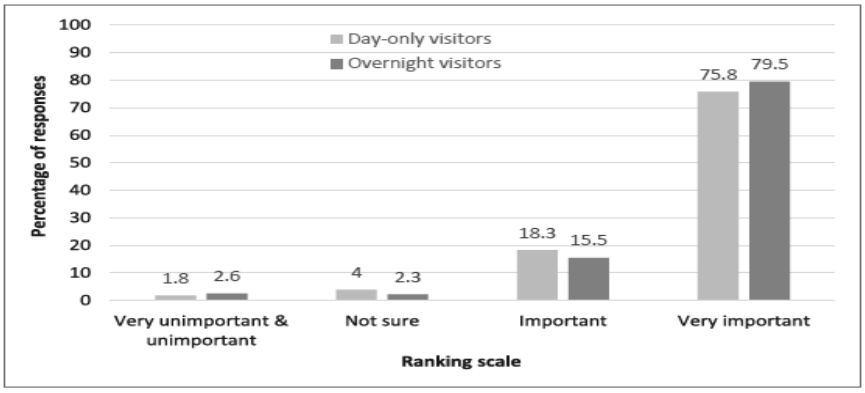


Figure 5: Comparison of user groups' responses to the question: "How important to you is the survival of Proboscis Monkey in Bako National Park?"

Most male (98%) and female (97%) visitors said that wildife habitat conservation was very important or important to them. There was no statistically significant difference between male and female visitors in attitude to wildlife habitat conservation (p = 0.3). This suggests that there is no association between attitude to wildlife habitat conservation and gender, at least among those visiting Bako NP. The opportunity to see wildlife was very important and important for a large proportion of male (89%) and female (91%) visitors as a motivation for visiting Bako NP. There was no statistically significant difference in visitor gender in this regard (p = 0.5). Male and female visitors had similar levels of awareness and understanding of the importance of Proboscis Monkey survival in Bako NP. Most male (79%) and female (78%) visitors said that the survival of these monkeys was very important to them. The difference was not statistically significant (p = 0.6).

Visitors over 46 (84%) and below 45 (86%) years of age thought that the conservation of wildlife habitat in Bako NP was very important to them. Age was not a significant determinant of attitudes to wildlife habitat conservation in this regard (p = 0.3). A large number of visitors aged over 46 (57%) and below 45 (55%) rated the opportunity to see wildlife as very important in influencing their decision to come to Bako NP. However, there was no significant difference between these two age groups in their views about the importance of viewing wildlife as a reason for visiting Bako NP (p = 0.6). The proportions of visitors over 46 (79%) and below 45 (78%) years of age who said that the survival of Proboscis Monkey was very important to them, was also not significantly different (p = 0.9).

A greater proportion of foreign visitors compared to local visitors considered the conservation of wildlife habitat to be very important (Figure 6). This difference was highly significant (p < 0.001).

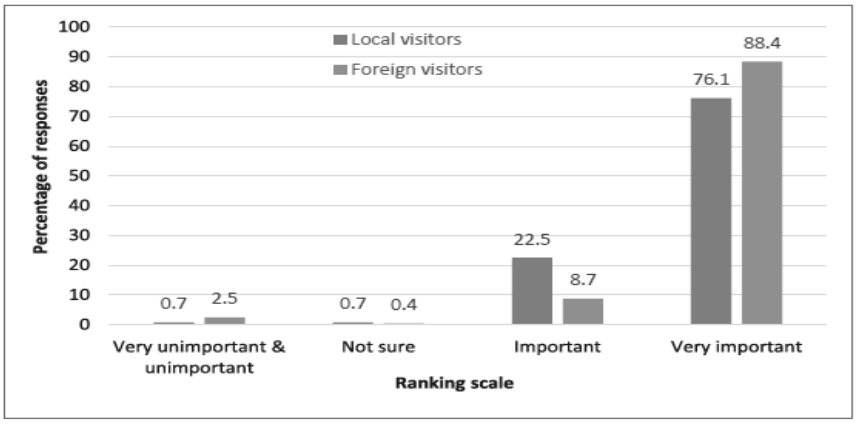


Figure 6: Comparison of local and foreign visitors' responses to the question: "How important is it to you that wildlife habitat be conserved in Bako National Park?"

There was no significant difference in the opportunity to see wildlife as a motivation for visiting Bako NP between local and foreign visitors (p = 0.1). However, the difference in views between local and foreign visitors about the importance of Proboscis Monkey survival was highly significant (p < 0.001). Foreign visitors were more likely to regard the survival of Proboscis Monkey as important or very important (Figure 7).

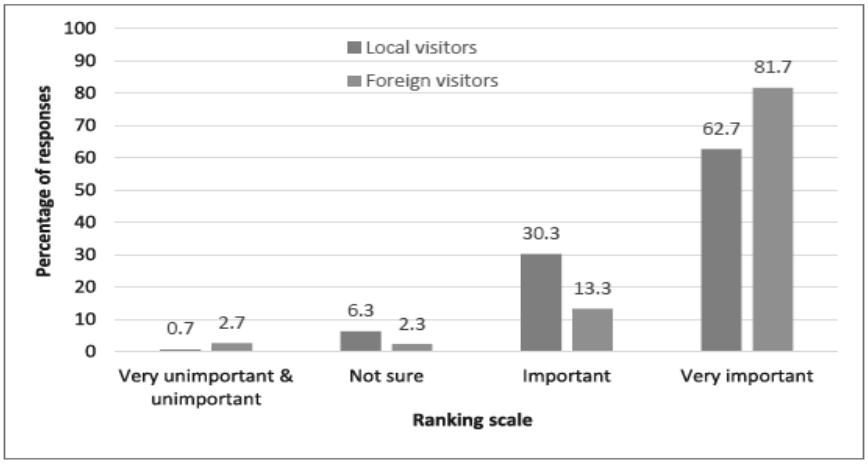


Figure 7: Comparison of local and foreign visitors' responses to the question: "How important to you is the survival of Proboscis Monkey in Bako National Park?"

There was a majority of visitors who regarded the fee as being about the right amount (Figure 8). A statistically significant difference existed between DO and ON visitors, in that a greater proportion of ON visitors compared to DO visitors thought the fee was too low (p = 0.002). A statistically significant difference also existed between DO and ON visitors in terms of their views on the use of entrance fee for the conservation of Proboscis Monkey (p = 0.001). A large number of DO visitors rated the entrance fee about right if it was used for the conservation of Proboscis Monkey, whereas the majority of ON visitors thought the entrance fee as too low (Figure 9). Face-to-face interviews revealed that ON visitors were willing to pay more if the entrance fee was used for wildlife conservation especially that of Proboscis Monkey, whereas DO visitors still said the amount was about right. Therefore, ON visitors were more likely to say the fee was too low if it was intended to be used for the conservation of Proboscis Monkey.

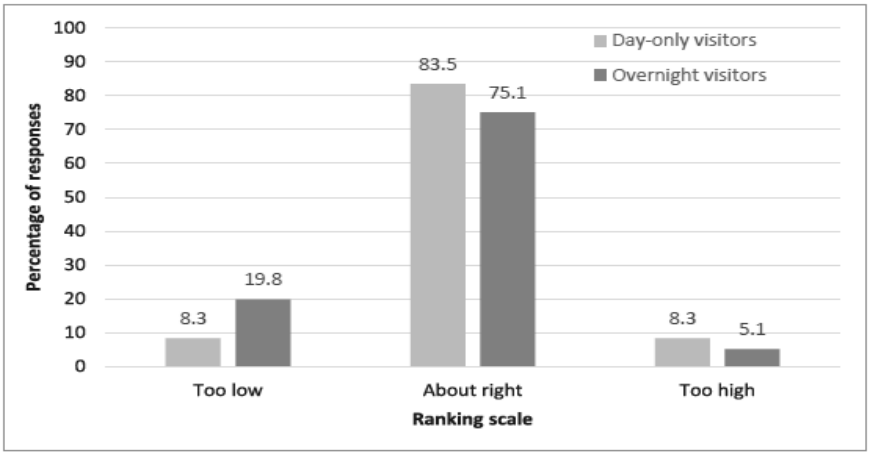


Figure 8: Comparison of user groups' responses to the question: "Do you think the Bako National Park entrance fee is: "

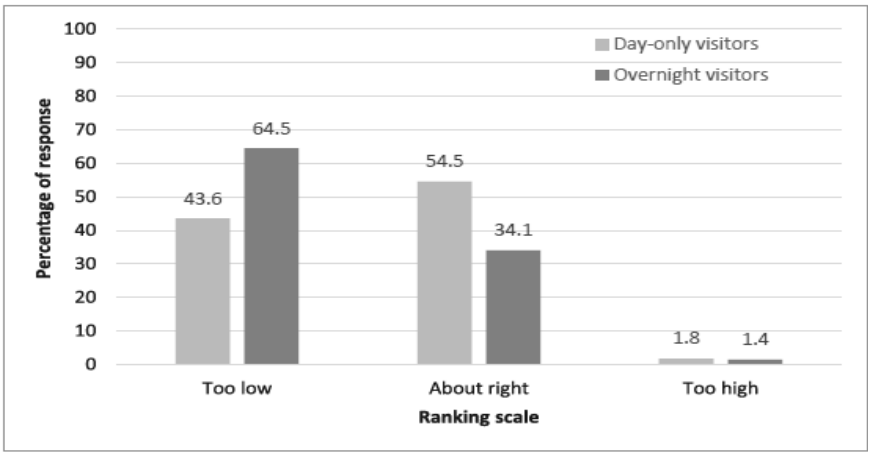


Figure 9: Comparison of user groups' responses to the question: "If the money from the entrance fee was used for the conservation of Proboscis Monkey how would you answer the above question?"

Discussion

Trail users' activities on-trail

The impact of trail users' activities on Proboscis Monkey corresponds to the types of activities they engaged in. Such impacts have been reported in other research by many researchers including de la Torre, *et al.*,(2000); Griffiths and van Schaik (1993); Grossberg, *et al.*,(2003); Johns (1996); and Werdenich *et al.*, (2003). Therefore, although Proboscis Monkey has become habituated over the last few years, visitors' activities on-trail may pose stress to these monkeys. The higher percentage of TUs talking on Paku Trail as opposed to other TUs' activities may be partly due to the higher number of DO visitors accessing this trail. DO visitors tend to make full use of their time while in Bako NP and Paku Trail is always the main targeted location for them to enjoy their trip to the park, as opposed to ON visitors who have more time and have planned to fulfil their different priorities of visiting a number of locations in the park.

The talking trail users at the entry point seriously affected Proboscis Monkey, forcing them to move away from the vicinity of the observation point. The tendency to engage more in talking while walking or viewing Proboscis Monkey occurred when trail users were in a large group. Although not all, some guided tours accessing Paku Trail involved an interpretive talk at the entry point, which is important in nature-based tourism with a wildlife component so as to inculcate better understanding and knowledge about protecting wildlife. The talking trail users were not proportional to the photographing trail users because in most cases not all trail users brought cameras with them. Likewise, while trail users engaged in photographing, they were not always engaged in talking at the same time.

Photographing Proboscis Monkey was the second highest activity observed on-trail; a challenging but predominantly silent and stationary activity that trail-users preformed on Paku Trail once the animals were sighted. This activity most often excluded talking and walking, although occasionally they were observed to walk closer to Proboscis Monkey in pursuit of a better photo. Moreover, Proboscis Monkey on Paku Trail were observed to be less habituated than Proboscis Monkey in the park headquarters (pers. obs.) and as such there was less opportunity to view and photograph the monkeys on the trail as a result of the infrequency of trail user-Proboscis Monkey encounters. According to Boyle and Samson (1985) photographing wildlife has been a popular non-consumptive activity in natural settings. However, they found photographing activity is potentially more disturbing to wildlife because encounters are likely to be more frequent and of longer duration. Given the situation on Paku Trail, although trail users walked closer to better view Proboscis Monkey, they could not come close enough to inflict direct impact because Proboscis Monkey was positioned high in the tree canopy. In a number of cases, they photographed Proboscis Monkey at a distance that was well out of direct impact range. The disturbance associated with photographing animals is not insignificant, given feeding together is important life sustaining activities for an animal of this size and energy requirements. Such a finding reflects that found by Green and Higginbottom (2000). Although some trail users went out of their way to approach the monkeys, most stayed at the entry point to photograph them and undertook prolonged vigils. This explains the lesser impact of photographing in comparison to talking and walking

Two categories of trail users walking on Paku Trail were identified. Firstly, a number of these walking trail users just passed the entry point and continued along the trail even though they were aware of Proboscis Monkey in the trees. A second category of walking trail users slowed down their walking pace when they encountered Proboscis Monkey in the tree canopy. It seemed that they inadvertently encountered Proboscis Monkey as they enjoyed walking on-trail. Therefore, most of the walking impact on Proboscis Monkey occurred incidentally. The impact was more disturbing to the monkeys if trail users comprised a large group of more than five people. As demonstrated by Griffiths and van Schaik (1993), some large animals change their activity patterns and move out of areas of heavy human disturbances. On Paku Trail, walking trail users may also cause changes in Proboscis Monkey's daily-activity patterns, as walking activity has been observed to disturb Proboscis Monkey's foraging behaviours. Large groups of walking trail users on Paku Trail were always accompanied by tourist guides. However, there were a number of incidents in which a large group of walking trail users without a tourist guide passed the entry point. Both of these types of walking trail users adversely affected the foraging behaviour of Proboscis Monkey. Proboscis Monkey did not flee immediately however they gradually moved away from the entry point. This reaction is similar to the behaviour of chimpanzees (*Pan troglodytes*) that were found to respond to both trail users walking or standing, as documented by Werdenich *et al.*,(2003).

It was unsurprising that pointing activity on-trail had a greater effect on Proboscis Monkey than photographing. Trail users would tend to tell other members in a group of the presence of Proboscis Monkey by pointing. Pointing disturbed Proboscis Monkey's foraging behaviour because it involved body movements such as raising hand and finger toward the monkeys. In comparison, most trail users who took photographs of Proboscis Monkey did not make such obvious movements. This level of disturbance was in contrast to trail users who kept silent or stayed at a standstill and used binoculars. Besides the limited number of trail users engaged in these activities, they also carried the activities out in a peaceful and quiet manner that was not disturbing to the foraging activities of Proboscis Monkey. Viewing Proboscis Monkey using binoculars did not require that trail users come closer to wildlife, and could be undertaken at any direction or distance from any Proboscis Monkey they encountered at the entry point. The nature of both silent and binocular activities that trail users engaged in on-trail therefore manifested the non-response behaviour of Proboscis Monkey.

In contrast, laughing and off-trail which were minor activities that trail users engaged in on Paku Trail inflicted a more adverse effect on Proboscis Monkey. A previous study of wildlife confirmed that trail users' behaviour on-trail caused serious displacement of wildlife from trail (Griffin *et al.*, 2007). In this study, Proboscis Monkey moved away from the observation point due to the trail users' activities, especially laughing and off-trail but the direction of movement was dependent on their position in the canopy when the disturbance occurred. On a

number of occasions, they moved to the mangrove forests due to trail users' activities, which could be considered a fairly serious displacement from their original location. Laughing and off-trail activities should not be undertaken in natural wildlife settings such as Paku Trail. Trail users who engaged in laughing may not have been aware of the consequences of this activity on the animals. Laughing would most likely have been generated by the physical appearance of the animals, the male in particular. Most trail users who engaged in this activity were young people or school children in large numbers or groups. Besides their high pitched tone, their voices were also louder than the typical talking that trail users engaged in on-trail, which had already been observed disturbing foraging activities of Proboscis Monkey. de la Torre *et al*., (2000) found that high noise levels have caused lower reproductive success in Pygmy Marmosets (*Cebuella pygmaea*) in areas of heavy tourism activity.

The impact of off-trail activity was also found to be seriously disturbing to Proboscis Monkey's foraging activities, regardless of the number of trail users engaged in it. The off-trail activity was engaged in regardless of whether trail users realized the presence of Proboscis Monkey in the trees or not. Therefore, both incidental and non-incidental contact with Proboscis Monkey through the off-trail activity had some adverse impacts on foraging behaviour. Taylor and Knight (2003) found off-trail activity is more disturbing to wildlife than other activities. They suggested that displacement of wildlife from trails due to off-trail activity is too great compared to other activities on-trail. However, at the Kanyancu tourist station in Uganda, off-trail activity is permitted for trail users to obtain close contact with the Eastern Chimpanzee (*Pan troglodytes schweinfurthi*) and other wildlife, resulting in increased habituation (Johns, 1996). While some primates respond differently to off-trail activity (Werdenich *et al.,* 2003), engaging in this activity with habituated primates would make wildlife viewing more interesting. Unregulated off-trail activity may have more disturbing effect on the monkeys. This was evident in a few cases when tour guides engaged in off-trail activity, which resulted in their actions denying Proboscis Monkey's access to mangroves forests, and also interfering with the opportunities of other trail users sighting for this animal. A similar case has been reported by Dunstone and O'Sullivan (1996) where tourist activities have hindered primates' access to important food resources.

Proboscis Monkey's response behaviour

Proboscis Monkey responded to all trail users' activities on-trail except silent and binocular activity. Disturbance to Proboscis Monkey was manifested by their response behaviours to trail users' activities. Proboscis Monkey's feeding activity was mostly affected, as shown by the highest feeding-response behaviour to laughing and off-trail activities. In most incidents, the monkeys on Paku Trail were engaging in feeding activities and seemed unaware of trail users approaching them. Sudden approaches were highly disturbing to the monkeys and caused them to move away from the vicinity of the observation point. However they fled in a dispersed fashion, reuniting in another foraging spot in trees visible from the vantage point, 5 minutes after disturbance. Their dispersal-reuniting time frame may be longer if disturbance continued in close vicinity of their foraging spot. This behaviour appears common as demonstrated in other research on primates, for example Treves and Brandon (2005). The presence of tourists and their associated activities not only causes stress to primates but also abrupt changes in primates' foraging behaviours (de la Torre *et al.,* 2000; Kinnaird & O'Brien, 1996; Westin, 2007). Proboscis Monkey on Paku Trail may not fully habituate to trail users' activities on-trail suggesting that its feeding activities have been adversely affected.

The adverse effect of the trail users' activities on-trail on feeding activity may partly due to Proboscis Monkey engaged in more feeding when the encounters occurred. While the changes in feeding-response behaviour are due to the types of activities on-trail, the types of food sources being accessed during the disturbance event may also be influential. A previous study demonstrated that feeding ecology of leaf-and-fruit-eating primates was influenced by the phenology of food plants (Son & Zoo, 2004; Watts, 2012). The area on Paku Trail where the Proboscis Monkey has been observed is a foraging spot for the monkey due partly to the availability of food resources. Their foraging path from the heath forest to the mangrove forest (coastal mangrove) also weaves through this area (Bennett & Sebastian, 1988; Salter, *et al.*, 1985; Yeager, 1989) such that they may respond frequently to trail users' activities on-trail. Despite the seasonal pattern of visitors accessing Paku Trail, disturbance from visitors continues to occur. There is a high likelihood that it will cause long-term changes in foraging behaviour and possibly displacement of the animals to less suitable habitat.

Perceptions of wildlife conservation

This study demonstrated that younger people below 35 years old dominated the visitor profile, with 66% of visitors under this age staying overnight. Both DO and ON visitors were well educated, and tended to have a positive perception of wildlife and its conservation. Thus, the level of education was not a significant factor influencing visitors' decision to stay overnight or to not stay overnight. The wildlife habitat conserved in Bako NP is of considerable concern to visitors. DO and ON visitors had more or less the same degree of awareness of wildlife habitat conservation. Face-to-face interviews confirmed that visitors did not like to see much intrusive

disturbance in areas of wildlife habitat. Both DO and ON visitors tended to come from developed countries and have a high level of education. As most were from urban environments, and were first-time visitors, DO and ON visitors shared similar levels of understanding in wildlife habitat conservation. As DO and ON visitors did not cover a wide range of social backgrounds, their awareness and understanding of habitat conservation was not associated with their age and gender. Moreover, both DO and ON visitors were dominated by foreigners and their levels of awareness and understanding of habitat conservation were higher than that of local visitors.

Conservation of wildlife habitat is a responsible mean of appreciation of wildlife and would form a good set of human values towards wildlife (Budeng, 2004). These kinds of values would have characterized the majority of visitors in Bako NP. Their awareness of the importance of wildlife habitat conservation is useful information for improving park management. Visitors' understanding of wildlife habitat conservation means that wildlife conservation itself constitutes part of their park experience through wildlife viewing. This is because the conservation of wildlife and wildlife habitat are intrinsically linked with one another. Any adverse impact on wildlife habitat will affect the wildlife or wildlife conservation will be ephemeral. Therefore, management of wildlife habitat should be in accordance with ecological principles (Warren & Goldsmith, 1974).

The importance of wildlife habitat conservation to park visitors was evident from the fact that the desire to see wildlife was part of the motives of both DO and ON visitors to come to the park; they did not differ in their desire to see wildlife. This was the case for both local and foreign visitors, for males and females and for a range of ages. Face-to-face interviews confirmed that they would not have come to Bako NP if there were no opportunities to see wildlife. Although DO and ON visitors appreciated wildlife and wildlife was important to them, their decision to come to Bako NP was not solely influenced by the opportunity to see wildlife. In other studies, viewing wildlife was the second (Good, 1998) or third (Gias, 2001) recreational opportunity or motivational factor for visitors to come to Bako NP. Therefore visitors were not only involved in one outdoor activity but nor did they discount the importance of the opportunity to see wildlife in their decision to come to Bako NP. They were aware of the importance of wildlife as part of ecosystem and the need to protect and conserve wildlife.

Visitors realized the importance of Proboscis Monkey survival to them, and there was little difference between DO and ON visitors, or between different age groups or genders in this regard. The level of awareness and understanding of the need for conservation of Proboscis Monkey was similar among DO and ON visitors. They understood that the survival of a single species was important and thus the conservation of Proboscis Monkey heightened their satisfaction and experience of the park. Survival of a single species can be construed as important to the survival of all species and their diversity including their function in an intact ecosystem (Jewel, 1974). A majority of DO and ON visitors may have held this principle because most came from urbanised countries. While the significant role of single species would enhance visitor experience, park and wildlife interpretation should focus more on local visitors because their awareness and understanding of the survival of Proboscis Monkey were lower than foreign visitors.

The awareness of the survival of Proboscis Monkey among DO and ON visitors indicated these monkeys would also influence their decision to come to and experience Bako NP. Accordingly, if anything happened to the survival of Proboscis Monkey in Bako NP this would not only affect visitor experience but also the park's long-term conservation goal. Therefore, affording opportunities for public appreciation and enjoyment should not be at the expense of the long-term conservation goal because it would detract from ecological sustainability of the park. Moreover, emphasis should not entirely focus on visitors' preferences because this could lead to a deterioration of wildlife habitat in general or adversely affect single species in particular (Lemons, 1987).

The entrance fee is one of the better yardsticks of visitors' awareness of wildlife conservation. Visitors differed in their views about the entrance fees although most said they were about right. They did not know who received entrance fees or how they were utilized. In face-to-face interviews, visitors commented that park fees should be used for park maintenance and wildlife conservation in the park. Most DO visitors thought the entrance fee was about the right amount. Conversely, there were two views among ON visitors about the entrance fee, one that it was about right or that it was too low, although most believed it was about right. Their awareness of wildlife conservation in general was underscored when most of them were convinced the entrance fee was too low if it was to be used for the conservation of Proboscis Monkey. Theopinion varies with DO visitors; most of them believed that the entrance fee for Proboscis Monkey conservation would have been about right. There was no association between DO and ON status of visitors and their views about the appropriateness of the fee. When the question did not state where the fees would be allocated, ON visitors were more likely to say the fee was too low. The different perceptions of entrance fees and willingness to pay suggested that ON visitors were more aware of and had a higher level of understanding of Proboscis Monkey conservation than DO visitors.

This finding suggests a difference in awareness between DO and ON visitors about Proboscis Monkey conservation. ON visitors were more understanding and had a higher degree of awareness of Proboscis Monkey conservation than DO visitors. ON visitors were willing to pay more if the entrance fee was used for wildlife conservation especially that of Proboscis Monkey, whereas DO visitors still said it was about right in the situation. ON visitors further commented that sufficient revenue should be obtained to maintain the park for wildlife conservation. Despite having good knowledge and a willingness to pay more for conservation, ON visitors' attitudes were also influenced by their background because a majority of them came from rich countries. This finding is supported by the fact that people from wealthier nations are willing to pay more for conservation (Niesenbaum & Gorka, 2001). Park and wildlife interpretation could focus more on DO visitors in terms of educating them about Proboscis Monkey in the park. Willingness to pay more for Proboscis Monkey conservation on the part of ON visitors should be seriously considered, because this is the client group that better understands issues relating to the sustainable use of the park, and whose experience will be rewarded through such conservation.

Conclusions

An understanding of wildlife habitat conservation can be nurtured in both visitors and park managers through park and wildlife interpretation. Therefore, both wildlife ecology and human dimensions of wildlife viewing need to be considered in the pursuit of conserving wildlife and providing quality of experience for visitors.

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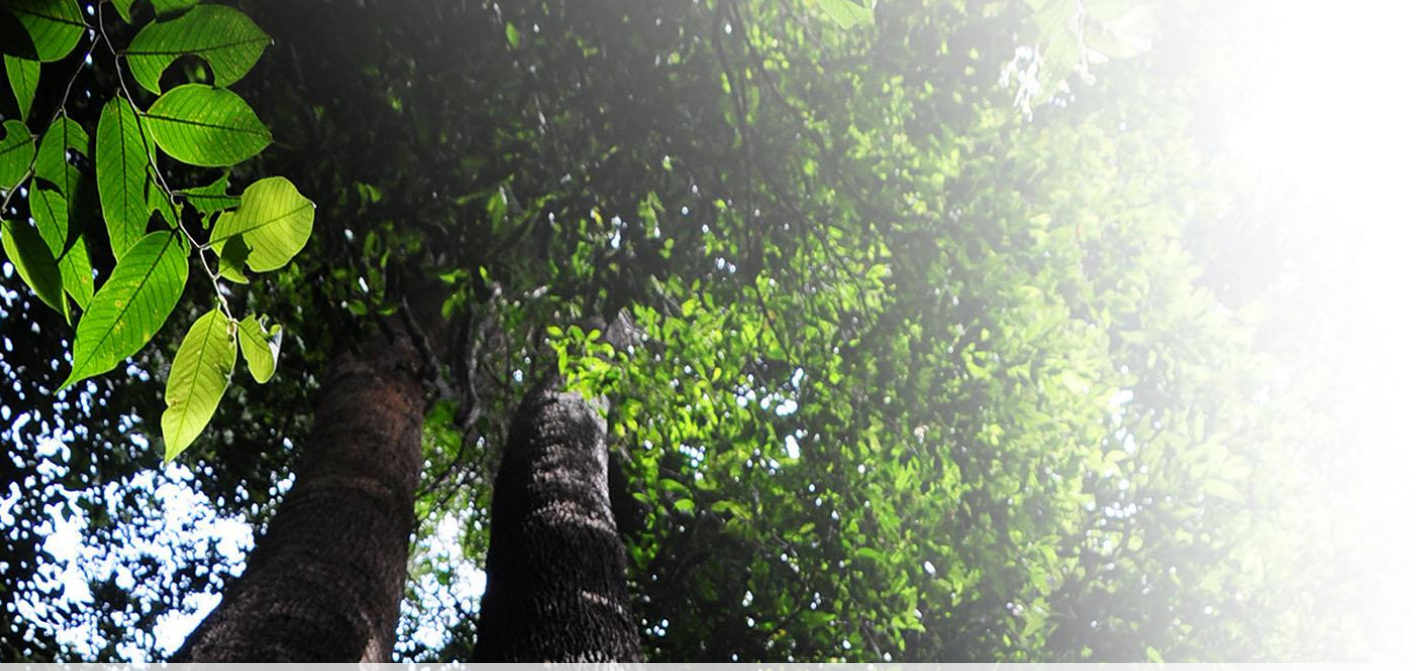
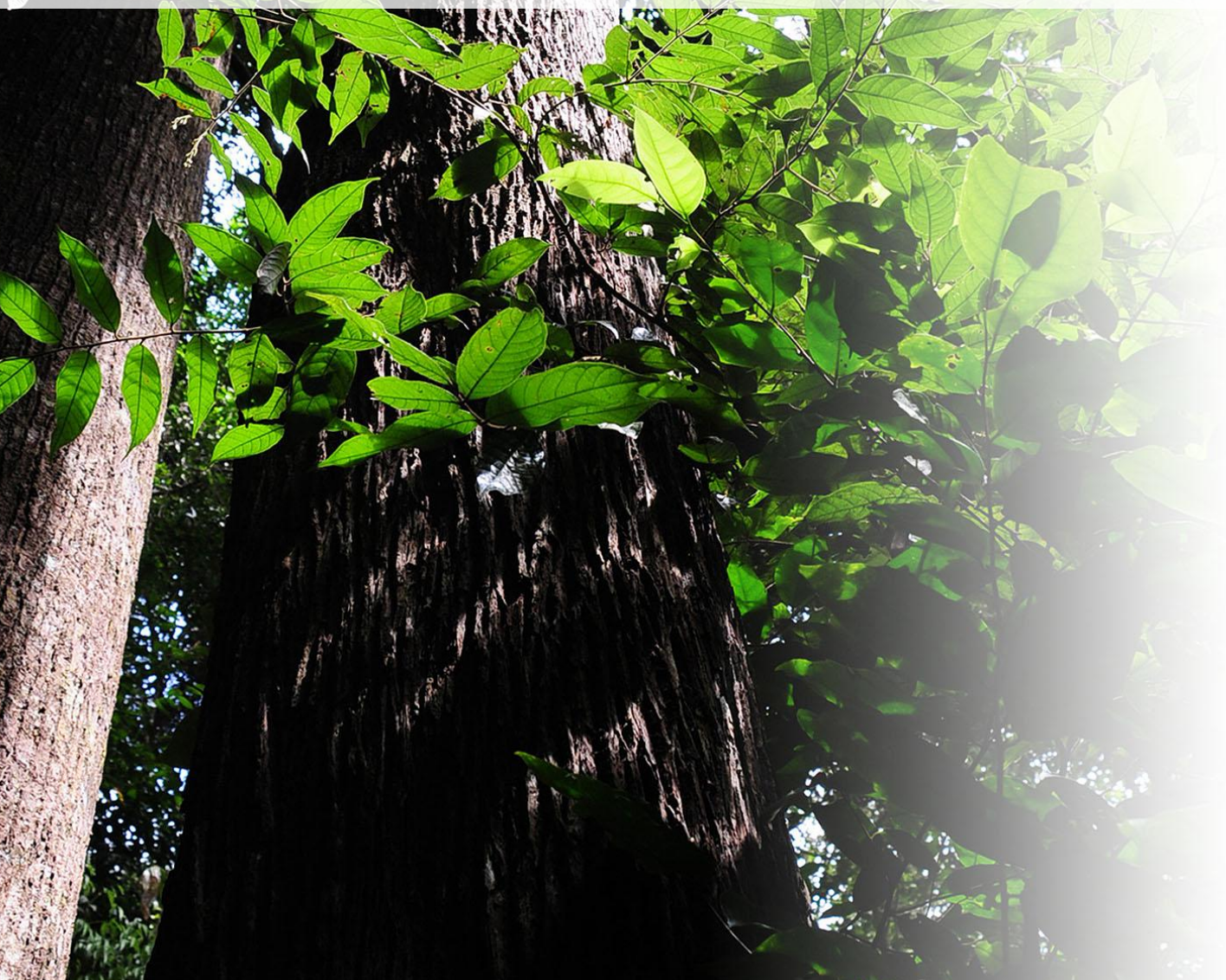


WORKSHOP SESSION VI

SOCIAL FORESTRY: STAKEHOLDERS, PARTICIPATORY AND AWARENESS



PAPER 6: 1

ENGAGING LOCAL COMMUNITIES IN SUSTAINABLE DEVELOPMENT AND CONSERVATION IN SARAWAK

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ABSTRACT

Sarawak has a large land area of 12.4 million ha and a small population of 2.6 million people. Some 50% of the people are rural-based and live in remote and sparsely scattered longhouses and villages. Owing to the very rugged and difficult interior terrain and lack of road infrastructure, bringing development to these people is extremely challenging for the government. Many communities live just outside of the 48 Totally Protected Areas (TPAs) comprising national parks, wildlife sanctuaries and nature reserves. They have little say in the TPAs management because protection and conservation are mainly the responsibility of the government. Resource protection is becoming increasingly challenging due to growing development pressure and competition among different stakeholders. TPAs are especially vulnerable due to their rich and exploitable resources. Local communities can play an effective complementary role in conservation management and sustainable development if they are given the opportunity to do so, as evidenced under the ITTO-funded projects in Lanjak Entimau Wildlife Sanctuary and Pulong Tau National Park. Allowing a share of the resources in the TPAs to be developed sustainably, participants have been able to generate steady additional cash income and become less dependent on the forest. They are also able to better appreciate the benefits of living in an unpolluted and resource-rich environment. Community service initiative aims to narrow the gap between the government and people through effective communication and collaboration in implementing community-based projects for mutual benefits.

1. INTRODUCTION

Sarawak has a large land area of 12.4 m ha and a small population of only some 2.6 million people. Some 50% of the 40 sub-ethnic communities in Sarawak still live in close association with the forest in scattered remote longhouses and villages. Although many can now be reached by logging roads, bringing development to the people still poses a great challenge to the government when the settlements are mostly small and widespread.

Like the rural settlements, most of Sarawak's 36 existing national parks and wildlife sanctuaries are also widely scattered and mostly without proper road access. These parks and sanctuaries represent the main store house of Sarawak's rich biodiversity which must be safeguarded against encroachment of any form. In order to do this, a number of factors have to be taken into consideration. Apart from the remote locations, almost all the TPAs surrounded by numerous settlements and timber and plantation licenses which all have an interest in the forest and its products. The TPAs would become vulnerable when resources in the surrounding forests are being steadily depleted. Illegal activities which could have adverse impacts would be tree felling, fishing and hunting for commercial purposes, and clearing of forest for agriculture.

Constituted under the National Parks and Nature Reserves Ordinance (1998) and Wild Life Protection Ordinance (1998), the TPAs are adequately protected by law, for no unauthorized are allowed entry into any of the TPAs without prior consent of the Park or Wildlife Wardens. The question is how to enforce the law effectively when there are 36 national parks and wildlife sanctuaries to look after and on-ground management presence is inadequate. As a result, any local people and timber worker will be able to hunt or remove anything from the parks or sanctuaries without being detected.

In this paper, it is emphasized that local communities can play an effective role in conservation management as co-partners, and by participating in sustainable utilization of forest resources which would lead to reduced dependence on the forest.

2. PEOPLE PARTICIPATION IN MANAGEMENT

There is a difference of opinion among the decision makers on how best to protect the resources of national parks and sanctuaries. The old school of thought insists that the law must be obeyed no matter what, or face the

risk of a penalty. Another group has come to realize that law enforcement by the government alone cannot be effective for reasons already explained above. The concept of local community involvement is mutually beneficial. The people can become the "eyes and ears" of the government in enforcement. In return, the government will provide assistance to help uplift their livelihoods and make them less dependent on the forest resources. The people will also feel a sense of belonging when they are made co-partners in management and given the opportunity to share the benefits of conservation. Examples of case studies in Lanjak Entimau Wildlife Sanctuary are given below.

2.1. Community-based development with local participation

In the mid-1990s, Forest Department Sarawak was appointed as the Executing Agency of the project which was co-funded by the International Tropical Timber Organization (ITTO). The project was entitled "Developing the Lanjak Entimau Wildlife Sanctuary (LEWS) as a Totally Protected Area". Under the project, several community-based activities were introduced to the people. The concept was to assist the people to develop some of the sanctuary's useful products for food security and additional cash income.

LEWS is Sarawak's largest TPA and home to the west Bornean sub-species of orangutan *Pongo pygmaeus pygmaeus*, found also in the adjacent Batang Ai National Park (BANP) and Betung Kerihun N.P. in West Kalimantan. Some 12,000 Iban people used to live in 120 longhouses scattered outside the sanctuary. Although frequent users of the resources are generally confined to those living close to the sanctuary boundary, many longhouse residents who live and work in nearby towns have come to the forest to hunt and fish.

Among the activities implemented in LEWS were:

2.1.1 Environmental education

The aim of this activity was to raise awareness among the longhouse communities and rural school children, with emphasis on the importance and benefits of conservation. It was also to change the perception that forests were meant for timber production only. Many also did not believe that national parks and wildlife sanctuaries were created for the government only and were not meant to be shared. It was for these reasons, among others, that almost all proposals to constitute Totally Protected Areas (TPAs) have met with strong resistance and objection at the initial stages.

2.1.2 Community-based activities

The activities chosen by local participants were fish culture by valley ponds and planting of indigenous fruit crops. Fish culture involved an entire longhouse community while crop cultivation was by individual farmers in their respective farmlands. Fish culture involved the exotic red tilapia (*Oreochromis* sp.) which is fast-growing and unlikely to cause environmental problem as it is not able to survive and breed in fast-flowing rivers. *Tagang* fishery was later introduced.

For pond fishery, an agreement was reached between the project and participating communities to implement the activities together. Construction materials like cement, steel rods and wire netting would be acquired by the project and transported to the sites. Local participants including women helped to collect stones and sand from the rivers, and later helped in the construction of the ponds across naturally flowing rivers.

In the MoU, after release of fish fry, fish feed would be supplied and local participants would take over the maintenance, while the project team would continue to monitor and provide further assistance if necessary. Supply of fry and feed would stop once the participants were able to earn income from selling the fish, but materials for repair would be given where necessary. Participants would get to keep the income, but must deposit 50% of it in a joint bank account, retain 25% for buying new fry and feed, and divided the remaining 25% among themselves.

Although a total of 29 fish ponds in 27 longhouse communities and two schools were constructed, not all were successful because the concept was new and many were not ready to change. Other factors were lack of interest and commitment.

Farmers involved in the planting of indigenous fruits have selected several well known and popular species, e.g. petai (*Parkia*), rambutan and mok (*Nephelium*) and dabai (*Canarium odontophylum*). Planting materials and fertilizers were also provided free of charge and on-farm training on planting and maintenance was given.

3. LESSONS LEARNT

In the past, inadequate publicity and understanding on the purpose of TPAs have led the forest-dependent people to regard TPAs as an obstacle and restriction to their survival and livelihoods. The awareness education programme and support of the government in community-based development have helped to change this. Granting of special privileges to hunt and collect forest produce is an indication that the government is well aware of the people's needs. However, these privileges have been granted only to some communities in several TPAs like LEWS and G. Mulu N.P. For many others which do not enjoy such privileges, encroachment would constitute an offence. With community-based development, the people get to enjoy a share of the resources which many are willing to help to protect.

Food security and additional income have reduced the need to depend on wild protein, so much so that the fish in the rivers has returned and wild pigs have come out of the forest to feed on the farm products. In some areas, e.g. Ulu Mujok, the local people have effectively prevented outsiders from entering the sanctuary to fish and hunt.

Among the main reasons for success are strong community leadership and cooperation of participants, commitment of the project staff, and support from decision makers. The activities in LEWS were later replicated in another ITTO project in Pulong Tau N.P. involving the Penan, Kelabit and Lun Bawang.

4. SUSTAINABILITY

At the end of the two ITTO projects, FDS established the new Community Service Initiative (CSI) unit in 2011 to continue the work in LEWS and PTNP, and to extend the activities to other areas. *Tagang* fishery will be considered wherever possible due to its economic potential and effect on conservation, and because it is easy to implement and maintain.

5. CONCLUSION

Activities that could pose a potential threat to the protected biodiversity in the TPAs are increasing socio-economic development and competition for land and resources. It is evident from the examples from LEWS and PTNP that the people can play an effective and complementary role in enforcement if given the opportunity to do so. This role must first be fully recognized and accepted.

More effort would be needed to enhance the role of the local people as the "eyes and ears" of the government. This includes proper training on law enforcement and creating a mechanism to enable suitable candidates to be recruited as local rangers. On-ground facilities like ranger's posts also need to be upgraded.

Political support is crucial. For the FDS, this has come in the form of increasing financial allocations for CSI to continue. More manpower will also be required.

Currently, Forest Department Sarawak is implementing the ITTO-supported project entitled "Buffer Zone Management for Pulong Tau National Park with Involvement of Local Communities in Sarawak". The objectives of this project are to contribute to the integrated development of the buffer zone for environmental conservation and uplifting local communities' livelihood, and subsequently to secure the buffer zone forest as a resource base for the local communities. This further demonstrates the government's intension to engage local communities in conservation management and sustainable development.

PAPER 6: 2

PILOT EU-REDD+ PROJECTS IN SABAH

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ABSTRACT

The European Union is financing a project named "*Tackling Climate Change through Sustainable Forest Management and Community Development"* to address reduction of carbon emissions from deforestation and forest degradation, conservation of forest carbon stocks and to involve local communities more closely in sustainable forest management initiatives. The project will enhance institutional capacity of the Sabah Government and develop tools to design and implement the State REDD+ Strategy. The intended work is to assist the State Government of Sabah to implement the road map to REDD+ and establish necessary systems and build capacity to design and implement the proposed State REDD+ Strategy. The work will focus on developing a Sabah Forest Monitoring System with functions for Monitoring, Reporting and Verification (MRV) systems and capacity for REDD+; developing or adapting Environmental and Social safeguard Standards (ESS) for REDD+ and enhancing capacity for addressing and implementing the standards; building the capacity of the State for the REDD+ strategy, design and implementation including operation of governance mechanisms and development and implementation of REDD+ projects. These initiative will be demonstrated in three pilot project areas, namely at Kg Gana, Kota Marudu; the K-CoL area along Sg Kinabatangan in Kota Kinabatangan and within the Eco-linc Area around Kinabalu Park, Ranau. This paper elaborates on the initiation and implementation of this State REDD+ initiative, focussing on the Gana Highland EU-REDD+ Project.

1.0 INTRODUCTION

The core elements of Reduced Emissions from Deforestation and Degradation (REDD+) are the reduction of greenhouse gas emissions from deforestation and forest degradation. For this to materialize, several predispositions are required. Among them are international rules, finance and investment, national accountability for future emissions levels compared to current levels; and incentive measures for changes in behavior and policy that involve major external and local drivers of change in tropical forest management, conservation and protection.

Forests have always been on the global agenda with significant adverse consequences of climate change looming over developing countries. The latest IPCC (2007) report estimates that forest conversion is estimated to contribute 17% to global CO_2 emissions. It is a well-known fact that the world's forests store more carbon than is actually contained in the atmosphere.

Sabah, the second largest state in Malaysia has a landmass of approximately 7.48 million hectares, covering 23% of the total land area of Malaysia. Sabah as a state has recorded 0.75% per annum average deforestation rate over the period 1990 to 2010[19]. In the past, during the 1970s' and 1980s' the timber extraction volumes for Sabah remained relatively constant at around 10 to 12 million m^3 per year. By the 1990s', much of Sabah's forests had been heavily and repeatedly logged which led to a decline in timber production. By 1999, the total volume of timber removed dropped to approximately 3.4 million m^3 per annum. This decline is a result of over harvesting, and combined with unsound sustained timber yields management, of the past.

In Sabah, there are many unresolved land tenure issues. Conflict with local communities continues to simmer which the communities claim is a result of historical and ongoing dispossession of their customary lands, whether for the gazettement of protected areas or granting of concessions for logging and plantations or alienation. It is with this challenging background that REDD+ program in Sabah be developed with adequate safeguards in place to ensure that the forests have a future for the wellbeing of the economic, social and environmental landscape in Sabah.

[19] Reynolds, G., Payne, J., Sinun, W., Mosigil, G. and Walsh, R.P.D. (2011) Changes in forest land use and management in Sabah, Malaysia Borneo, 1990-2010, with a focus on the Danum Valley region. *Phil. Trans. R. Soc. B***366**, 3168-3176.

The REDD+ process originated within the climate community and focused predominantly on the reduction of carbon emissions due to deforestation and forest degradation. For Malaysia, it is crucial that when Sabah undertakes future REDD+ activities, they are developed through implementation of state action plans that address the drivers of deforestation and forest degradation, land tenure issues, forest governance issues, gender considerations while ensuring full and effective participation of relevant stakeholders. All of these must be linked to national and state level development goals.

This paper is written as an information dissemination paper under the Tackling Climate Change through Sustainable Forest Management and Community Development, funded through the EU grant.

REDD+ in Malaysia

REDD stands for Reducing Emissions from Deforestation and Forest Degradation. REDD is an international approach of the United Nations Framework Convention on Climate Change, one of the many international Conventions that Malaysia has signed and ratified. Malaysia became a Non-Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC) when it ratified the UNFCCC in 1994, and later in 2002, Malaysia ratified the Kyoto Protocol.

The REDD initiative, from the UNFCCC is to help developing countries manage forests and reduce emissions while maximizing the benefits for the communities and people living around the forests. For this to happen, it requires the cooperation of various ministries and government agencies whose activities and mandates have an impact on forests. In Sabah, Ministries and agencies who have a jurisdictional control over forests, agriculture, industry, mining, energy, water and irrigation are significant stakeholders as they have impacts on forests and all land related sectors. The Sabah Economic Development and Investment Authority (SEDIA) which is responsible for the implementation of the Sabah Development Corridor (SDC) is also a key stakeholder in the process. The SDC is one of the five regional growth corridors in Malaysia, with the specific mission to triple Sabah's GDP per capita by 2025. The impacts of activities at the scale envisaged by the SDC are also expected to affect the forestry and other natural resource based sectors.

The activities to contribute to mitigation actions in the forest sector that are deemed eligible and appropriate are listed below (Decision 1/CP.16, para 70):

- ✓ Reducing emissions from deforestation;
- ✓ Reducing emissions from forest degradation;
- \+ Conservation of forest carbon stocks;
- \+ Sustainable management of forests;
- \+ Enhancement of forest carbon stocks.

REDD entails consultation with a wide range of stakeholders which include local communities, indigenous people, NGOs, government agencies, statutory bodies, private sector companies, prior, during and after the implementation of the REDD activities.

Malaysia is committed to maintaining at least 50% of its total land area under permanent natural forest cover, a commitment made at the Rio Earth Summit in 1992. In support of this national level target, Sabah being the second largest state in Malaysia pledges to ensure that 55% of its land area to be maintained under natural forests cover. As of 2012, about 60% of Sabah's land mass is covered with natural tropical rainforests which covers Permanent Forest Reserves, Parks, Wildlife Sanctuaries, Wildlife Conservation areas, state/alienated forest lands (SFD Annual Report, 2012). About 3.61 million hectares of forests or 49% of Sabah's total land area is legally gazetted as Permanent Forest Reserve (PFR) under the Sabah Forest Enactment (1968).

In 2009, Malaysia made a pledge announced at the UNFCCC COP15 in Copenhagen to a voluntary indicator of up to a 40% reduction in the GHG emissions intensity of GDP compared to 2005 values by the year 2020[20]. This is subject to the timely transfer of environmentally friendly and sound technologies, in addition to access to adequate financing under the UNFCCC, to ensure that Malaysia meets this ambitious goal. In some part, it is expected to be a measure of the nation's success in efforts to develop sustainably.

Within the UNFCCC, many approaches to avoid deforestation have been discussed over the past years. Recently, the non-carbon environmental and social dimensions of REDD+ related to rights and livelihoods development of indigenous peoples and local communities, and the conservation of biodiversity are becoming

[20] Malaysia National Communication to UNFCCC 2011

increasingly noteworthy in the REDD+ dialogue. It is now widely accepted that ensuring environmental and social safeguards of REDD+ efforts will actually make projects more likely to meet the carbon objectives of REDD+.

Therefore, here in Malaysia and specifically Sabah, efforts to develop specific Environmental and Social Safeguards to guarantee the implementation of REDD+ programs are critical. This will contribute to the achievement of the above-mentioned pledges and commitments at the international level. While Malaysia is aiming to be a fully developed nation by 2020, the development of reliable ESS Standards will act to minimize negative impacts and safeguard forests and society for the long term.

2.0 PILOT EU-REDD+ PROJECTS IN SABAH

The European Union and the Sabah State Government has entered into an agreement in 2013 to co-finance a programme entitled "*Tackling Climate Change through Sustainable Forest Management and Community Development".* The purpose is to demonstrate initiatives on community-based forest management and REDD+ in Sabah. The overall objective is to contribute to the sustainable and low carbon development of the State, while the specific objectives is to improve Sabah's REDD+ readiness and implementation through demonstration activities to strengthen community engagement in forest protection and pro-poor sustainable forest management.

The programme, started in December 2013 will run for 48 months with a total co-funding cost of approximately EU4.2 million (approx RM17.5 million). The target groups are the indigenous and local communities living in target areas of Kg Gana, Upper Kinabatangan and Kinabalu Park. Final beneficiaries would be all the forest-based or forest-dependent communities in Sabah, Malaysia and related government agencies.

The expected result is that the forest resources are sustainably managed in three pilot geographical areas in partnership with local communities and community related benefits enhanced. Main activities are:-

- Documentation and sharing of community forest protection, management and livelihood experience;
- Community-based protection and rehabilitation of water catchments in Gana Forest Reserve and agroforestry in degraded lands in and adjacent to Lingkabau Forest Reserve;
- Incorporating REDD+ Concepts into forest conservation activities in the Kinabatangan Corridor;
- Enhancing Forest Conservation and sustainable livelihoods within the Batu Puteh-Deramakot-Malua-Segaliud Lokan forest landscape;
- Establishment and restoration of Community-Conserved Forest Areas (CCAs) and development of sustainable agriculture and enhanced forest-related community tourism options in selected communities in Kinabalu ECOLINC Zone;

The Project will also link with other initiatives and programmes including:

- The Sabah REDD+ strategy development/implementation led by the Sabah Forestry Department
- The Sabah Forestry Department Social Forestry Programme;
- The Heart of Borneo Initiative (HOB) which is supporting the conservation of the forests in the Centre of Sabah and has an emphasis on promoting connectivity and restoration of remaining forest patches;
- The Kinabatangan Corridor Of Life Initiative (KCOL) supported by the Sabah Wildlife Department to enhance conservation of a riverine Corridor along the Kinabatangan River; and
- The Ecological linkage (ECOLINC) Initiative developed by Sabah Parks to conserve forest on community land between Kinabalu and Crocker Range National Parks.

There are 10 specific activities that will be implemented by the Project Team, SFD, Sabah Wildlife Department (SWD) and Sabah Parks, i.e.:

Location: All three pilot sites, by the Project Team.

- Activity 1: Documentation and sharing of community forest protection, management and livelihood experience and feeding results into REDD+ and community development policies and plans.

Location: Kg Gana and Lingkabau Forest Reserve, Kota Marudu, by the SFD.

- Activity 2: Community-based protection and rehabilitation of water catchments in Gana Forest Reserve.

- Activity 3: Community-based agroforestry in degraded lands in and adjacent to Lingkabau Forest Reserve.

Location: Kinabatangan Corridor, by the SWD.

- Activity 4: Development of REDD+ strategy for forest conservation in the Kinabatangan Corridor.
- Activity 5: Enhancing forest protection and rehabilitation within the Batu Puteh-Deramakot-Malua-Segaliud Lokan forest landscape.
- Activity 6: Promoting forest-related sustainable livelihoods and community support for conservation in target villages.

Location: Kinabalu ECOLINC Zone, by the Sabah Parks.

- Activity 7: Establishment of Community-Conserved Forest Areas (CCAs) in selected communities.
- Activity 8: Community-based restoration of degraded habitat in CCAs and adjacent areas.
- Activity 9: Development of sustainable agriculture for livelihoods and enhanced land management.
- Activity 10: Enhancing forest-related community tourism options to support forest management.

3.0 GANA HIGHLAND EU-REDD+ PROJECT

a. Background and Project Context

The Kampung Gana is located on an area of about 2600 ha of stateland in an upland valley surrounded on three sides by Lingkabau Forest Reserve (LFR). More than 2,000 people live in Kampung Gana and adjacent villages. The Lingkabau and Gana Forest Reserves act as water catchment for the villages and agricultural areas. The local communities (in and outside LFR) are mainly Dusun Sundazo and Dusun Kimaragang ethnics groups. When the Forestry Department first started work in area in 1996, there were no school, medical facilities or infrastructure in the area and the villages had no sources of income. They were surviving on shifting cultivation, planting hill padi, tapioca, maize, sweet potatoes, various kinds of vegetables and wild jungle fruits.

The communities from the seven villages in the Lingkabau FR who voluntarily resettled in Kg. Gana have been planting agricultural and agroforestry crops. Due to the fact that majority of the local communities voluntarily resettled in Kg. Gana since 2000, the area developed for agricultural land in their old villages in the Lingkabau Forest Reserve has reduced, and since they moved to the resettlement area, they have access to schools and medical services, but still have restricted options for livelihood. Currently, there are about 50-80 households still remain in their old villages inside Lingkabau FR.

b. Project Location

Figure 1 shows the project area involved (Gana Stateland, Lingkabau Forest Reserve and Gana Forest Reserve). The following Figure 2 shows the location of old villages before they voluntarily resettle at Kg Gana.

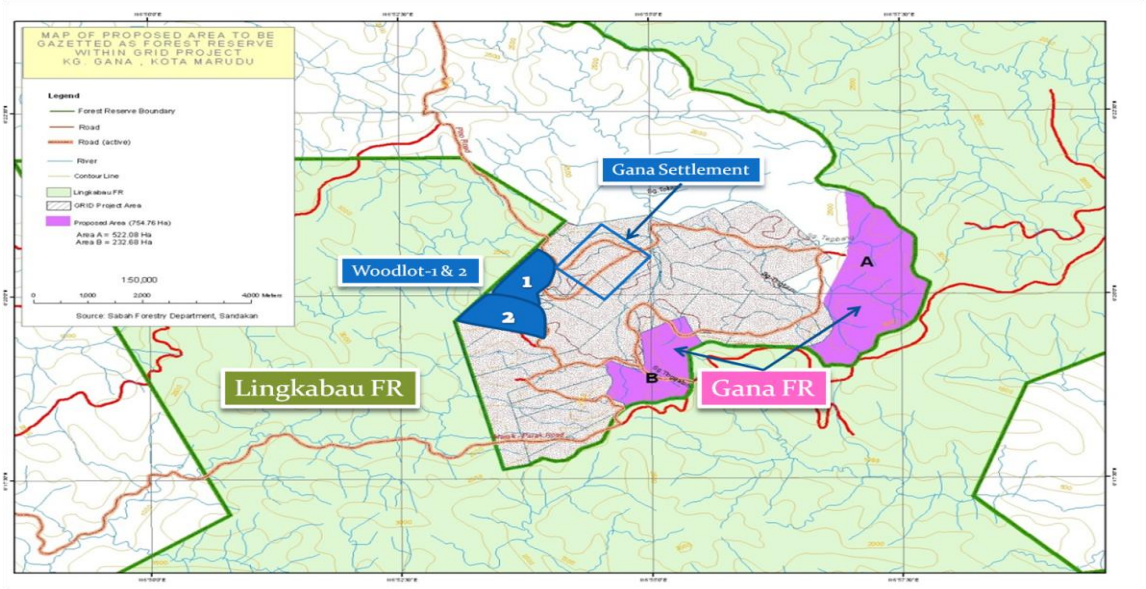

Figure 1: Location of project area.

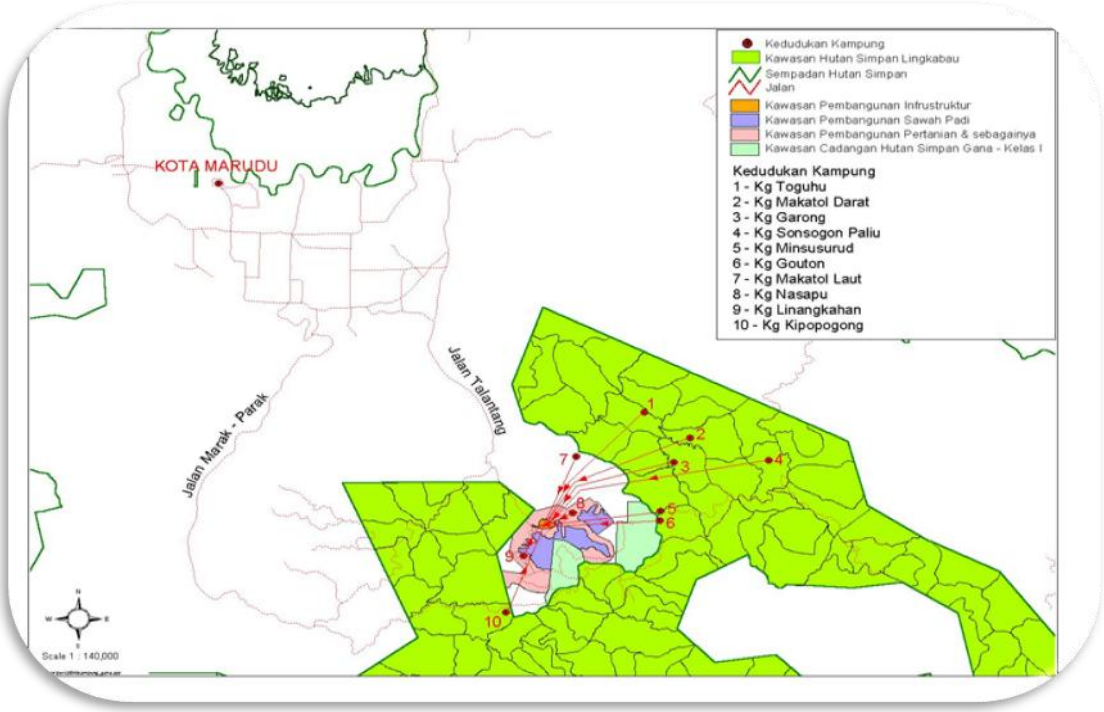

Figure 2: Location of old villages now resettling at Kg Gana.

c. Methodology

The main methods and approaches envisaged in implementing the Action include;

i. Forest Resource Assessment

Assessment of the forest resources will be undertaken to determine the state of the forests resources. This will build on the ongoing work supported under the Ministry of Natural Resources and the Environment to undertake a baseline assessment of forest resources in all of Malaysia using SPOT satellite images. This baseline analysis will map boundaries of forests, plantations and agriculture land.

During the project implementation, the baseline maps for the project sites will be refined as appropriate using more detailed satellite analysis. This may involve separating areas of degraded forest and also overlaying the baseline maps on land status maps to determine the forest areas outside of Forest and Wildlife Reserves and State National Parks. These baseline maps will be used to guide the focus of interventions for forest protection and rehabilitation.

ii. Participatory Community Engagement

Since a major focus of the action is community involvement it is essential that appropriate techniques for participatory engagement be used at the project area. This will depend on the exact nature of the proposed interventions at the sites but will include early consultation with communities in the pilot areas to provide complete information and obtain as appropriate Free Prior and Informed Consent (FPIC) for any activities which may restrict access to traditional used resources or to indigenous lands.

It is also proposed that as fast possible, all activities related to forest management and rehabilitation should involve the engagement of community members directly in propagating the seedlings through community nurseries, replanting and enrichment planting of degraded forests; development and maintenance of rubber and agroforestry zones; monitoring and patrolling of forest areas; and development of alternative livelihoods. Where appropriate, focus will be on empowering the communities to protect and manage the forests on their traditional village lands. Priority will be also being placed on Community-to-community and peer-to-peer learning approaches.

iii. Community Livelihood Development

This action will include various measures to enhance the livelihoods of the targeted communities. The specific livelihood options will be developed and selected through consultation with the respective communities as well as based on expert advice and feasibility assessments. Where possible the livelihood options will be linked back to the maintenance of the forest areas by the communities. Support will also be given for market development and market access to ensure that the communities get a good return from the livelihood activities. Linkage with and guidance from relevant government agencies including Forestry Department, Agricultural Department, LIGS etc. will be provided. Their involvement will be in the form of providing inputs in meeting with the targeted communities, as and when needed, on a case to case basis.

d. Project Activities

Based on the project key methodologies as described earlier, the following project activities and sub-activities have been identified in order to fulfil REDD+ as well as community development criteria, so that this pilot site can be a model system to inform development of future community-based REDD+ policy at local, regional, national and international levels. The proposed activities comprise the core activities needed for the establishment of the "Gana Highlands REDD+ Project" and sub activities.

Activity No 1: Implementation of community-based protection & rehabilitation of water catchment in Gana Forest Reserve.

Project sub-activities include:

1. Assessment of status of water catchment areas and need for rehabilitation or protection activities.
2. Development of community nurseries with suitable indigenous tree species with buy-back scheme for rehabilitation.
3. Replanting and maintenance in selected areas with poor natural regeneration.
4. Silvicultural treatments (climbing cutting, weeding around seedlings etc.) to enhance natural regeneration of existing forest areas.
5. Regular community patrolling to prevent encroachment of fire.
6. Establishment of a community fire prevention programme.
7. Maintenance and protection of streams and rivers important for water supply.
8. Strengthen community organizations to supports engagement in forest protection.
9. Upgrading and maintenance of community gravity of water supply.
10. Enhancing community based monitoring and reporting systems for forest cover and water resources.

Activity No 2: Implementation of community-Based agroforestry in degraded lands in and adjacent to Lingkabau Forest Reserve.

Project sub-activities include:

1 Undertake a rapid assessment of the carbon in the project area and develop and indicative baseline scenario for forest carbon stock for next 5-10 years.
2 Assessment and mapping of vegetation in targeted village and prioritisation of areas for agroforestry enhance livelihoods and provide alternatives for annual crops.
3 Support for strengthening community organization among targeted communities to enhance effectiveness of forest protection, agroforestry management and livelihood development.
4 Rehabilitation of at least 70 ha of degraded land in Lingkabau Forest Reserve.
5 Establishing partnership with FMU licensee for Lingkabau Forest Reserve for development and implementation of agroforestry programme with guaranteed buyback for community tree plantation.
6 Detail assessment and mapping of the additional proposed rubber-agroforestry area at Kg. Gana.
7 Purchasing of high quality latex-timber clone rubber and planting 100 ha of rubber woodlots and maintenance of existing 232 ha of rubber woodlots.
8 Protection of remaining forest in Lingkabau Forest Reserve from encroachment and fire.
9 Development of options for cultivation and harvesting of non-timber forest product (rattan, Medical plants etc.) in rehabilitation areas and rubber agroforestry zones.
10 Community-Based monitoring of agroforestry and rehabilitation areas to determine recovery and carbon stock enhancement.

This activity is led by the Gana Highlands EU REDD+ Project Team with technical support from the SFD, villagers and other partners.

e. Monitoring and Evaluation

Internal monitoring of the project progress will be undertaken by the REDD+ Unit in the Sabah Forestry Department in conjunction with the respective lead agencies for each action. Monitoring missions to the sites will be undertaken at a minimum of six monthly intervals and will assess the progress of the work on the ground in relation to annual and project plans. It is envisaged that periodic evaluation will be undertaken by the EU Delegation and/or external consultants.

f. Management Arrangement

The project is managed by the Sabah Forest Department in coordination with the Sustainable Forest Management Division and Kota Marudu District Forestry Office.

4.0 ECO-LINC PROJECT

a. Background and Project Context

The Kinabalu Ecolinc Project is a connectivity conservation efforts initiated by Sabah Parks to improve ecological connectivity between the Kinabalu Park (KP) and the Crocker Range Park (CRP); two of the most important protected areas (Parks & Wildlife Sanctuary) in Sabah, established under the Parks Enactment in 1964 and 1984 respectively.

The Kinabalu Park is the main tourist attraction in Sabah, hence contributes a big parcel of economic income for the state and for a large number of local communities nearby. Mount Kinabalu, the highest peak in the Malay Archipelago, is located within the Park. Due to its high biodiversity in both fauna and flora, the Kinabalu Park had been designated as Malaysia's first World Heritage Site in the Natural Site category in December 2000. Meanwhile, the Crocker Range Park is the largest state terrestrial park, comprising an area of 139,919ha. It holds significant biological diversity and consists of hill dipterocarp and montane forests. It also serves as a watershed of a number of important rivers that are sources of water supply.

Although Kinabalu Park and Crocker Range Park reside on the same range, the parks are physically separated from each other; their boundaries separated by a distance of about 10km at the closest points.

Forest fragmentation that occurs within these two protected areas due to uncontrolled deforestation and expansion of agricultural and human activities has been the major issue. In the very long run, this could cause the discontinuation of species development, the decrease of biodiversity level and quality of rivers and watershed areas, which is unhealthy for all living creatures. Both parks could become completely isolated from each other and the surrounding forests – hence threaten their ecological integrity.

This Project is therefore an attempt to create a more harmonized habitat corridor for people, plants and wildlife living in between these two Parks, conserving Sabah's natural heritage and empowering indigenous communities. It is to complement current conservation practices, based on the principles that local communities are the best guardian of their natural environments and heritages. Due to this long term vision, a feasibility study for the Kinabalu Ecolinc Project, commissioned by Sabah Parks and funded by SEDIA (Sabah Economic Development and Investment Authority) was conducted by ERE Consulting Group between March 2010 and July 2011 with the aims to propose a strategy for ecological connectivity improvements and implementation plan including costing and funding options.

The study suggests two (2) types of zoning areas; Primary Areas and Secondary Areas. The Primary Areas will be strictly protected; hunting will be prohibited and only limited resource utilization shall be allowed. Meanwhile, the Secondary Areas shall be managed as zones for sustainable resource utilization, and for eco-tourism and related activities. These areas are also known as Kinabalu Ecolinc Zone.

The basic principles for implementation would be:

i. There shall be NO new parks or forest reserves gazetted in this Zone.
ii. Village land and agricultural land shall not be disturbed.

iii. The local communities must be involved in the implementation and management of the proposed Zone.
iv. Land managed for the proposed Zone should be secured in the long term.
v. Any threats to biodiversity must be reduced.

The key method of implementation is the establishment of Community Conserved Areas (CCAs) within this Zone, managed by the local community voluntarily, with supports from the government and its agencies. This is followed by:

i. Community-based restoration of degraded habitat in CCAs and adjacent areas.
ii. Development of sustainable agriculture for livelihoods and enhanced land management.
iii. Enhancing forest-related community tourism options to support forest management.

Improving the connectivity between Kinabalu Park and Crocker Range Park is in line with recommendations of previous studies in Sabah, namely the "Strategy for the Sustainable Development of the Highlands of Sabah and Sarawak", Heart of Borneo Project Implementation Framework for Sabah as well as the Bornean Biodiversity and Ecosystems Conservation (BBEC) programme.

For this strategic vision and community-based conservation approach, the Kinabalu Ecolinc Zone has caught the attention of international funder. This connectivity conservation Zone has been selected as one of the three (3) demonstration sites for the European Union (EU) – REDD+ Climate Change Action programme namely "Tackling Climate Change through Sustainable Forest Management and Community Development", starting from January 2014 to December 2017. This four-year's pilot project is expected to contribute to the implementation of Sabah REDD+ Strategy, comprises:

- Sabah REDD+ MRV (Monitoring, Reporting and Verification System).
- Environmental and Social Safeguards (ESS) for REDD+.
- REDD+ policy frameworks and market opportunities for REDD+ in Sabah.
- REDD+ implementation among key stakeholders.

In June 2014, the Kinabalu Ecolinc Project Team has been established to kick off the Project implementation phase under this EU-REDD+ programme with the Team mission;

"*to enhance awareness and understanding of local communities of the importance of their forests for the continuation of life, and to encourage and raise their participation in conservation efforts and sustainable management of natural resources, voluntarily and continuously*"

The Kinabalu Ecolinc Zone is indeed a long term project goal. It is a strategic action plan, a line of life, a bridge to the future, a path for the continuation of Sabah's natural heritage. The Kinabalu Ecolinc Project is a vision with one ultimate goal – improved connectivity for the sake of all.

b. Project Location

The following maps show the two parks - Kinabalu Park and Crocker Range Park (Figure 3), and the Kinabalu Ecolinc Zone / proposed ecological corridor (Figure 4).

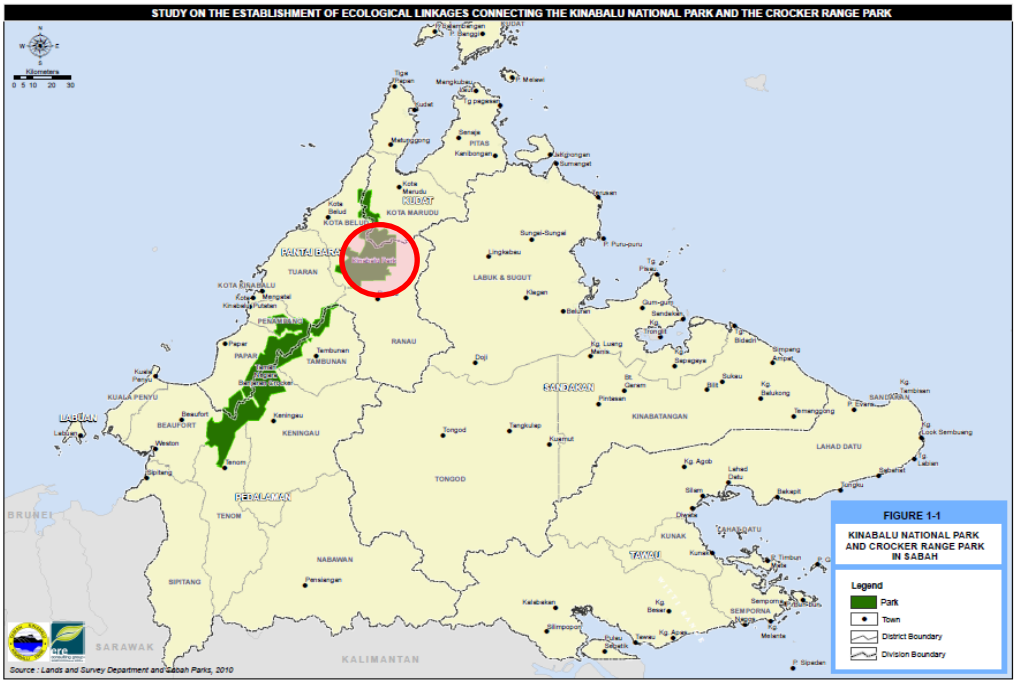

Figure 3: Kinabalu Park and Crocker Range Park.

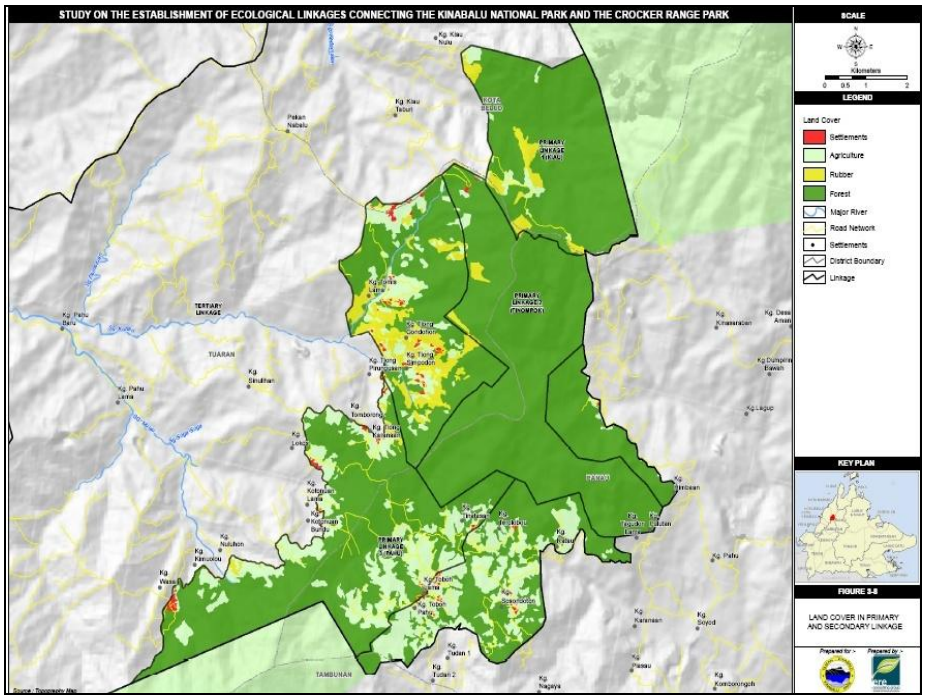

Figure 4: Kinabalu Ecolinc Zone/Proposed Ecological Corridor.

c. ***Methodology***

The key methods and approach for project implementation phase are:

i. Establishment of Community-Conserved Area (CCAs) in selected communities.

The Kinabalu Ecolinc Zone will comprise of a network of CCAs. In addition to the existing Bundu Tuhan Native Reserve, eight other CCAs will be established as Native Reserves. Local communities will be provided

with the necessary support to conduct land surveys and to develop the application for the gazette. The proposed CCAs are listed in Table 1:

Table 1: Proposed Community Conserved Areas (CCAs).

No.	Proposed CCAs	Area (ha.)	District
1	Kiau Nuluh- Bersatu CCA	522.6	Kota Belud
2	Kiau Taburi CCA	395.5	Kota Belud
3	Bundu Tuhan CCA	902.4	Ranau
4	Terolobou-Ratau CCA	138.8	Ranau
5	Toboh Tinatasan	130.6	Ranau
6	Toboh Pahu		Ranau
7	Lokos	166.7	Tuaran
8	Kotonuon CCA	104.3	Tuaran
9	Nuluhon-Kimulau-Wasai CCA	426.3	Tuaran
	Total Area	3,057.2	

Each CCA will have its own Board of Trustees. The Board of Trustees will comprise of village elders and a representative from the government. The day-to-day management of the CCAs will be guided by the Trustees. Once the CCAs are gazetted, the local communities shall develop the management plan for their respective CCAs. The management plan will be based on the general prescriptions for the management of the primary and secondary areas and will be further detailed based on the community's own requirements.

ii. Community-based restoration of degraded habitat in CCAs and adjacent areas

The main focus of this Activity is the reforestation of degraded habitats, which are estimated to be about 200ha, and to enhance structural connectivity in the Primary and Secondary areas. In the Primary Areas, reforestation would be based on 'ecological restoration' where selective replanting of native species would be conducted to develop high quality habitats for wildlife. In the Secondary Areas, reforestation would utilize the 'analog forestry' model where plant species that are utilized by the local communities would be planted while mimicking the ecological functions of natural forest.

Local communities would be engaged to conduct reforestation activities which include the identification and collection of samplings, the establishment of nurseries and implementation of the tree-planting programme. It would therefore be necessary to provide members of the local communities with the technical and financial support to implement this activity.

iii. Development of sustainable agriculture for livelihoods and enhanced land management

The development of sustainable agriculture aims to raise the income levels of households in the region, thereby reducing the local community's direct reliance on the unsustainable utilization of land and forest resources. The sustainable agriculture may help in maximising the returns form a unit of agricultural land, crop production among farmers in the region must be better planned to avoid oversupply which leads to wastage and loss of incomes. In addition to this, new agricultural activities that have the potential to generate higher returns should be explored such as floriculture and organic-farming.

Other activities that will be complementary with agriculture production can be introduced to create wider spectrum of income streams. These include mushroom-farming (which is already well-established in Kundasang), the production of bamboo handicrafts (there is an abundant supply of raw material in the region), and the development of downstream processing, preservation and packaging of food products.

iv. Enhancing forest-related community tourism options to support forest management.

The heritage and lifestyle of the people of the Kinabalu-Crocker Range region offer the opportunity to develop distinct forms of tourism that combine non-consumptive utilization of biological resources and culture. The present lack of 'cultural visibility' of Sabah offers considerable opportunities for tourism development in the region. Three tourism clusters are proposed i.e. (1) Kiau, (2) Wasai-Lokos, and (3) Toboh-Tudan-Bundu Tuhan. These clusters are distinct but share similar characteristics – extensive mountainous terrain, heritage of customs and traditions through language and local beliefs, and patrimony connected to Mount Kinabalu.

Each tourism cluster offers unique products i.e. jungle survival and bird watching (Kiau), alpine-like landscape and outdoor activities (Tudan-Toboh-Bundu Tuhan), and agro-tourism (Wasai-Lokos). The infrastructure for tourism development in each cluster is to be upgraded. These include road infrastructure (road upgrade, signboards, and look-out points), information centre, and a cultural centre to showcase the highland Kadazandusun culture.

d. Project Activities

Based on the key activities outlined and described earlier, the following project activities and sub-activities have been identified to fit into the objective EU-REDD+ Programme 'Tackling Climate Change Through Sustainable Forest Management and Community Development', as well as to achieve the Kinabalu Ecolinc – Connectivity Conservation goals.

Activity No.1: Establishment of Community-Conserved Area (CCAs) in selected communities.

Project sub-activities include:

1. Workshop/dialog/discussion with communities involved: Purpose and benefits of Kinabalu Ecolinc project.
2. Participatory identification of CCAs, planning of communities activities for establishment of CCAs (Part of participatory land-use planning).
3. Establishment of CCAs management committees.
4. Prepare and formulate CCAs framework, laws & regulation.
5. Prepare agreements/MOU with communities, other stakeholders and neighbours.
6. Official launching of agreements/MOU.
7. Survey and mapping of CCAs.
8. Gazetting/publishing of CCAs according to existing laws and regulations.
9. Community patrolling and monitoring.

Activity No.2: Community-based restoration of degraded habitat in CCAs and adjacent areas

1. Ground survey with stakeholders to identify restoration area.
2. Participatory identification of areas of restoration.
3. Participatory planning of activity.
4. Establishment of community nurseries for forest species and raising of seedling construction (poly bag, seeds collection, maintenance tools and equipment.
5. Establish community-based replanting and maintenance of selected areas.
6. Implementation of restoration (planting event).
7. Maintenance and monitoring.
8. Replanting to ensure survival rate.
9. Silviculture operation (maintenance of existing trees).

Activity No.3: Development of sustainable agriculture for livelihoods and enhanced land management

1. Conduct workshop on sustainable livelihood and land management.
2. Participatory assessment and mapping of existing agricultural lands and identification of risks and opportunities for sustainable management.
3. Conduct capacity building for sustainable agriculture (soil conservation, crop selection and rotation, fire prevention etc).
4. Implementation of the guidance on sustainable agriculture and livelihood development.
5. Participatory identification of fields intervention planning done under sub-activity 2 and memo of agreement.
6. Design of intervention project.
7. Implementation of intervention.

Activity No.4: Enhancing forest-related community tourism options to support forest management.

1. Ground assessments and consultation.
2. Participatory assessment and development of forest-related ecotourism in selected villages.
3. Identification of field intervention, planning and memo of agreement.
4. Design of interventions.

5. Implementation of interventions.
6. Conduct capacity building for ecotourism (community organisation, ecotourism product development, marketing, guiding and language etc).
7. Small grants to community groups to support implementation – homestay programme.
8. Small grants to community groups to support implementation – hiking trails, visitor facilities etc.
9. Monitoring and reporting.

e. Monitoring and Evaluation

Internal monitoring of the project progress will be undertaken by the REDD+ Unit in the Sabah Forestry Department in conjunction with the respective lead agencies for each action. Monitoring missions to the sites will be undertaken at a minimum of six monthly intervals and will assess the progress of the work on the ground in relation to annual and project plans. It is envisaged that periodic evaluation will be undertaken by the EU Delegation and/or external consultants.

f. Management Arrangement and Project Visibility

The project is managed by Sabah Parks Board of Trustees through its site implementation team, namely Kinabalu Ecolinc Project Team comprises of eight newly appointed personnel led by a Project Manager and assisted by Field Officer (Monitoring System Programme), details of which shown in Table 3. A senior officer based at Sabah Parks Headquarters in Kota Kinabalu has been assigned to oversee and coordinate the implementation of the project activities from time to time.

5.0 KINABATANGAN PROJECT (K-COL)

a. Background and Project Context

The Kinabatangan floodplain is one of the largest and most important wetland ecosystem in Sabah (Map 1). A hundred years ago the floodplain was almost completely covered by different forest types, such as freshwater swamp forest, dipterocarp forest, mangrove forest, peat swamp forest and limestone forest. Past logging activities and forest conversion to agricultural and industrial plantations has decreased the characteristic vegetation of the area by as much as 90% within the Lower Kinabatangan floodplain - leaving a patchy corridor along the main stream of the Kinabatangan river. The remaining natural habitat is highly degraded and fragmented, most of it having been subjected to heavy logging and fires.

The area is however crucial for biodiversity conservation and is currently the only physical link between the centre forests of Borneo Island (heart of Borneo) and the coastal wetlands of the Sulu-Sulawesi sea. The demonstration activities on this pilot site will focus in the section of the Kinabatangan River between Deramakot Forest Reserve and Kg. Batu Puteh as shown in the following Map 2, below which to date has received lee support compared to lower sections of the corridor.

It is a significant site for biodiversity conservation with important fisheries and water shed areas; forests play a key role in habitat connectivity. The forests and peat lands in the corridor are important for carbon storage. There is a high potential for community development in forest maintenance and rehabilitation. This area is currently significant for the state eco-tourism industry. Despite the importance large portions have been converted to agriculture – especially oil palm and there is a continuing high risk of future conversion. Government, non-government, community and private sector stakeholders have been working together for a number of years and good initial progress has been made in protecting and rehabilitating some sites.

The site would be a good pilot area to explore the application of REDD to an area with significant forests and biodiversity, large and supportive local community, high threats, history of multi-stakeholders (including private sector) engagement, and high interest in REDD+.

Significant patches of forest and some areas of peat land remain along the Kinabatangan Corridor that will secure substantial tracts of forest areas thereby protecting standing carbon stocks within the region, helping the mitigation of climate change. This national and global contribution towards reducing climate change will further be facilitated by the promoting of reforestation practices and the rehabilitation of degraded forest areas within the corridor area that will further promote future carbon sequestration.

Biodiversity Value – The forests of the Kinabatangan harbour a remarkable diversity and abundance of wildlife including more than 300 bird species, more than 100 species of reptiles and 30 species of Amphibians, 129 species of mammals and some iconic and endemic species such as the orang-utan, proboscis monkey, Bornean Gibbon, Bornean Elephant, Clouded Leopard, etc. The Kinabatangan has been recognized as one of the four "major elephant ranges" for Borneo and a "high priority area" for Bornean orang-utans. Recently, the coastal areas of Kinabatangan were designated as the "Lower Segama Kinabatangan Wetlands Ramsar Site", and a project to establish a "UNESCO Man and Biosphere Reserve" is currently being processed for the area.

The high diversity and productivity of the habitat found in the Kinabatangan and a relatively low hunting pressure have contributed to maintain healthy populations of wildlife. However. Most species depend on forest habitat for survival, and the rapid development of human activities in the floodplain greatly affects their prospects of long-term survival. Today, many species are threatened with localized extinctions, and habitat fragmentation has imperilled the preservation of the genetic flow and diversity of orang-utans and many other species. However, due to forest conversion and degradation, the Kinabatangan floodplain is currently not a viable habitat for the elephants since the density of elephants in this area is very high (more than 2 elephant per km square). Linking habitat with forest corridors will improve the habitat viability – one of the key reasons the orang-utans population is declining is the loss and fragmentation of habitat due to the conversion of degraded forests into large-scale plantation. There is now a vital need to reconnect these forest fragments to allow wildlife movements along the river, from the estuary to the large reserves of the interior.

Community – An estimated 20,000 people live in the proposed pilot area. There are about 7 key villages in the proposed pilot area, namely Kg. Batu Puteh, Kg. Bukit Garam, Kg. Balat, Kg. Sangau, Kg. Lokan, Kg. Buang Sayang and Kg. Long Manis. A majority of the local communities in the seven villages are from the Sungai community. 60% of the villagers have their own small palm oil plantations, or work with the adjacent oil palm plantations along the Kinabatangan River, and the remaining local communities (40%) are dependent on fishing and small handicraft industries, in order to support their family.

Traditional subsistence living (fishing, rice farming, forest produce collecting, hunting) was a major part of livelihood until recently. Declining natural resources, improvement of basic road infrastructure and emergence of new potential sources of incomes (eco tourism and else) has shifted job demographics to the nearby towns and the large plantations for better and more reliable income.

Ecotourism has been recognized as part of the potential activities that could be further diversify the source of income for local communities, but the quality of the remaining forest in the pilot project is poor (due to illegal logging and oil palm encroachments) and some of the areas need to be restored. Wildlife such as elephants, orang-utans, clouded leopard and banteng has been sighted regularly by the local communities along the Kinabatangan forested riverine area (in the pilot area), and therefore restoring, protecting and securing the remaining forest area in the proposed pilot area, could further increase the value of the forest for local community and enhance the function of the ecosystem within the proposed pilot area.

There is also potential for further development of non-timber forest products (NTFP) including rattan, medicinal plants, swiftlets and handicrafts to enhance livelihood in the villages.

b. Project Location

Figure 5 shows the Kinabatangan Floodplain area including key bottleneck area and important ecological corridor in the Mega Biodiversity Corridor in Kinabatangan. The following Figure 6 shows location of land that is important for biodiversity corridor, named as B7, B8, B9 and B10.

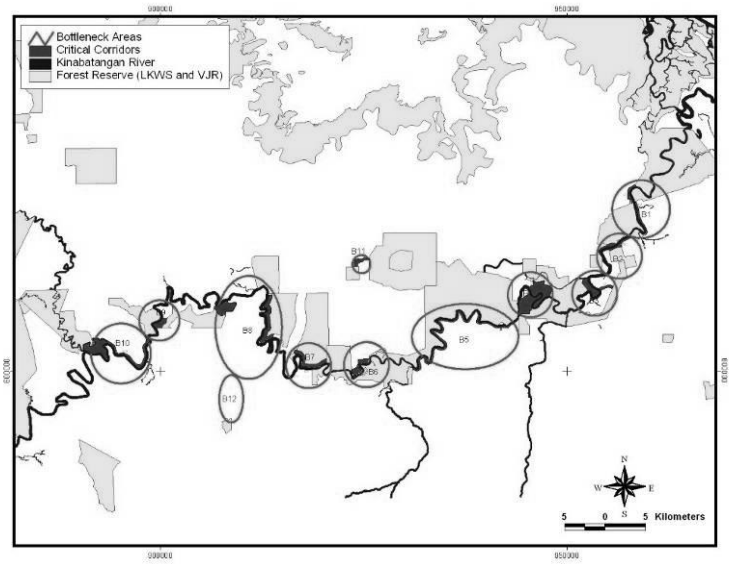

Figure 5: The Kinabatangan Floodplain area.

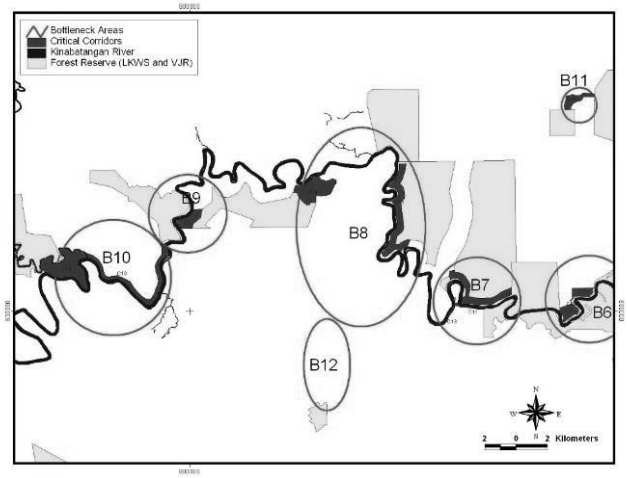

Figure 6: Location of lands that is important for biodiversity corridor.

c. Methodology

The main methods and approaches envisaged in implementing the Action include:

i. Forest Resource Assessment

Assessment of the forest resources will be undertaken to determine the state of the forests resources. This will build on the ongoing work supported under the Ministry of Natural Resources and the Environment to undertake a baseline assessment of forest resources in all of Malaysia using SPOT satellite images. This baseline analysis will map boundaries of forests, peatlands, mangroves, plantations and agriculture land. During the project implementation, the baseline maps for the project sites will be refined as appropriate using more detailed satellite analysis.

This may involve separating areas of degraded forest and also overlaying the baseline maps on land status maps to determine the forest areas outside of Forest and Wildlife Reserves and National Parks. These baseline maps will be used to guide the focus of interventions for forest protection and rehabilitation.

ii. Participatory Community Engagement

Since a major focus of the action is community involvement it is essential that appropriate techniques for participatory engagement be used at the project area. This will depend on the exact nature of the proposed interventions at the sites but will include early consultation with communities in the pilot areas to provide

complete information and obtain as appropriate Free Prior and Informed Consent (FPIC) for any activities, which may restrict access to traditional used resources or to indigenous lands.

It is also proposed that as far possible, all activities related to forest management and rehabilitation should involve the engagement of community member directly in propagating the seedlings through community nurseries, replanting and enrichment planting of degraded forests; development and maintenance of rubber and agroforestry zones; monitoring and patrolling of forest areas; and development of alternative livelihoods. Where appropriate, focus will be on empowering the communities to protect and manage the forests on their traditional village lands. Priority will also be placed on Community-to-community and peer-to-peer learning approaches.

iii. Community Livelihood Development

This action will include various measures to enhance the livelihoods of the targeted communities. The specific livelihood options will be developed and selected through consultation with the respective communities as well as based on expert advice and feasibility assessments. Where possible the livelihood options will be linked back to the maintenance of the forest areas by the communities. Support will also be given for market development and market access to ensure that the communities get a good return from the livelihood activities.

Linkage with and guidance from relevant government agencies including Forestry Department, Agricultural Department, FELCRA, Fishery Department, Tourism Unit etc will be provided. Their involvement will be in the form of providing inputs in meeting with the targeted communities, as and when needed, on a case-to-case basis.

d. Project Activities

Based on the project key methodologies as described earlier, the following project activities and sub-activities have been identified in order to fulfill REDD+ as well as community development criteria, so that this pilot site can be a model system to inform development of future community-based REDD+ policy at local, regional, national and international levels. The proposed activities comprise the core activities needed for the establishment of the "Kinabatangan River Corridor" and sub activities.

Activity No 1: Development of REDD+ strategy for forest conservation in the Kinabatangan Corridor.

Project sub-activities include:

i. Forest and Carbon Mapping and Assessment
ii. Land Use Change and Carbon Monitoring programme
iii. Support the operation of the Kinabatangan Management Committee and enhance its work to ensure participation of key stakeholders in REDD+ related initiatives in Kinabatangan River Corridor
iv. Finalization of a REDD+ strategy for the Lower Kinabatangan

The above activities will be led by SWD as the secretary of the Kinabatangan Management Committee (KMC) with support from BCT and other partners. The other partners are members of the KMC, i.e. Land and Survey Department, Sabah Biodiversity Centre, Drainage & Irrigation Department, District Office of Kinabatangan, and WWF-Malaysia.

Activity No 2: Enhancing forest protection within the Batu Puteh – Deramakot – Malua – Segaliud Lokan forest Landscape.

Project sub-activities include:

i. Securing the remaining key forest blocks in the project area.
ii. Patrolling and protection of existing Forest River Corridor.

The above activities will be led by SWD with support from BCT and other partners. The other partners are members of the KMC, i.e. Land and Survey Department, Sabah Forestry Department, Drainage & Irrigation Department and other stakeholders, based on the criteria and guidelines to be drawn and agreed by the Programme Steering Committee.

Activity No 3: Promoting forest-related sustainable livelihoods and community forest conservation in target villages.

The community development programme will draw on the successfully experience of KOPEL – a community cooperative at Kg. Batu Puteh. Support will be provided to expand the facilities of KOPEL to act as a training and support centre for other villages in the pilot areas. Three target communities have been identified for support under the project as follows:

a) Kg. Bukit Garam – One third of the way between Batu Puteh and Deramakot in a region where there is significant development of small-scale oil palm in the river corridor;
b) Kg. Sungai Lokan – near Sg. Lokan Forest Reserve another area with significant community pressure on the forest;
c) Kg. Balat on the Boundary of Deramakot Forest Reserve where the community are significantly dependent on forest resources for their livelihood.

Project sub-activities include:

i. Village level assessment and planning
ii. Establish community-based forest conservation groups in selected villages
iii. Development of forest-related sustainable livelihood
iv. Implementation of Community-based Forest Restoration.

It is proposed that this activity will be led by KOPEL with technical support from BCT, Hutan, LEAP and other partners.

e. Monitoring and Evaluation

The REDD+ Unit in the Sabah Forestry Department in conjunction will undertake internal monitoring of the project progress with the respective lead agencies for each action. Monitoring missions to the sites will be undertaken at a minimum of six monthly intervals and will assess the progress of the work on the ground in relation to annual and project plans. It is envisaged that the EU Delegation and/or external consultants will undertake periodic evaluation.

f. Management Arrangement

The project is managed by the Sabah Wildlife Department in coordination with the Kinabatangan Management Committee (KMC) under MTCE. It is coordinated by a project manager based in Wildlife Department Office in Kota Kinabalu. This project is also supported by a number of partners including BCT and HUTAN.

6.0 CHALLENGES

Within the Sabah context, taking into cognizance the overall master plan development agenda for the State, the following challenges are anticipated for the smooth implementation of full-fledged REDD+ activities in the future:

- That all state and national laws and international treaties, conventions and multilateral agreements are complied with.

- That the Environmental and Social Safeguards (ESS) Standards for Sabah is in harmony with, and shall complement many of the state policies, plans and programs for sustainable development both at state and national levels.

- That the REDD+ programs support good governance to maintain and enhance biodiversity and ecosystem services through the Sabah Forest Policy (Goals a. b. & c.) strategies of conservation and sustainable management.

- That the strategies and actions plans developed under REDD+ programs will address the drivers of deforestation and forest degradation, land tenure issues, forest governance issues, gender considerations (Decision 1/CP.16, para 2)

- That the REDD+ programs ensure full and effective participation of relevant stakeholders, *inter alia* indigenous peoples and local communities (Decision 1/CP.16, para 2)

- That the ESS Standards are meant to ensure that Sabah is adequately addressing the five eligible REDD+ activities that are being reported to the UNFCCC (Decision 1/CP.16. para 70)

- That forest-dependent communities are a significant part of REDD+ program implementation

- That consultation and effective participation of stakeholders, in particular indigenous peoples and local communities are crucial in planning and decision making

- That the different use rights to lands, territories and resources are recognized and respected and that land tenure issues are addressed, relevant to the REDD+ program

- That the REDD+ program improves the long-term livelihood security and well-being of indigenous peoples and local communities with attention to women and marginalized groups.

- That the high costs of conserving Sabah's rainforests including opportunity costs are heterogeneous and difficult to be estimated due to large carbon stores, endangered biodiversity, large stores of timber, and high potential for conversion to oil palm plantations[21].

- That the pressure on forests and its resources will increase with rapid urbanization and improving infrastructure such as roads, townships and related facilities in light of Malaysia achieving a developed nation.

It is also important to note that the overall management of REDD+ implemented activities at the state level, it's reporting, and verification has not been fully addressed. It is also essential that the coordination at the state level must involve the State Planning Unit, relevant Ministries, Sabah Forestry Department, Sabah Biodiversity Centre, Sabah Wildlife Department, Sabah Parks, Department of Agriculture, Lands and Surveys Department, SFMLA holders, NGOs, CSOs, indigenous people and local community groups.

7.0 WHAT NEXT

As mentioned earlier, the primary aim of REDD+ is climate change mitigation. However, monitoring of biological diversity and social indicators would have enormous co-benefits for conservation and climate change mitigation. Monitoring of biological diversity and social well being however, has not yet been established because there is, at present, no reliable objective measurements of these environmental and social dimensions.
To ensure the REDD+ Safeguards are fully implemented, the REDD+ program must also be subject to monitoring, reporting and independent verification to be able to demonstrate delivery of results-based benefits to stakeholders. An effective monitoring system of the various REDD+ activities is needed so that the developed and accepted principles and criteria for social and environmental safeguards are included in all aspects of REDD+ project implementation. Apart from that, periodical checks via third-party independent audits are also anticipated to ensure progress in compliance with standards or operational procedures are adhered to. Finally the results of the audits are to be made public which ensures transparent governance.
With regards to the monitoring of the standards that are being implemented, a centralized information system should be established to collect, store, and analyze all data available at the REDD+ project/program level for reporting from Sabah to the national level. Designing a monitoring system that is effective and efficient is needed and is definitely beyond the terms of this project.
In future, the activities that are eligible for REDD+ projects in Sabah are reforestation, avoided deforestation, forest conservation and restoration. There are a number of expected divisions of tasks for monitoring adherence in future full-fledged REDD+ project/programs, be it Administrative, Technical or Social, which are listed here.

Administrative

- The REDD+ project area and management license are granted (proposal) by the Sabah Forestry Department, representing the State government to the Applicant (be it a community forest management group, cooperative, government agency, independent licensee, concession holder, etc.) subject to the approval of the application.
- The Applicant is responsible for conducting forest management activities while ensuring compliance with State and Federal laws and regulations pertaining to the REDD+ project management license.
- The Applicant will be a legally recognized entity for the purpose of the REDD+ project.

[21] Brendan Fisher, David P Edwards, Xingli Giam, and David S Wilcove 2011. The high costs of conserving Southeast Asia's lowland rainforests. *Frontiers in Ecology and the Environment* **9**: 329–334.

- Several additional organizations may be involved as project partners, including Sabah Wildlife Department, Sabah Parks, Sabah Lands and Surveys Department, Natural Resources Office and NGO and CBO partners such as WWF-Malaysia, Hutan, KOPEL Bhd., Winokok Bundu Tuhan and PACOS Trust who have experience in forest conservation and community facilitation. None of the NGO or CBO partners should have a commercial interest in the REDD+ project.
- For the purpose of ensuring local context of partner relationships and sharing of skills and expertise, certain independent project coordinator responsibilities will be led or co-implemented by the partners above.
- To facilitate transfer of payments from future Carbon certificates to target beneficiary (communities and other stakeholders), a dedicated Sabah-registered administrative facility is to be established for the primary purpose of managing and monitoring certificate sales and PES payments. Such entity is to be established by agreed partners as an independent structure, with clear and transparent governance, and will have financial management carried out efficiently and in accordance with State and Federal legislation.
- Record keeping, PES agreements, results of monitoring, project finance and administering, coordinating the verification reporting, securing donor funds and/or revenue from the sale of PES for the PES payments are some of the administrative roles that need to be considered.

Technical

- The responsibilities of each agency, organization mentioned above and their functions must be clearly defined and formalized in written legal agreement, through a Memorandum of Agreement/Understanding, which must be updated from time to time throughout the project cycle.
- A Project Coordinator (PC) of the organization responsible for the REDD+ project must undertake the responsibility of carrying out long term monitoring to ensure that ecosystem service benefits are captured and delivered. It is also the role and responsibility of the PC to ensure the full and effective participation of indigenous peoples and local communities in the project, to develop effective participatory planning and working relationships among the various partners. The PC is to identify key stakeholders through a stakeholder analysis of all groups, communities, organizations and local government authorities that have a stake in the project or are likely to be impacted by the project. The PC must take pro-active steps to inform all stakeholders about the nature of the project, solicit their views, and secure approval where and if necessary.
- All relevant State and Federal laws and regulations that have an impact on the project design and management must be identified and documented. Additionally, the process undertaken to include these laws and regulations - and how they are taken into account to ensure compliance - need to be identified and documented.
- All legal or regulatory permissions required to carry out REDD+ project must be identified and secured, such as approved forest management plans from the Sabah Forestry Department.
- Local community members, including women, are to be given fair and equal employment opportunities to fill positions in the project where job descriptions are met or for roles that they can be trained to fill in a cost-effective manner.

Social

- Special provision needs to be given on evidence of, or for establishing land tenure and use rights in REDD+ projects. The relationship, whether legally or customarily defined, through which people, as individuals or groups, own or hold rights to use land is to be identified and agreed by all parties.
- Engagement with indigenous peoples and/or local communities in assessing their capacity, identifying local conflicts or legal issues must be carried out. Free, Prior and Informed Consent (FPIC) guidelines are to be developed for proposed REDD+ activities.
- Carrying out participatory sustainable land use planning with the affected communities that includes inputs from a wide range of stakeholders, communicating project requirements and payment mechanisms, addressing disputes, claims or conflicts.

To conclude, the necessary framework and guidance to advance in REDD+ development and implementation in the State has been provided by the Sabah REDD+ Roadmap. Based on that, the three pilot sites were established and will demonstrate the initiative on community-based forest management and REDD+ in Sabah. The paper has elaborated the various challenges facing the pilot projects currently and in the future, while recommending some future action to be taken by the State, particularly by the implementing government department, agencies, NGOs and CBOs. Finally, it is our hope that the REDD+ pilot projects will succeed, in time be replicated to other areas in Sabah and eventually be rewarded financially for keeping and managing our forests sustainably.

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PAPER 6: 3

PERANAN MASYARAKAT BAGI MEMANTAPKAN PENGURUSAN KAWASAN HUTAN LIPUR

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ABSTRAK

Terdapat 16 buah Hutan Lipur (HL) di bawah pengurusan Jabatan Perhutanan Negeri Perak (JPNPk). Kesemua HL terletak di dalam Hutan Simpanan Kekal (HSK) berhampiran dengan penempatan penduduk kerana kebanyakan HL adalah berasaskan sumber air semulajadi. JPNPk sejak bertahun lalu telah berusaha menyediakan pelbagai kemudahan dan mewujudkan suasana yang sesuai bagi tujuan rekreasi. Sehingga kini, tiada caj bayaran masuk dikenakan kepada para pengunjung kecuali beberapa kemudahan seperti chalet, tapak perkhemahan dan dewan. Kesannya, pengurusan HL hanya bergantung kepada peruntukan yang diberi oleh Kerajaan Negeri bagi aktiviti penyelenggaraan dan pembersihan. Menyedari peranan masyarakat dalam memantapkan pengurusan HL, JPNPk telah melibatkan mereka dalam mempertimbangkan keputusan untuk mengenakan caj masuk ke HL. Tiga (3) HL dipilih menjadi lokasi kajian iaitu HL Kuala Woh, Tapah, HL Pulau Tali Kail, Gerik dan Pusat Eko Pelajaran Hutan Paya Laut Matang, Kuala Sepetang. HL ini dipilih kerana mempunyai daya tarikan tersendiri serta mewakili topografi yang berlainan. Kajian bagi kesanggupan untuk membayar (*Willingness To Pay*) adalah teknik yang paling komprehensif dalam menentukan semua nilai-nilai dan maklumat yang dikumpul daripada pengunjung boleh menjadi asas dalam menentukan harga untuk pengurusan HL ke arah membentuk satu sistem yang cekap. Kajian ini adalah untuk meninjau kesediaan pelawat untuk membayar bayaran masuk ke tiga-tiga HL berkenaan, seperti yang dinyatakan dan mengenalpasti faktor-faktor yang mempengaruhinya agar ianya dapat dijadikan sampel bagi HL yang lain di Negeri Perak. Hasil kajian ini boleh bertindak sebagai garis panduan bagi pengurusan dalam membuat keputusan nilai tiket masuk berdasarkan kesediaan dan kesanggupan pelawat untuk membayar.

1.0 PENDAHULUAN

Kawasan berhutan Negeri Perak sehingga Jun 2014 adalah 1.05 juta hektar atau 49% daripada jumlah keluasan tanah negeri. Daripada jumlah ini, Hutan Simpanan Kekal (HSK) seluas 996 ribu atau 46.9% dari keluasan negeri. Kerajaan Negeri Perak telah mendedikasikan kawasan hutan sebagai Hutan Perlindungan Sepenuhnya (*Totally Protected Forest*) di mana Hutan Lipur (HL) tersenarai satu daripadanya. Ia ditekankan melalui Dasar Perhutanan Negara yang mengistiharkan HSK yang mencukupi untuk diuruskan di bawah HL. Dasar utama penubuhan HL adalah untuk mengekalkan sejumlah kawasan hutan asli yang mencukupi dalam HSK sebagai tempat rekreasi dan eko-pelancongan serta memupuk kesedaran masyarakat mengenai kepentingan hutan dan fungsinya. Kepentingan HL turut diwartakan bersama 11 kelas fungsi hutan melalui Seksyen 10 (1) Akta Perhutanan Negara 1984 (Pemakaian) 1985.

HL didefinisikan sebagai kawasan dalam HSK yang digunakan bagi tujuan menjalankan aktiviti-aktiviti rekreasi seperti beristirehat, bersukan, penyelidikan, pendidikan serta pemeliharaan flora dan fauna. Selaras dengan keperluan tersebut, Jabatan Perhutanan Negeri Perak (JPNPk) telah menubuh dan membangunkan 16 HL berasaskan alam semulajadi yang menjadi tarikan bagi aktiviti pelancongan di negeri Perak sejak tahun 1987. Penubuhan HL bertujuan untuk memenuhi tuntutan sosial dalam usaha mengurangkan berlakunya masalah-masalah berunsur negatif terutamanya di kalangan remaja. Di samping itu, kegiatan rekreasi yang dijalankan dalam hutan lipur juga dapat membantu mewujudkan nilai-nilai murni dalam kehidupan seharian.

HL yang ditubuhkan di negeri Perak terdiri dari pelbagai demografi yang mempunyai keunikan yang tersendiri. Kebanyakkan HL adalah berasaskan air terjun dan sungai dengan keindahan flora sepertimana di HL Ulu Kenas, HL Lata Kinjang, HL Lata Iskandar, HL Lata Kekabu, HL Ulu Kinta, HL Ulu Licin, HL Sungai Salu, HL Kuala Woh dan HL Sungai Nyior. HL Bukit Larut hanya bersandarkan fungsi sebagai tapak perkhemahan tetapi masih mempunyai keistimewaan tersendiri. HL Papan dilengkapi Taman Herba yang menjadi sumber pembelajaran dan rujukan berkaitan Hutan Bukan Kayu seperti herba ubatan. HL di negeri Perak turut menawarkan pantai sebagai panorama rekreasi di HL Pulau Pangkor dan HL Pasir Panjang manakala HL Tali Kail satu-satunya HL yang berada di kepulauan Tasik Temengor. Tidak hanya tertumpu di bahagian daratan, Pusat Eko-Pelajaran Hutan Paya Laut melengkapi pelbagaian jenis HL di negeri Perak. Terkini, JPNPk telah membangunkan Taman

Rimba Kledang Saiong yang terletak di Bandar Meru Raya, Ipoh dengan tawaran aktiviti seperti *mountain bike downhill*, denai interpretasi dan Taman Nepenthes.

Dengan pengurusan dan pembangunan yang dilaksanakan menyerlahkan potensi Hutan Lipur sebagai kawasan eko-pelancongan yang mampu menjana kekayaan baru dari sumber hutan negeri ini.

Hutan Lipur dan Masyarakat

HL dan masyarakat bagaikan isi dengan kuku yang berkait rapat dan saling bergantungan. HL dibangunkan mengambilkira kira kemudahsampaian dan keperluan masyarakat setempat menjalankan aktiviti rekreasi. Jika disingkap sejarah, kawasan HL dahulu merupakan tumpuan bagi mendapatkan sumber air dan makanan masyarakat setempat melalui aktiviti memancing. Masyarakat memainkan watak utama dalam kemajuan HL. Ini kerana masyarakat setempat merupakan pengunjung yang berulang dan menghidupkan kemeriahan persekitaran HL.

Secara umumnya, terdapat dua (2) HL yang dikelilingi oleh orang asli secara dekat iaitu HL Lata Kinjang dan HL Kuala Woh yang terletak di Daerah Tapah. Kehadiran perkampungan orang asli ini memberi dimensi baru kepada pengunjung bagi mendekati budaya dan latar kehidupan mereka yang hidup berteraskan alam semulajadi.

HL merupakan alternatif yang menjadi pilihan masyarakat terutamanya yang mementingkan keindahan semulajadi. Ini terbukti dengan rekod kemasukan pengunjung ke HL semakin bertambah sejak lima (5) tahun kebelakangan sebagaimana statistik kehadiran pengunjung di **Jadual A**. Perkembangan positif ini menggambarkan bahawa HL telah melalui transformasi untuk menjadi sebuah pusat eko-pelancongan yang popular.

Jadual A: Rekod kedatangan pengunjung ke hutan lipur dari tahun 2010 sehingga Julai 2014.

BIL	TAHUN	BILANGAN PENGUNJUNG
1	2010	423,282
2	2011	400,611
3	2012	429,547
4	2013	541,219
5	2014 (sehingga Julai)	364 346

Pengurusan Hutan Lipur

Pengurusan HL menggariskan objektif menyedia kemudahan beristirehat dan memberi peluang serta dorongan kepada masyarakat untuk menjelajah kawasan hutan di samping mempelajari dan menerap rasa mencintai hutan.

Demi memenuhi aspirasi tersebut, JPNPk telah menonjolkan denai interpretasi, pusat informasi, muzium perhutanan bagi menyampaikan ilmu perhutanan kepada masyarakat di samping penyediaan kemudahan rekreasi yang merangkumi kemudahan-kemudahan asas seperti tandas awam, dewan terbuka, padang, wakaf, pusat penerangan, gerai makan tapak perkhemahan, chalet, wakaf, tempat meletak kenderaan dan kemudahan air dan elektrik .

Sejak penubuhan sehingga kini, pengunjung HL menikmati sumber rekreasi secara percuma. Kesannya, penyelenggaraan dan pembersihan HL terpaksa bergantung sepenuhnya kepada peruntukan yang diberikan oleh pihak Kerajaan Negeri. Namun begitu peruntukan ini tidak dapat menampung sepenuhnya usaha penyelenggaraan terutama apabila ianya melibatkan kes-kes vendalisma.

JPNPk telah membelanjakan peruntukan yang besar untuk menubuh dan menyelenggara HL di seluruh Negeri Perak. Bagi tahun 2012 sahaja, jumlah peruntukan yang dibelanjakan untuk tujuan ini adalah RM1.95 juta. Dalam tempoh Rancangan Malaysia Ke-10 (RMKe-10) Kerajaan Negeri Perak telah memperuntukan sejumlah RM45.725 juta melalui Peruntukan Kumpulan Wang Pembangunan Hutan (KWPH) dan Peruntukan Pembangunan Negeri (P07). Pengaliran wang keluar yang banyak tanpa sebarang pulangan merupakan sesuatu yang perlu di atasi bagi menjamin kelangsungan sesebuah pusat eko-pelancongan seperti HL.

Masyarakat dan Isu Bayaran Masuk Ke Hutan Lipur

JPNPk berhasrat untuk mengenakan bayaran dari segi kutipan masuk untuk menampung kos pembangunan dan penyelenggaraan HL di Negeri Perak. Kajian-kajian terdahulu juga menunjukkan taman-taman rekreasi yang berjaya telah menjana pendapatan untuk membiayai kos operasi dan kekal relevan. Ini dibuktikan oleh negara Kenya dan Zimbabwe, yang memperoleh pendapatan yang tinggi setelah menyesuaikan dasar penentuan harga dan mengenakan bayaran masuk ke taman rekreasi. Berdasarkan penemuan ini, JPNPk melihat bayaran masuk sebagai keperluan dan sumber kewangan di HL dan yakin bayaran masuk akan membantu HL menjadi lebih berdikari dari segi kewangan. Harga masuk yang efisien akan memastikan HL dapat menyumbang kepada masyarakat dalam konteks pelancongan mampan.

Namun begitu untuk mengubah persepsi masyarakat berkaitan kadar bayaran masuk merupakan isu utama. Hal ini berikutan minda masyarakat yang telah sebati dengan pemahaman bahawa sumber-sumber rekreasi berteraskan hutan adalah milik bersama dan ia merupakan tanggungjawab kerajaan sepenuhnya untuk masyarakat.

2.0 SURVEI KESANGGUPAN MEMBAYAR

Kesanggupan membayar merupakan teknik komprehensif dalam menentukan nilai. Responden dipilih menggunakan persampelan bersistem di mana responden pertama dipilih secara rawak manakala responden seterusnya adalah dari setiap pelawat ketiga yang memasuki HL. Data yang dikumpul dari responden yang merupakan pengunjung HL menjadi sumber-sumber asas dalam menunjukkan dasar penentuan harga bagi pengurusan HL di samping menyumbang ke arah membentuk satu sistem yang cekap.

Kaedah survei kesanggupan membayar untuk penilaian ekonomi ini tidak memberi jawapan tepat namun masih boleh menyediakan satu garis panduan terhadap strategi penentuan harga dan memberi maklumat tambahan untuk pengurusan HL terutama bagi penentuan harga bayaran masuk. Survei ini akan cuba untuk meletakkan satu nilai di atas nilai-nilai bukan pasaran. Selain menjana lebih banyak pendapatan, sistem harga efisien di lihat dapat mengurangkan kebergantungan HL kepada peruntukan kerajaan. Di sinilah sebenarnya peranan masyarakat dalam memantapkan pengurusan kawasan HL dengan sumbangan idea.

Lokasi Survei

Tiga (3) lokasi kajian yang di pilih iaitu di HL Kuala Woh, Tapah, HL Pulau Tali Kail, Gerik dan Pusat Eko Pelajaran Hutan Paya Laut Matang, Kuala Sepetang, Taiping, Perak. Pemilihan lokasi adalah berdasarkan perbezaan dari segi bentuk muka bumi serta daya tarikannya yang tersendiri. Hasil kajian bagi ketiga-tiga HL ini akan memberi kesan dan rujukan bagi HL lain yang mempunyai asas demografi yang sama.

Hutan Lipur Kuala Woh (HLKW)

Terletak lebih kurang 13 km dari Tapah. HLKW menawarkan sungai sebagai daya penarik dilengkapi kemudahan asas dan aktiviti rekreasi lain seperti perkhemahan, *jungle trekking*, perkelahan dan air panas semulajadi yang menjadi faktor penambah. HLKW turut dilengkapi pemandangan indah kumpulan rama-rama *Rajah Brooke Birdwing* di persisiran sungai.

Pusat Eko Pelajaran Hutan Paya Laut Matang (PEPHPLM)

Terletak lebih kurang 10 km dari Taiping dan lebih kurang 84 km dari Ipoh. PEPHPLM merupakan satu-satunya HL yang berasaskan pembelajaran terhadap ekosistem paya laut yang menawarkan aktiviti seperti denai interpretasi, *bird watching* dan riadah menaiki bot meninjau kehidupan persekitaran hutan paya laut. PEPHPLM telah dianugerahkan sebagai penerima anugerah Pelancongan Negeri Perak Kategori Agensi Kerajaan Berinovasi pada tahun 2011 oleh Kerajaan Negeri Perak.

Hutan Lipur Pulau Tali Kail (HLPTL)

Terbentuk setelah wujudnya empangan Temenggor. Terletak di sebuah pulau kira-kira 45 km dari Gerik dan lebih kurang 190 km dari Ipoh. HLPTL dikenali kerana keunikan geografi dan keindahan pemandangan persekitarannya. Kebanyakkan pengunjung yang datang adalah untuk menikmati pemandangan semulajadi menara pandang serta denai interpretasi.

Objektif Survei

Survei bertujuan memperolehi harga-harga efisien yang boleh menyumbang kesinambungan hutan lipur pada masa akan datang. Secara umumnya, objektif kajian ialah untuk menilai kesanggupan pengunjung menanggung kos bayaran masuk di tiga HL seperti yang dinyatakan. Objektif utama kajian adalah sebagaimana berikut:

i. Untuk mengganggar kesanggupan membayar tiket masuk dan
ii. Untuk mengenalpasti faktor-faktor yang mempengaruhi kesanggupan membayar tiket masuk.

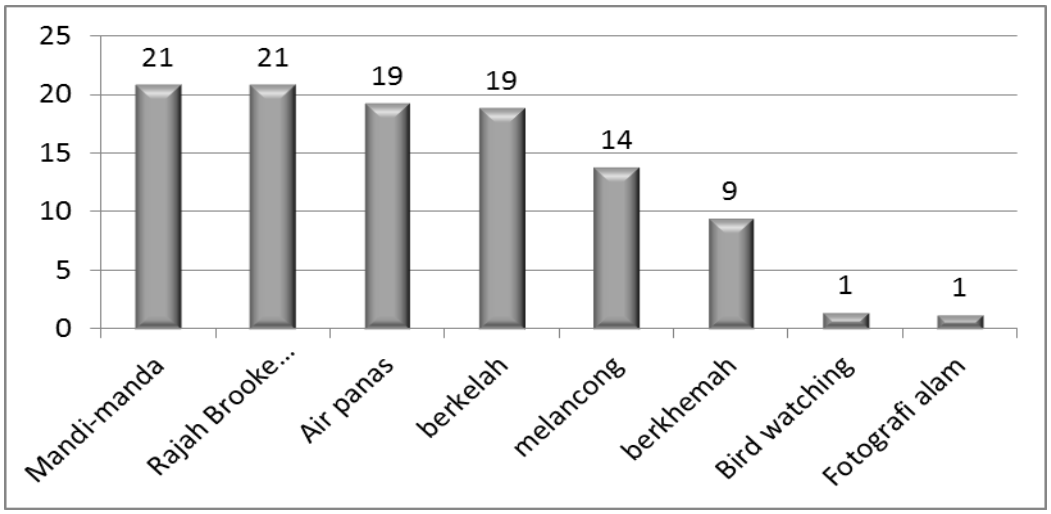
Hasil kajian akan dijadikan panduan dalam menentukan bayaran tiket masuk ke Hutan Lipur.

3.0 KEPUTUSAN

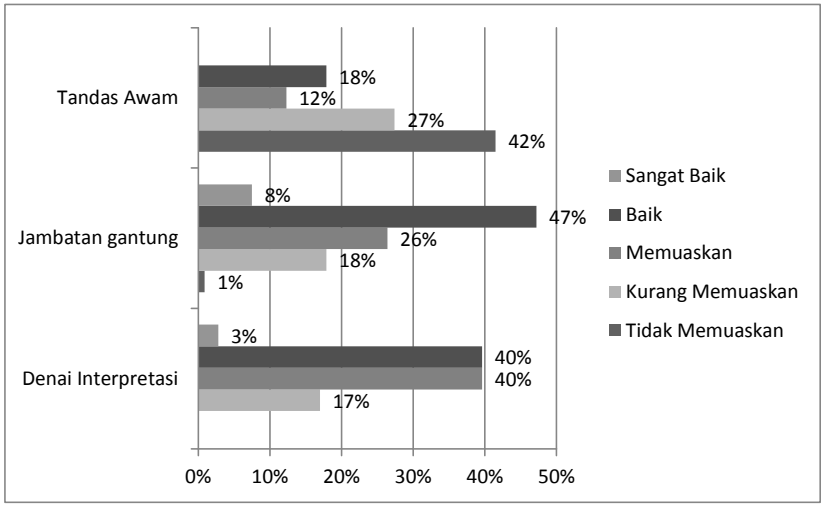
Hutan Lipur Kuala Woh (HLKW)

Survei dijalankan pada 23 sehingga 27 Oktober 2013 terhadap 106 responden dengan pecahan tertinggi mengikut negeri adalah 63 orang dari Perak, 11 orang dari Selangor dan 9 orang dari Melaka. Melalui survei tersebut kehadiran responden adalah untuk aktiviti sebagaimana Rajah 1.1 manakala Rajah 1.2 menunjukkan tahap kepuasan responden terhadap kemudahan yang disediakan.

Rajah 1.1 : Aktiviti pilihan responden di HLKW.

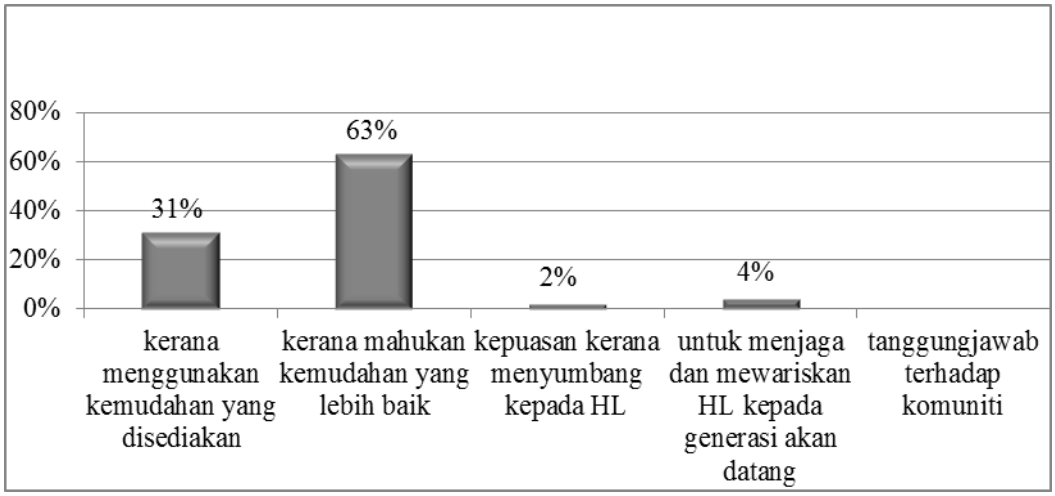


Rajah 1.2 : Tahap kepuasan responden terhadap kemudahan yang disediakan di HLKW.



Berdasarkan Rajah di atas menunjukkan masyarakat berperanan dalam menghidupkan sesebuah hutan lipur sebagai pusat rekreasi dan mengambil peluang ke atas kemudahan yang disediakan. Survei di HLKW merekodkan 84 responden dengan 79% sanggup membayar untuk memasuki HLKW manakala baki 22 responden (21%) tidak bersetuju atau tidak sanggup membayar untuk tiket masuk. Peratusan yang tinggi terhadap kesanggupan membayar adalah satu petanda yang positif kesedaran terhadap kemudahan dan keindahan persekitaran yang ditawarkan. Rajah 1.3 menunjukkan motivasi lain atas kesanggupan membayar tersebut. Secara keseluruhannya, 79% responden sanggup membayar tiket masuk pada kadar purata RM 1.43.

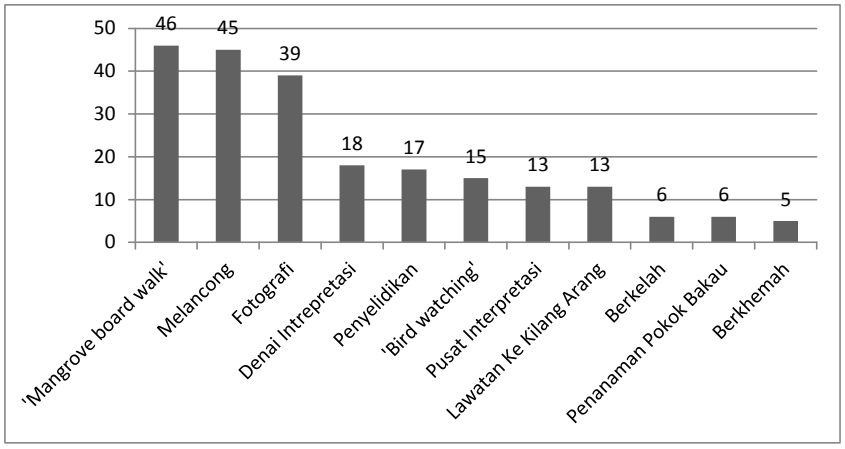
Rajah 1.3 : Motivasi responden ke atas kesanggupan membayar tiket masuk ke HLKW.



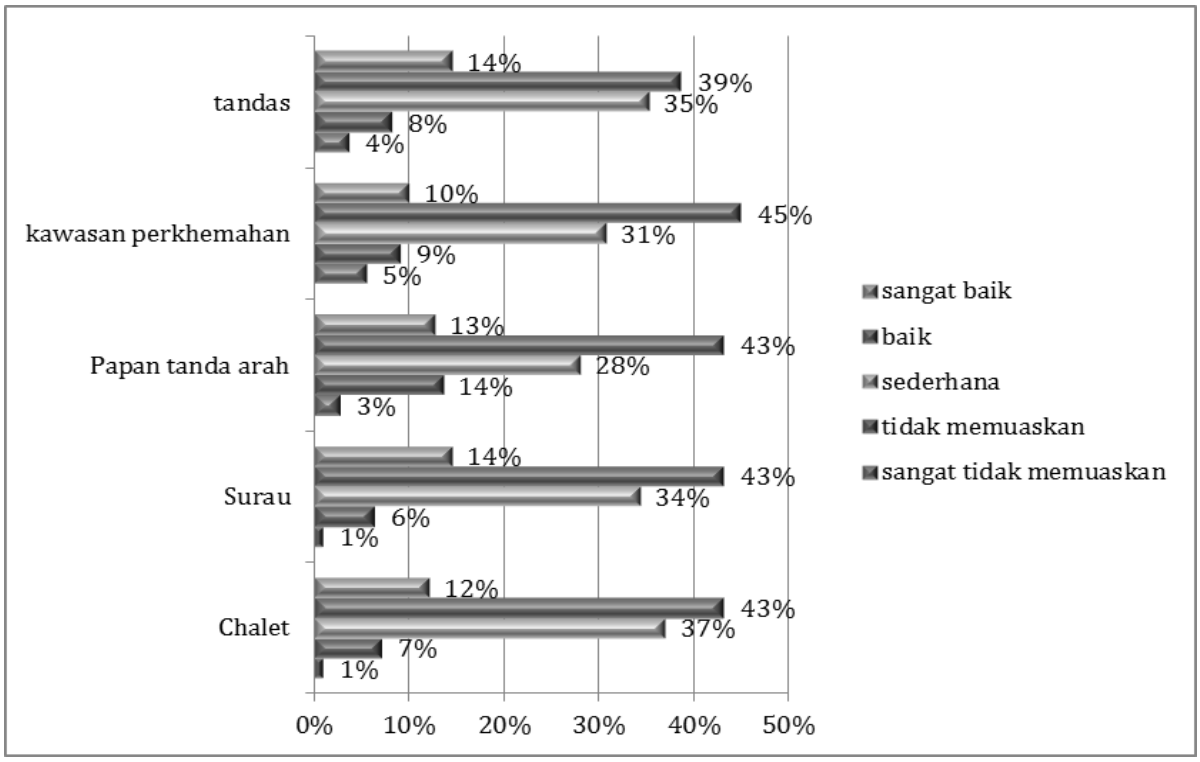
Pusat Eko-Pelajaran Hutan Paya Laut Matang (PEPHPLM)

Seramai 111 responden terlibat dalam survei yang dijalankan pada 1 hingga 6 November 2013 di mana rakyat negeri Perak merupakan responden paling ramai iaitu 30 orang di ikuti Selangor dengan 10 responden dan Pulau Pinang 9 responden. Survei mencatatkan kehadiran pengunjung adalah untuk aktiviti sebagaimana Rajah 2.1 dan kepuasan responden terhadap kemudahan yang disediakan seperti Rajah 2.2

Rajah 2.1 : Aktiviti responden di PEPHPLM mengikut pecahan peratus.

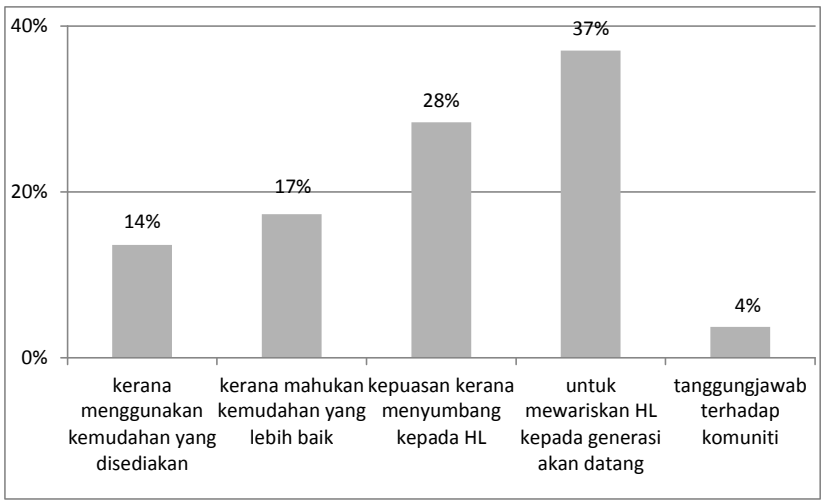


Rajah 2.2 : Tahap kepuasan responden terhadap kemudahan di PEPHPLM.



Kesanggupan Membayar tiket masuk ke PEPHPLM dipengaruhi oleh kepuasan responden terhadap kemudahan yang disediakan. 83 responden sanggup membayar untuk memasuki PEPHPLM manakala baki 28 responden tidak bersetuju atau tidak sanggup membayar untuk tiket masuk. Daripada jumlah ini turut dipengaruhi oleh latar belakang responden yang rata-rata lebih berfikiran terbuka. Rajah 2.3 menunjukkan motivasi responden untuk membayar tiket masuk. Secara keseluruhannya, 75% responden sanggup membayar tiket masuk pada kadar purata RM 7.41.

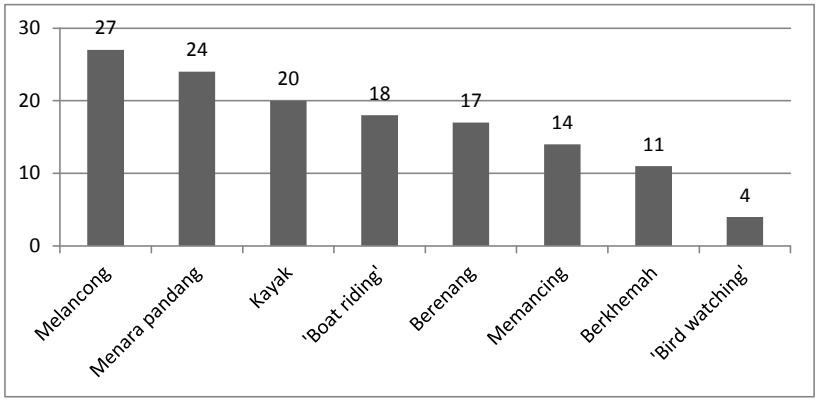
Rajah 2.3 : Motivasi responden ke atas kesanggupan membayar tiket masuk ke PEPHPLM.



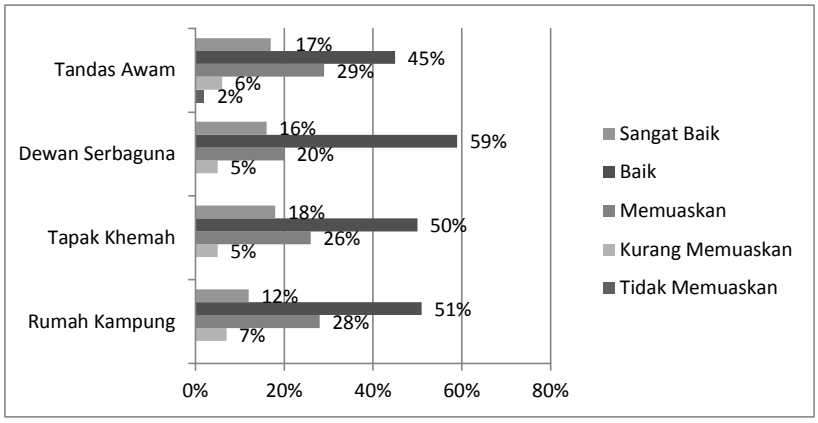
Hutan Lipur Pulau Tali Kail (HLPTL)

Dua sesi survei dijalankan pada tarikh berlainan iaitu pada 8 hingga 11 November dan 23 hingga 25 November 2013. Kedua-dua sesi ini melibatkan 82 responden dengan pecahan tertinggi mengikut negeri adalah 33 orang dari Perak, 20 orang dari Putrajaya dan 7 orang dari Kedah. Melalui survei tersebut menunjukkan kehadiran responden adalah untuk aktiviti sebagaimana Rajah 3.1 dan manakala Rajah 3.2 menunjukkan kepuasan responden terhadap kemudahan yang disediakan.

Rajah 3.1 : Aktiviti responden ke HLPTL mengikut pecahan peratus.

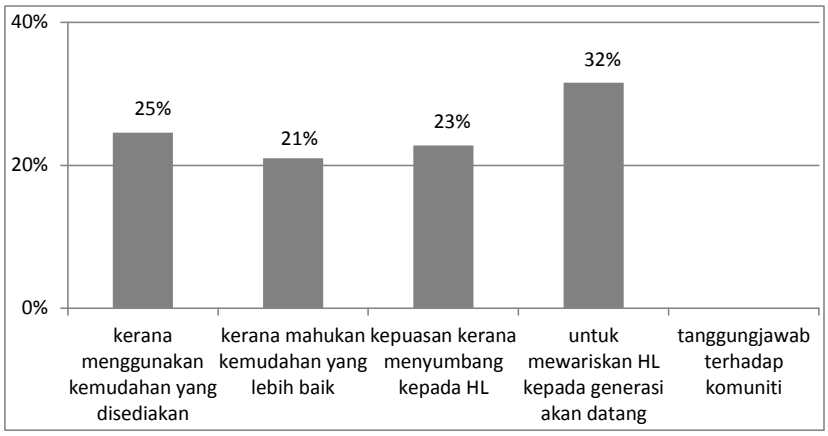


Rajah 3.2 : Tahap kepuasan responden terhadap kemudahan HLPTL.



Keseluruhannya kajian merekodkan responden yang menikmati keindahan HLPTL ramai dari golongan sederhana yang berpendapatan RM 1001.00 sehingga RM 4000.00 sebulan. Responden berpuashati dengan tahap kemudahan yang disediakan sehingga 71% atau 58 responden sanggup untuk membayar tiket masuk pada kadar purata RM5.66. Kesanggupan membayar adalah disebabkan kemahuan responden terhadap tawaran alam persekitaran sebagaimana ditunjukan dalam Jadual 3.3

Jadual 3.3 : Motivasi responden untuk membayar tiket masuk HLPTL.



4.0 PERBINCANGAN

Tidak dinafikan masyarakat memainkan peranan dalam memantapkan pengurusan HL. Kehadiran masyarakat sebagai pengunjung membolehkan sesuatu HL bertahan sebagai pusat rekreasi. Masyarakat juga bertindak sebagai agen promosi yang menwar-warkan kewujudan serta keunikan HL.

Survei Kesanggupan Membayar yang dijalankan telah menunjukkan masyarakat mula menyedari kepentingan sumber alam dan tidak keberatan untuk mengeluarkan wang bagi menikmatinya. Kajian ini memberi gambaran yang positif dalam mengurus HL ke arah lebih sistematik.

Survei yang dijalankan membuktikan HL negeri Perak telah menarik minat pengunjung untuk menjalankan pelbagai aktiviti dan tidak tertumpu kepada aktiviti mandi-manda semata-mata. Perubahan arus zaman dan kemodenan membawa perubahan terhadap minat masyarakat, lebih 20% responden datang ke HLKW dengan tujuan utama menyaksikan kemandiri rama-rama *Rajah Brooke* dan 19% dengan tujuan terapi air panas.

PEPHPLM sebagai pusat eko-pelajaran telah menjalankan fungsinya dengan berkesan apabila kedatangan responden ke PEPHPLM dicatatkan sebanyak 25% secara berkumpulan dengan aktiviti yang menjurus kepada pengenalan kepada Hutan Paya Laut. Kumpulan umur 17 – 30 tahun merupakan 67% dari jumlah responden menggambarkan PEPHPLM menjadi tumpuan pelajar dan mahasiswa dalam bidang pembelajaran dan penyelidikan. Hampir 46% responden memilih *board walk* sebagai aktiviti utama.

Sebanyak 38 responden (46%) mengabdikan percutian bersama keluarga dan rakan di HLPTL. Faktor persekitaran yang bebas dari pencemaran bunyi dan hiruk-pikuk kota menjadi aset bernilai HLPTK. Rata-rata responden yang memilih HLPTK adalah bertujuan merehatkan diri dan meransang minda.

Tindakan pengutipan tiket masuk ini bakal mengurangkan beban kebergantungan terhadap peruntukan kewangan di samping berharap mampu menjana pendapatan yang lebih baik. Melalui wang ini kerja-kerja penyelenggaraan HL akan bertambah baik di samping merendahkan kos operasi. Hasilnya HL akan lebih terurus dengan kapasiti pengunjung dapat dihadkan sekaligus mengurangkan kadar kerosakan sesuatu kemudahan.

Responden yang tidak sanggup membayar untuk tiket masuk adalah disebabkan oleh ketidakpuasan terhadap tahap kemudahan yang disediakan. JPNPk mengambil pandangan ini sebagai titik permulaan bagi memperkemaskan lagi kerja penyelenggaraan dan akan membuktikan kepada golongan ini jika masyarakat bersama-sama membantu dalam merealisasikan pengutipan tiket masuk kemudahan akan berada pada paras yang diinginkan.

5.0 HASIL

Kajian ini telah menjadi panduan kepada JPNPk untuk menetapkan kadar yang munasabah dan relevan serta tidak membebankan pengunjung. Kertas kerja untuk mengenakan bayaran masuk telah diangkatkan ke Majlis Mesyuarat Kerajaan Negeri Perak Bil. 1786 pada 17 Ogos 2014 yang mana telah meluluskan pindaan kadar bayaran tiket masuk ke enam (6) buah HL berkuatkuasa 1 Januari 2015 dengan kadar dalam Jadual B. JPNPk akan mewartakan pindaan di dalam Kaedah-Kaedah Hutan Negeri Perak bagi membolehkan kutipan dibuat mengikut perancangan.

Tindakan pengutipan tiket masuk ke atas enam HL tersebut dianggarkan mampu memberi pulangan kira-kira RM 98,943.00 sebulan dan RM 1,187,316.00 setahun sebagaimana Jadual C.

6.0 PENUTUP

Kesedaran tentang kelestarian HL merupakan teras kepada peranan penting dalam memacu masyarakat memantapkan pengurusan HL. Melalui sikap ini, masyarakat akan bertindak memelihara persekitaran HL dengan menghindari kegiatan bercorak pencemaran secara langsung mahupun tidak langsung.

Kesediaan masyarakat untuk berubah melalui kesanggupan membayar tiket masuk HL menjadi asas kerjasama antara masyarakat dan JPNPk dalam pengurusan HL.

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Jadual B : Kadar Bayaran Masuk Ke Hutan Lipur Negeri Perak Darul Ridzuan**.**

Bil	Hutan Lipur	Kadar Bayaran Masuk ke Hutan Lipur (RM)				
		Dewasa	Veteran	Kanak-Kanak	Warga Asing	Kanak-Kanak 3 tahun ke bawah
1.	Pulau Tali Kail	20.00	10.00	5.00	50.00	Percuma
2.	Pusat Eko Pelajaran Hutan Paya Laut	5.00	3.00	2.00	15.00	Percuma
3.	Hutan Lipur Ulu Kenas	2.00	1.00	1.00	5.00	Percuma
4.	Hutan Lipur Kuala Woh	2.00	1.00	1.00	5.00	Percuma
5.	Taman Eko Rimba Lata Kinjang	2.00	1.00	1.00	5.00	Percuma
6.	Hutan Lipur Papan	2.00	1.00	1.00	5.00	Percuma

Jadual C: Anggaran Kutipan Bayaran Masuk Hutan Lipur Berdasarkan Bilangan Pengunjung Semasa.

Bil.	Hutan Lipur	Jumlah Pengunjung	Anggaran Kutipan		Jumlah (RM)
			Warganegara (RM)	Warga Asing (RM)	
1.	Pulau Tali Kail	105 (W)	2,100.00	0	2,100.00
2.	Pusat Eko Pelajaran Hutan Paya Laut Matang	3,590 (W) 280 (A)	17,950.00	4,200.00	22,150.00
3.	Hutan Lipur Ulu Kenas	8,388 (W)	16,776.00	0	16,776.00
4.	Hutan Lipur Kuala Woh	13,770 (W) 936(A)	27,540.00	4,680.00	32,220.00
5.	Taman Eko-Rimba Lata Kinjang	8,926 (W) 146 (A)	17,852.00	735.00	18,587.00
6.	Hutan Lipur Papan	3,555 (W)	7,110.00	0	7,110.00
	Jumlah				**98,943.00**

*Petunjuk
(W) = Warganegara, (A) = Warga Asing

PAPER 6: 4

VOICE OF THE PEOPLE IN CONSERVATION: THE PIASAU CAMP STORY

Oswald Braken Tisen | Abang Arabi Abang Aimran
Sarawak Forestry Corporation

ABSTRACT

Piasau Camp was established as an exclusive residential area for Sarawak Shell Bhd. employees in the 1950s. A final decision was made in 2013 to discontinue the use of this residential area. As the area is one of the few remaining green landscapes in urban Miri, the local community seized upon the opportunity and campaigned vigorously for the establishment of a nature reserve on the site. The government relented and Piasau Camp was officially gazetted as Piasau Nature Reserve (NR) in March 2014. This NR is currently being developed as an urban forest park for the conservation of wildlife species such as Oriental Pied Hornbill, *Anthracoceros albirostris,* as well as for recreation purposes.

1.0 INTRODUCTION

Piasau Camp is located about 5 km north of Miri City Centre on the Piasau Peninsula, a narrow spit of land with Miri River along one length and the South China Sea shoreline on the other. The Camp was originally developed in 1950's to house Shell employees and is a legacy of the days when Miri was unable to provide the housing needs of expatriates and senior Shell staff. It was further developed in the 1970's by Sarawak Shell Berhad (SSB), the occupants again being mostly expatriates. During the height of its utilization, the Camp housed 250 units of residential buildings of various sizes situated on unfenced lots, surrounded by casuarina trees and various indigenous and decorative flora. Integrated within the camp were a school (now closed), the SSB Managing Director's residence (P100) and the Piasau Boat Club (PBC). Further to developments in the oil and gas industry and the Petroleum Development Act (1974), the land was later subleased by SSB from the Sarawak State Financial Secretary through PETRONAS. Of the original 250 houses, over 80 units were returned to the government in the mid-90's due to a decreasing requirement for housing and consequently occupied by government officers and a care centre for children with special needs. The Persatuan Wanita Petroleum Miri, an NGO has its base in the Hornbill House within the area of the former school compound. This was once the rest house for VVIP visitors including former Kings and Prime Ministers. Although the lease from the State Government would not expire until 2029, SSB was closing the camp as expatriate housing by the end of 2013. Parts of the camp to the north have already been handed over to the State Government leaving a core area of 51.55 ha, comprising the housing lots, kindergarten / school, Piasau Boat Club and Piasau 100.

Map 1: Location of Piasau Camp.

2.0 BIODIVERSITY OF PIASAU CAMP

Piasau Camp has always been an attraction to visitors especially those who enjoy nature and outdoor recreation. The spacious garden-like set up of the residential units draws various species of birds and small mammals. A study by UNIMAS in 2006 recorded 12 species of trees, two species of mammal and 39 species of birds, including the Oriental Pied Hornbill (ERM, 2006). A further study by UNIMAS in 2013 recorded 45 bird species, five species of frogs and toads, 12 species of reptiles, mammals such as long tailed macaques, palm civet, prevost and plantain squirrels, ten species of butterflies and 111 plant species, including small trees and shrubs as well as four species of figs (Seman, 2014). Out of these, three species of birds are totally protected while nine species of bird, one mammal and three reptiles are protected under the Wild Life Protection Ordinance, 1998 (SGG, 1998).

Table 1: Totally Protected and Protected Species in Piasau Camp.

No	Birds	Status
1	Oriental Pied Hornbill	TP
2	Intermediate Egret	P
3	Little Egret	P
4	Cattle Egret	TP
5	Brahminy Kite	P
6	White-bellied Sea-eagle	TP
7	Buffy Fish Owl	P
8	Brown Hawk Owl	P
9	White Collared Kingfisher	P
10	Buff-necked Woodpecker	P
11	Hill Myna	P
12	Swiftlets	P
	Mammals	
1	Long-tailed Macaque	P
	Reptiles	
1	Reticulated python	P

2 King Cobra P, V
3 Water Monitor P
P = Protected & TP = Totally Protected (WLPO 1998), V = Vulnerable (IUCN Red List)

2.1 Oriental Pied Hornbill

The Oriental Pied Hornbill is iconic to Piasau Camp. This rather large and easily visible birds make the Camp their breeding place, the only known urban breeding site for this hornbill in Malaysia. They were first discovered making their nest in a tree hole in the Camp during a rapid ecological assessment of Piasau Camp commissioned by Shell in 2006. Since then, the breeding of hornbills here has been closely monitored by enthusiasts. The breeding period normally lasted for about four months, from when the female seals herself in the tree hole to when the fledglings emerge (UNIMAS, 2013). The breeding of the Oriental Pied Hornbill presents an excellent opportunity for study the behavior, reproduction, nutrition and ecology of the species. The Camp provides nesting sites not only for the hornbill but other fauna species as well. Comprehensive monitoring of hornbills by SFC commenced in 2012, with the support of Malaysian Nature Society, Miri Branch (MNSMB). Today, the garden of House No. 58 continues to be a favorite nesting site.

3.0 CHRONOLOGY OF EVENTS AND PUBLIC INVOLVEMENT LEADING TO CONSTITUTION OF PIASAU CAMP AS NATURE RESERVE

The local residents and members of the MNSMB have been monitoring the breeding of the Oriental Pied Hornbills in Piasau Camp since 2007. They have become very familiar with the hornbills at Piasau Camp and were concerned about the plight of these birds, especially when the Camp was to be handed back to the State Government at the end of 2013. The Camp was also popular amongst the Miri community for recreational activities such as walking and bird-watching due to the tree-lined walkways and abundant birdlife.

Further to the decision to close the camp and resulting public outcry, Sarawak Shell Berhad (SSB) began to explore the possibility of conversion of Piasau Camp into a conservation area in consultation with PETRONAS and the Sarawak Forestry Corporation (SFC). The target was to finalise the decision in September 2013 to coincide with the 50th anniversary of the formation of Malaysia. This would be a positive and lasting legacy and serve as a commemorative golden jubilee gift to Miri in recognition of its historical significance as the birthplace of the country's oil and gas industry.

Table 2: Chronology of recent events on the development of Piasau Camp.

Time	EVENT
Jan 2013	Universiti Malaysia Sarawak (UNIMAS) was approached to study the conservation value of Piasau Camp
Jan 2013	In parallel with the corporate effort, the community was galvanizing support by organizing the first Hornbill Walk or Walk to conserve Piasau Camp for future generations and residents of Miri - 700 people attended in support through the Piasau Camp Miri Nature Park Society
Feb 2013	Shell Malaysia Chairman and managing director of Sarawak Shell Berhad announced that Piasau Camp would be closed as a residential area in 2013 but would not relinquish the land pending a decision on the land's status
Mac 2013	UNIMAS and Sarawak Shell Berhad signed an MOU to conduct conservation value study of the Camp
Apr-May 2013	UNIMAS commenced the study with volunteers from Sarawak Shell Berhad, Malaysian Nature Society Miri and Sarawak Forestry Corporation.
May 2014	YB Tan Sri Adenan Satem, Minister of Special Functions in the Chief Minister's Office and now YAB Chief Minister of Sarawak announced that the government was exploring Piasau Camp as a potential Nature Rreserve
Jun 2013	Datu Haji Ali Yusop SFC's managing director and CEO announced that the State Government was considering adopting Piasau Camp, Miri as a potential area for the conservation of hornbills
Jul 2013	UNIMAS presented their findings to a stakeholder meeting of the Sarawak Government, Shell and PETRONAS on the Conservation and Ecological Values of Piasau Camp. The stakeholders agreed with the university's recommendations that Piasau Camp be protected for

	urban biodiversity and awareness with broad guidelines
Jul 2013	Working with Sarawak Shell Berhad and PETRONAS, SFC reported and presented to Permanent Secretary, Natural Resource and Environment Ministry on UNIMAS' recommendation and for it to be recommended and tabled to Cabinet and State Planning Unit
Sep 2013	Mother hornbill 'Feridah' was killed by three poachers on September 23rd 2013, galvanizing the community into action
Sep 2013	It was announced that the Chief Minister would like to see a quick gazetting process for Piasau NR
Oct 2013	International consultants Gensler were appointed to provide high level conceptual design of the makeover of the camp
Oct 2013	Sarawak Government announced the decision to convert all of Piasau Camp into Nature Reserve including government lots
Oct 2013	Piasau Camp Miri Nature Park Society officially registered as a society, continued to hold Nature Walks
Nov 2013	MNSMB held 'Enchanting Piasau' exhibition in collaboration with Pustaka Miri
Nov 2013	The government announced that Piasau Camp will be gazetted as a nature reserve by end December 2013, and that the area would be about 170 acres
Dec 2013	'Enchanting Piasau' exhibition at Boulevard Supermarket on 23 December 2013
Apr 2014	The State Cabinet announced the decision to gazette the area as a nature reserve
10th May 2014	Earth breaking Ceremony

4.0 GALVANIZING OF PUBLIC SENTIMENTS BY THE 'DEATH OF FERIDAH'

On the 26th September 2013, a group of young men were seen poaching the Oriental Pied Hornbill at the Camp by members of the public. The young men catapulted and took Feridah, the mother bird. This was brought to the attention of an Honorary Wild Life Ranger who approached and took photos of the poachers and notified the authorities. This went viral on the social media, stirring anger at all levels of society who demanded punishment for the offenders. The authorities with the help of the public managed to trace the offender leading to the recovery of the dead bird (Seman, 2013). A successful prosecution of the offender resulted in a jail-term of six month. The death of Feridah was a major loss to the population of the OPH in Piasau Camp. However, this may be considered a blessing in disguise as it galvanized public sentiments resulting in calls for Piasau Camp to be accorded appropriate protection under the law. This brought about a chain reaction of involvement by various quarters, especially the MNSMB and the Piasau Camp Miri Nature Park Society (PCMNPS) conducting hornbill walks and public awareness program participated by all levels of society including school children. The walks were much publicized which in turn drew the attention of politicians who then expedited the decision to gazette Piasau Camp as a Nature Reserve. Subsequently, a joint SSBH, PETRONAS and SFCSB working committee was established to launch Piasau as a nature reserve, to be officiated by YAB the Chief Minister of Sarawak

5.0 GAZETTEMENT OF PIASAU NATURE RESERVE

Piasau camp was finally gazetted as Piasau Nature Reserve effective 31st December 2013, following a notification by the Minister for Resource Planning and Environment on the 2nd May 2014 with the approval of the Majlis Mesyuarat Kerajaan Negeri on the 3rd April 2014. The gazettement was made under Section 19 of the National Parks and Nature Reserves Ordinance, 1998 [Cap.27]. The newly established nature reserve covers an area of approximately 88.5 hectares.

6.0 THE LEGACY: ENDOWMENT FUND FOR PIASAU NATURE RESERVE

PETRONAS and Sarawak Shell Berhad agreed to contribute RM5 million each to the Endowment Fund for Piasau Nature Reserve made under Section 12 of Sarawak Forestry Corporation Ordinance, 1995. The members of the Committee are as follow:

- Deputy Chairman SFC Board - Chairman
- Director of Forests, Sarawak - Member
- State Financial Secretary - Member
- Chief Executive Officer, SFCSB - Member

- PETRONAS (Representative) - Member
- SHELL (Representative) - Member
- SPC PNR (Representative) - Member
- General Manager of PABC, SFCSB - Secretary

SFC is entrusted as the custodian of the guidelines set forth for the systematic and uniform operational management processes of Piasau Nature Reserve Implementation and Endowment Fund in terms of administration, processing of applications to use funds and the management of disbursements.

This is without precedent as never before has an Endowment Fund been established with contributions from outside to run and develop a nature reserve. Hopefully, more of such precedents would be set in time to come.

7.0 CONCLUSION

The events that led to the establishment of Piasau Nature Reserve is a manifestation of direct and effective public involvement in the conservation and protection of a particular species and its habitat. This represents the arrival of a new paradigm in Sarawak whereby conservation initiatives could be driven by public sentiments to positively impact government decisions. The Piasau Camp Story also broke new grounds in the creation of an Endowment Fund to conserve a flagship species as well as address the long-term funding needs of a Totally Protected Area.

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PAPER 6: 5

KLIAS FIELD CENTRE AND ENVIRONMENTAL EDUCATION – ENHANCING PUBLIC AWARENESS ON PEAT SWAMP MANAGEMENT AND CONSERVATION

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ABSTRACT

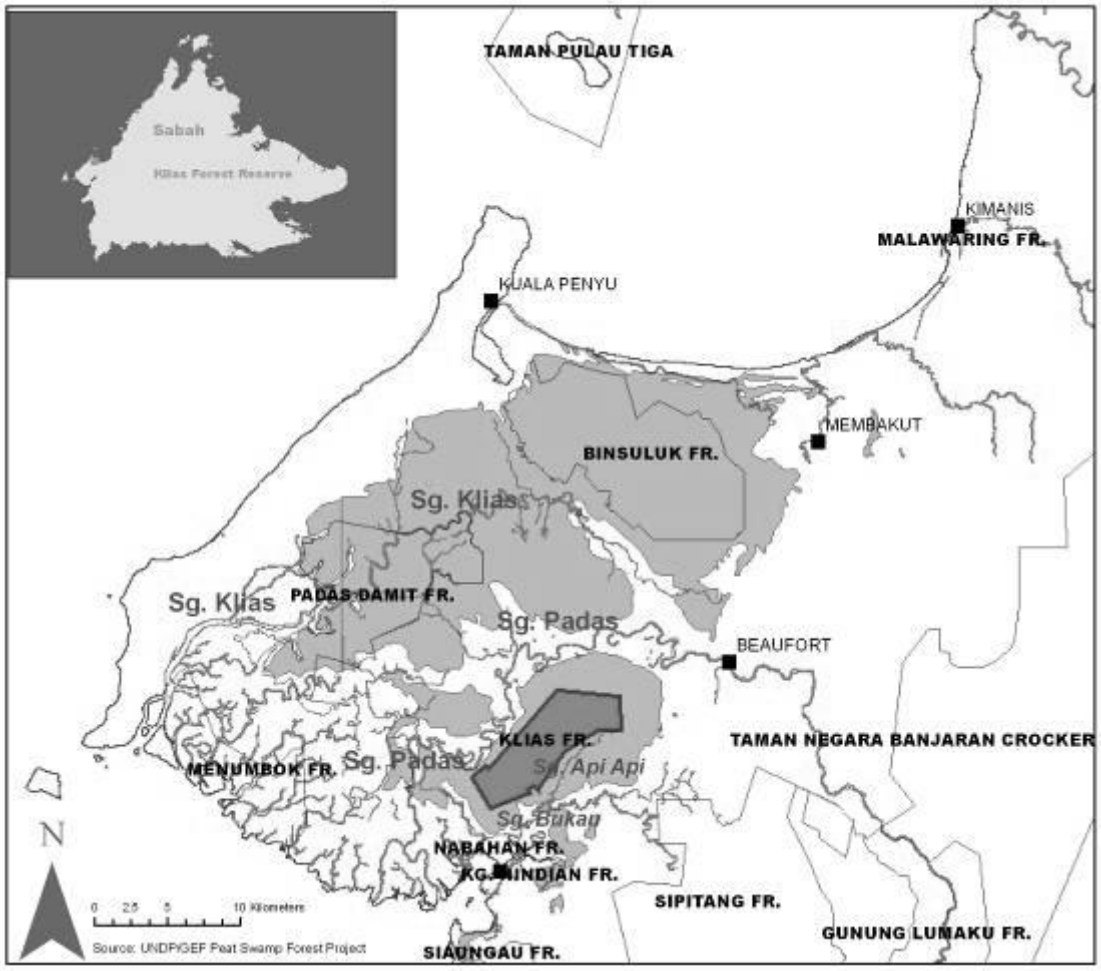
The Klias peat swamp is located within the Klias Peninsula, situated at the southern part of the the lower west coast of Sabah between the Padas River and the Bukau-Api-api River where the peat deposit measures up to 7 kilometers wide and 15 kilometres in length. Today, the remaining intact peat swamp forest is largely confined to the Klias Forest Reserve (approx. 3,630ha), which was established as a Class I protection forest in 1984. Since its designation as a protection forest, no commercial logging has taken place within the forest reserve although selective timber extraction had been carried out in the sixties. Nevertheless, peat fire incidents and extensive land conversion, including the construction of drainage canals, surrounding the reserve, posed significant threats to the integrity of the peat swamp forest ecosystem. Realizing these issues, the reserve was selected as the core area to be protected and conserved in Sabah under the Peat Swamp Forest Conservation project which was implemented by the Government of Malaysia (GoM) in cooperation with DANIDA (2002-2005) and UNDP/GEF (2002-2008). In summary, DANIDA's component looked into the Hydrological aspect of Klias peat swamp forest which complemented the development of Klias Site Conservation Plan pursued under the UNDP/GEF's component. Towards the end of the project implementation, the project had proposed various management and conservation strategies to address the various threats and issues affecting the Klias peat swamp forest. These strategies are 1) promoting rapid development on adjacent alienated land; 2) initiating critical restoration exercise; 3) extending protected area boundary; 4) addressing abandoned drainage canals; 5) collecting and monitoring of critical data for long term forest protection i.e. Fire Danger Rating System (FDRS); and 6) enhancing local knowledge base. In order to implement these strategies, the government had constructed a field centre located on site. The centre is equipped with basic facilities to promote awareness among the general public on the management and conservation of this last remaining intact peat swamp ecosystem in Sabah. This paper briefly highlights activities implemented by the Klias Field Centre related to environmental education and awareness on peat management and conservation and also presents the issues and challenges in running the center since its establishment.

1.0 Introduction

Sabah has a land area of 73,619sq km (or 7,361,900ha) with a coastline of 1,440km in length. Most of the low-lying coastal regions in the west coast are well established human settlements, but the more inland are harsh rugged hills and mountain ranges. Sabah forest is known for its plant and animal species diversity. It is estimated that there are approximately 124,457 ha of land classified under peat soil.

The Klias peat swamp is located within the Klias Peninsula, along the southern part of the west coast of Sabah on the northern tip of Borneo at the latitudes of 5° 10'─5° 30'N and longitudes of 115° 20'─115° 42'E. The peat deposit at Klias is the only known dome-shaped peat deposit in Sabah and is probably one of only a few examples of such peat lands that are easily accessible in Southeast Asia (Map 1). The area is drained by three major river systems: Sg. Klias, Sg. Padas and Sg. Bukau/Api Api.

Map 1 : Extent of Klias Peat Swamp Forest Reserve.



Source: SFD, 2007

The Klias Peninsula falls within the district boundaries of Kuala Penyu and Beaufort. The major towns include, Membakut, Beaufort and Weston, all of which are located along the coastal main road between Kota Kinabalu and Sipitang. Most of the remaining forested areas within the Klias Peninsula fall within the boundaries of existing Forest Reserves (Table 1).

Table 1 : Major Forest Reserves within the Klias Peninsula.

Forest Reserve	Class	Area (ha)	Major vegetation type
Binsuluk	Class I	12,106 ha	Mixed peat swamp forest
Klias	Class I	3,630 ha	Mixed peat swamp forest
Padas Damit	Class IV	9,339 ha	Mixed peat swamp forest and nipah swamps
Kampung Hindian	Class IV	580 ha	Mangroves, mixed peat swamp forest and *Gymnostoma* swamp forest
Menumbok	Class V	7,710 ha	Mangroves
Nabahan	Class IV	356 ha	*Gymnostoma* swamp forest, nipah swamps and mangroves

Source: SFD, 2013

Originally, the Klias peat swamp forests was situated between the Padas River and the Bukau-Api-api River where the peat deposit stretches up to 7 kilometers wide and 15 kilometres in length. Today, the remaining forests are largely confined to the Klias Forest Reserve (approx. 3,630ha), which was established as a Class I protection forest in 1984. Selective logging was carried out in parts of the forest in 1960s. Since its designation as a *protection forest*, no commercial logging has taken place within the forest reserve. The reserve has the following key attributes:

- Unique forest type in the State of Sabah and distinct from any other peat swamps in Borneo;
- One of the pristine mixed peat swamp forests on the island of Borneo;
- One of the few places in the world where large individual trees of important peat swamp tree species can still be found. For example: *Gonystylus bancanus* (ramin) and *Dryobalanops rappa* (kapur paya - recorded to exceed more than 60 cm dbh);
- Has a high potential to be an international site for peat swamp forest research and conservation. One of the few peat swamp forest sites in Southeast Asia which has been extensively studied from both biological and hydrological perspectives.
- Has a high potential for the protection and conservation of a protected area to provide a catalyst for community development in the surrounding areas.

2.0 Threats and Issues to Klias Forest Reserve

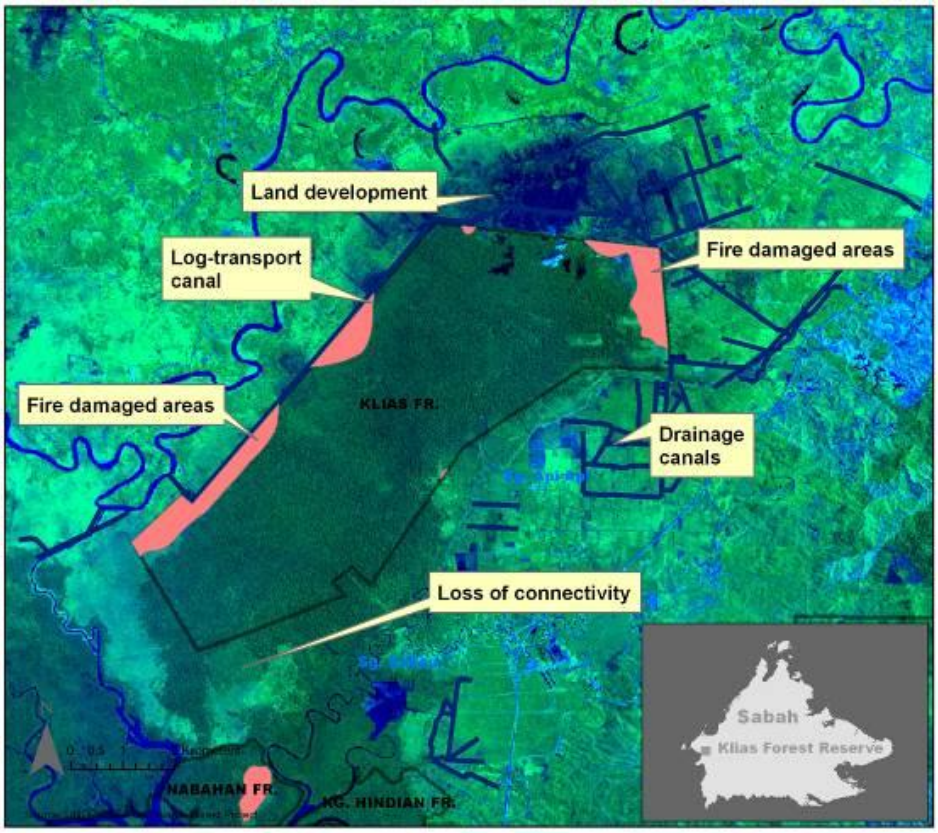
It was noted that peat fire incidents and extensive land conversion/development, including the construction of drainage canals at the surrounding Klias peat swamp conservation area, posed as significant threats to the integrity of the peat swamp forest ecosystem. The following are the prevalent and most critical threats operating at the site:

	Drainage and irrigation canals The impact of drainage canals is on the hydrology of the peat soils. Unplanned and uncoordinated drainage schemes on peatlands adjoining the Forest Reserve are the main area of concern.
	Conversion to agriculture Land clearance for agriculture contributes to the loss of biodiversity and natural areas. Most of the land surrounding the Klias Forest Reserves has been (or will be) developed for agriculture (e.g., oil palm, pineapple, etc).
	Idle land Land earmarked for forest conversion, often to agriculture, is sometimes left idle for many years. These areas pose huge risks to the adjacent forested areas and peatlands. The major threats are fire-risks (large volume of combustible material) and from impact on the underlying hydrology (due to excessive evapotranspiration).
	Fire By far the most significant threat is fire. Fire destroys peat and results in the loss of the characteristic "peat" properties of the soil. Where areas have been burnt, it is unlikely that peat forest will regenerate.

	Climatic change A long period of prolonged drought is a common phenomenon in Sabah. Often, this is associated with the *El Nino* effect. During such drought, the risk of fire is heightened and can result in significant loss of peatlands. The fires of 1998-1999, for example, almost burnt the entire Binsuluk Forest Reserve.

The extent of these threats is illustrated on the following map:

Map 2 : Threats to Klias Peat Swamp Forest Reserve.



Source: SFD, 2007

Realizing these issues and the importance to protect this globally significant ecosystem, Klias Forest Reserves was selected as the core areas to be protected and conserved in Sabah under the Peat Swamp Forest Conservation project which was undertaken by the Government of Malaysia (GoM) in cooperation with DANIDA (2002-2005) and UNDP/GEF (2002-2006). In summary, DANIDA's component looked into the hydrological aspect of Klias PSF which complemented the development and demonstration of Klias Site Conservation Plan developed under the UNDP/GEF's component. Towards the end of the National Peat Swamp Conservation Project, various conservation strategies were proposed. The following were proposed for Klias Forest Reserve:

1) promote rapid development on adjacent alienated land;
2) initiate critical restoration exercise;
3) extend protected area boundary;
4) address abandoned drainage canals;
5) collecting and monitoring of critical data for long term forest protection, i.e. Fire Danger Rating System (FDRS); and
6) enhance local knowledge base.

3.0 Klias Peatswamp Field Centre

In order to implement agreed conservation strategies for Klias FR, the government had constructed a field centre. Construction began in 2004 and was officially opened in 2006. The centre is equipped with basic facilities to promote awareness among the general public on the management and conservation of this last remaining intact ecosystem in Sabah (Pic. 1).

Picture 1: Overview of Klias Peatswamp Field Centre.

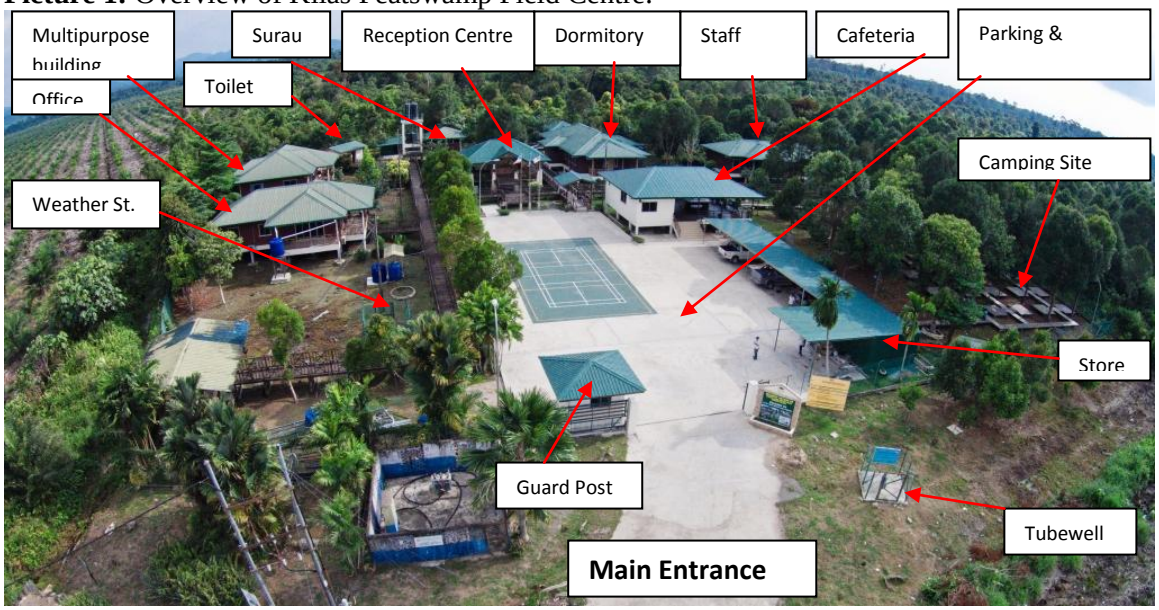


Photo: Videographics S/B

Apart from these facilities, the centre is also equipped with a 2.7 km boardwalk which connects the centre to the natural regeneration of peat swamp forest (Pic. 2). This boardwalk plays an important role in educating the general public in terms of illustrating peat restoration activity and observing natural intact forest stand, and at the same time providing easy access for various observation activities.

Picture 2 : View of a 2.7 km Belian Boardwalk at Klias Forest Reserve.

Photo: Videographics S/B

4.0 Implementing Conservation Activities

4.1 Promoting Rapid Development on Adjacent Alienated Land

The department acknowledged that in order to lessen threat over the conservation of Klias FR (as prescribed by the Klias Site Conservation Plan, 2006), there is a need to provide basic facilities to promote rapid development on adjacent land neighbouring the reserve. Some of the facilities provided that promoted the rapid development of these lands were proper access, electricity and water supply.

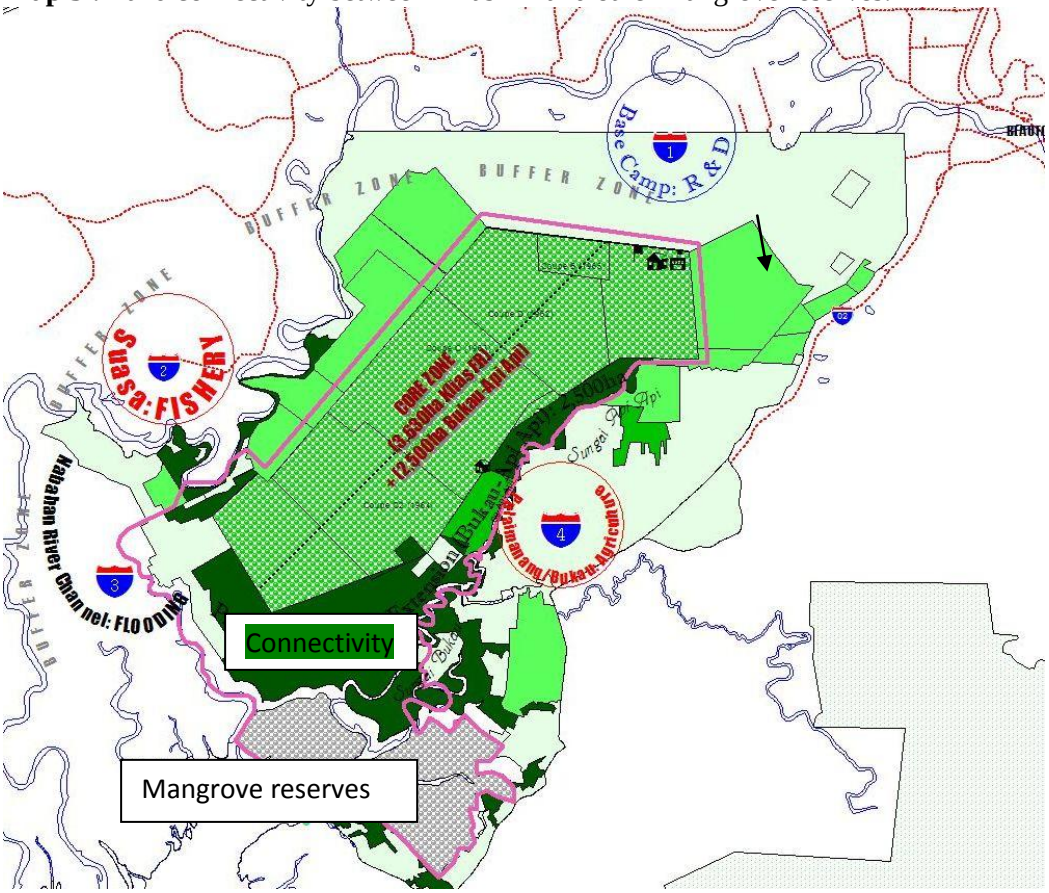
4.2 Initiating Critical Restoration Exercise

Previous observation had indicated that there are approximately 300 ha of burnt areas within Klias FR. This area requires urgent restoration to avoid recurring peat fires and to avoid further subsidence of the peat layer. Tree planting had been carried out since 2006 and by year 2010, the department had completed planting those identified degraded areas. The most tree species planted for this exercise were 1) Serungan (*Cratoxylon arborescens*), 2) Kapur paya (*Dryobalanops rappa*), 3) Ramin (*Gonystylus bancanus*), and 4) Pulai (*Alstonia* sp.).

4.3 Extending Protected Area Boundary

The mangrove reserves, namely Nabahan FR and Menumbok FR are located at the southern part of Klias FR. These reserves are home to various types of wildlife especially the state's flagship icon, the Proboscis monkey. Past observations showed that the proboscis uses Klias FR as the alternate roaming areas. Unfortunately, Klias FR is not connected to the mangrove reserve. Pursuant with the recommendation proposed under the site conservation plan, the department gazetted some 856 ha (SFD, 2013) connecting these reserves (Map 3). The acquisition of this new area had also assisted in reducing threat the the Klias FR in terms of land conversion to other uses.

Map 3 : Land connectivity between Klias FR and other mangrove reserves.



4.4 Addressing Abandoned Drainage Canals

There are approximately 7 km drainage canal at the northern part of Klias FR. In the past, this canal was built to transport logs salvaged from surrounding Klias FR. Once those activities ended, the canal was subsequently used by the land owners to lower the water table on their respective land enabling them to develop these areas, i.e. oil palm plantation. This issue posed significant threat to the hydrological integrity of the reserve. As a compromised mitigation measure, the department had constructed a series of check dams along this canal allowing only a certain amount of water to flow out of the reserve.

4.5 Collecting and Monitoring Critical Data for Long Term Forest Protection

Peat fire is notably the most significant threat to the conservation of Klias FR. Hence, the department using Fire Danger Rating System (FDRS) at site to monitor and prevent of any fire occurrence at Klias FR. Information such as precipitation; temperature and humidity are daily relayed to FDRS administrator who in return will alert the office of any possible danger. Apart from that, observation on water level is also conducted during drought to assess on the fuel material and source of water for fire suppression. Various hot spots had been detected and some areas were burnt but no major peat fire had occurred in Klias FR since the implementation of the FDRS.

4.6 Enhancing Local Knowledge Base

There are various information and experiences gained through implementing the peat conservation initiatives (Frame 1). This knowledge has been documented in form of report, booklet, pamphlet, video and poster which are disseminated to the general public in various functions, i.e. visitation, seminar, workshop etc.

Frame 1 : Documented information on Klias Peat Swamp Forest.

5.0 Issues & Challenges in Implementing Conservation Activities

The Klias Peat Swamp Field Centre had been in operation for almost a decade. Over the years, various issues and challengers had been encountered. They are as follows:

- Assurance of continuous funding to implement the various conservation initiatives, i.e. restoration, awareness raising, hydrological management, building maintenance, man-power, etc;
- Multi-sectoral coordination among key agencies to implement various conservation activities which are sometimes not properly synchronized, i.e. duplication of activities resulting in resources not effectively utilized and executed;
- The various conservation strategies may not be accepted by some members of the communities resulting in delay and or 'hick-up' in implementing some activity, e.g. construction of a check dam objected by land owners who think that it may cause prolonged flooding on their land;
- Working environment in peat land areas is very difficult. It requires physical and mental agility to continuously implement conservation related activities;
- Works and research on peat land and peat swamp is far from over. Not many individuals or groups of individuals fully understand the future impact on this ecosystem with the various current land use types and various development means, i.e. use of chemicals, machineries, lowering water tables, etc.

6.0 Discussion and Conclusions

Regardless of the existing issues and challenges, the Klias Peatswamp Field Centre continues to operate and execute its conservation activities. Over the years, the centre had been greatly appreciated either by domestic and or international visitors. Degraded areas within the reserve were restored and their performance is evaluated in years to come. Since the implementation of forest protection initiatives, no major peat fire had threatened the integrity of the reserve. The success of conserving this last remaining peat swamp is greatly dependent on addressing issues and challenges discussed above.

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PAPER 6: 6

FAEDAH SOSIOEKONOMI: KAWASAN KORIDOR EKOLOGI *CENTRAL FOREST SPINE* (CFS), GERIK, PERAK

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ABSTRAK

Hutan menyediakan biodiversiti yang bernilai dan menjadi habitat bagi flora dan fauna. Menyedari fungsi ini, Dasar Perhutanan Negara (pindaan 1992) memperuntukkan kepada Jabatan Perhutanan Semenanjung Malaysia (JPSM) untuk melindungi dan memulihara biodiversiti hutan dan juga fungsi-fungsi lain. Fragmentasi kawasan hutan memberi kesan negatif kepada aktiviti perlindungan dan pemuliharaan biodiversiti hutan. Dalam hal ini, Rancangan Fizikal Negara (RFN) mencadangkan penubuhan *Central Forest Spine* (CFS) sebagai tulang belakang untuk mewujudkan jaringan antara kompleks hutan dan berfungsi sebagai koridor ekologi untuk melindungi dan memulihara kepelbagaian biologi hutan. Kertas kerja ini membincangkan kajian yang dijalankan ke atas 592 isi rumah daripada 53 buah kampung yang tinggal di dalam atau di sekitar kawasan CFS Gerik Perak. Kaji selidik ini mendedahkan bahawa pelbagai aktiviti yang boleh dilakukan di kawasan CFS untuk menjana pendapatan kepada masyarakat tempatan seperti aktiviti eko-pelancongan berimpak rendah, rumah penginapan, trek hutan, aktiviti berjalan kaki pada waktu malam dan lain-lain. Masyarakat tempatan juga boleh melibatkan diri dalam program penanaman, perlindungan hutan dan pemberi maklumat bagi tujuan keselamatan hutan. Bagi prospek masa hadapan, CFS Gerik Perak boleh ditubuhkan sebagai Pusat Pemuliharaan Biodiversiti dengan pengurusan hutan secara sistematik dan penyimpanan stok karbon yang tinggi.

1. PENGENALAN

Pelaksanaan kawasan Koridor Ekologi CFS tercetus hasil daripada keputusan Mesyuarat Rancangan Fizikal Negara (RFN) ke-2 yang telah diluluskan oleh Jemaah Menteri yang telah mengenalpasti fragmentasi hutan sebagai ancaman kepada pemeliharaan hutan dan perlindungan biodiversiti. Salah satu dasar yang ditekankan dalam RFN ke-2 adalah Dasar RFN23 yang menyatakan keperluan mewujudkan kawasan CFS bagi membentuk tulang belakang jaringan Kawasan Sensitif Alam Sekitar (KSAS). Kawasan CFS diwujudkan bertujuan mengekalkan kawasan berhutan untuk pemeliharaan dan pemuliharaan biodiversiti menerusi penyambungan 4 kompleks hutan utama di Semenanjung Malaysia. Susulan daripada itu, Jemaah Menteri telah bersetuju dengan Pelan Induk Koridor Ekologi CFS yang melibatkan pengwujudan 37 koridor ekologi di Semenanjung Malaysia. Sebagai permulaan dalam melaksanakan pelan tersebut, kawasan koridor ekologi telah dikenalpasti iaitu di Gerik, Perak yang melibatkan Hutan Simpan Belum, Hutan Simpan Royal Belum dan Hutan Simpan Temenggor di Koridor Ekologi Utama 2 (Primary Linkages 2 (PL2)). Pemilihan Gerik sebagai projek permulaan pembangunan koridor ekologi adalah kerana kawasan Belum-Temenggor merupakan antara kawasan yang mempunyai populasi gajah, harimau belang dan seladang yang tertinggi di Semenanjung Malaysia dan wujudnya konflik manusia dan hidupan liar yang tinggi termasuklah aduan gajah melintas dan membahayakan pengguna jalan raya. Kawasan ini juga menyumbang kepada pemeliharaan biodiversiti merentasi sempadan (*transboundary biodiversity conservation*) di antara Malaysia dan Thailand[22]. Pelaksanaan projek CFS ini dijangka akan memberi faedah-faedah seperti pengekalan kawasan berhutan serta menjamin hasil dan perkhidmatan hutan yang berterusan terutama kepada generasi akan datang serta dapat membasmi kemiskinan dan menjamin pendapatan tetap terutama kepada penduduk setempat. Selain itu ianya juga dapat memberi jaminan sosial dan persekitaran bagi generasi akan datang melalui pengekalan kestabilan alam sekitar, ekologi dan kepelbagaian biologi di samping mencegah kejadian konflik manusia-haiwan liar yang mengakibatkan kerugian dalam bentuk kemusnahan ternakan dan hasil pertanian, kerosakan harta benda dan serangan kepada manusia. Bagi melihat keberkesanan projek koridor ekologi CFS ini yang dilihat dapat memberi pelbagai faedah di pelbagai peringkat terutama faedah kepada masyarakat setempat, satu tinjauan telah dijalankan bagi mengenalpasti peluang-peluang ekonomi yang boleh dibangunkan di kawasan CFS di samping melihat kesan sosio ekonomi kepada masyarakat setempat akibat penubuhan Koridor Ekologi CFS dari segi peningkatan dalam pendapatan isirumah.

[22] Memorandum Bersama daripada Menteri Sumber Asli dan Alam Sekitar dan menteri Perumahan dan Kerajaan Tempatan; Central Forest Spine: Pelan Induk Koridor Ekologi dan Pelaksanaannya di Semenanjung Malaysia.

2. TINJAUAN DAN PENGUMPULAN MAKLUMAT

Tinjauan ini telah dijalankan pada bulan Ogos hingga Disember 2013 yang meliputi kawasan projek koridor ekologi CFS (PL2:CFS1) dalam jejari 50km yang berpusat di kilometer 157 Lebuhraya Timur-Barat di mana *viaduct* akan dibangunkan. Tinjauan ini adalah berbentuk soal selidik dan jumlah keseluruhan penduduk bagi kawasan ini adalah berjumlah 101,646 orang (2010) dan dianggarkan meningkat kepada 118,794 orang menjelang tahun 2020[23]

Seramai **592 ketua isirumah** dari **53 buah kampung** (19 kampung tradisi dan 34 buah perkampungan Orang Asli) telah dipilih sebagai responden dan ditemubual, disoalselidik dan dicerap untuk tinjauan sosio ekonomi ini. Ketua isirumah yang dipilih adalah dari 3 kategori kampung iaitu kampung tradisi, kampung pinggir Orang Asli dan Rancangan Pengumpulan Semula (RPS) Orang Asli iaitu RPS Banun, RPS Dala dan RPS Kemar. Seramai 317 (53.5%) ketua isirumah dari kampung tradisi dan 275 (46.5%) ketua isirumah dari kalangan Orang Asli telah ditemubual, disoalselidik dan dicerap untuk tinjauan ini. Ketua isirumah dari RPS Banun pula adalah seramai 116 orang (42.2%) dari 275 ketua isirumah di kalangan Orang Asli telah disoal selidik. Ketua isirumah dari RPS Kemar pula adalah seramai 93 orang (33.8%) manakala dari RPS Dala adalah seramai 52 orang (18.9%). Dari kampung pinggir Orang Asli ketua isirumah adalah seramai 14 orang iaitu 5.1%. Menerusi tinjauan ini, pelbagai maklumat telah diperolehi seperti profil penduduk, persepsi terhadap projek CFS, daya libat diri dan keinginan merebut peluang-peluang ekonomi dan pekerjaan serta lain-lain pandangan terhadap pembangunan yang dicadangkan. Penemuan-penemuan tinjauan dan pengumpulan maklumat ini telah dirumuskan sepertimana di **Lampiran I** bagi menjadi panduan dalam melaksanakan aktiviti-aktiviti ekonomi di kawasan koridor ekologi CFS, Gerik, Perak.

3. FAEDAH-FAEDAH SOSIO EKONOMI

Hasil daripada tinjauan dan soal selidik yang dijalankan penerimaan penduduk setempat terhadap projek koridor ekologi CFS adalah positif dan yakin ianya memberi pelbagai faedah kepada mereka. Antara faedah- faedah sosio ekonomi yang telah dikenalpasti adalah seperti berikut:

3.1 Kesan Positif Pembinaan Infrastruktur

Pembinaan infrastruktur *viaduct* bukan sahaja menyatukan kawasan fragmentasi hutan malah dilihat dapat menjana punca pendapatan kepada masyarakat setempat. Dengan adanya infrastruktur *viaduct* ini secara tidak langsung ianya membuka ruang dan peluang kepada masyarakat setempat untuk menjalankan aktiviti-aktiviti ekonomi seperti jualan hasil pertanian dan ternakan. Pembinaan infrastruktur-infrastruktur yang lain di sekitar viaduct ini dapat membantu penduduk setempat menjalankan aktiviti ekonomi di kawasan tersebut. Di samping itu ianya juga dapat menghubungkan masyarakat di satu perkampungan ke perkampungan yang lain yang mana dapat memperluaskan sasaran dan meningkatkan jumlah pembeli serta seterusnya meningkatkan ekonomi masyarakat setempat.

3.2 Peluang Pekerjaan

Dengan wujudnya pelbagai aktiviti ekonomi di kawasan koridor ekologi CFS tersebut, secara langsung ianya membuka peluang pekerjaan kepada penduduk setempat. Peluang pekerjaan selama ini yang hanya tertumpu di perkampungan atau kelompok mereka sendiri dapat dipertingkatkan dengan adanya infrastruktur ini sekaligus dapat meningkatkan pendapatan isirumah serta membantu mengurangkan kadar kemiskinan di kalangan penduduk setempat. Secara umumnya, hal ini juga dapat membantu meningkatkan taraf hidup masyarakat setempat dan meningkatkan pendapatan Kerajaan Negeri. Pekerjaan utama masyarakat setempat pada masa ini hanyalah tertumpu pada bidang pertanian dan hasil hutan sahaja.

3.3 Industri Eko-pelancongan Berimpak Rendah

Selain itu, kawasan koridor ekologi CFS ini juga boleh dimajukan dengan mewujudkan industri eko-pelancongan yang berimpak rendah. Antara industri eko-pelancongan yang boleh dimajukan di kawasan ini adalah seperti penubuhan kawasan/menara pemerhatian hidupan liar termasuk kemudahan eko-pelancongan berimpak rendah di tempat-tempat yang bersesuaian di sepanjang Lebuhraya Timur-Barat serta mempromosikan kawasan koridor ekologi sebagai *Jumbo Trail* selari dengan *National Ecotourism Master Plan.* Selain itu, perkampungan Orang Asli di sekitar kawasan ini juga dilihat sebagai salah satu daya tarikan kepada

[23] Laporan Penduduk Negeri Perak 2001, Laporan taburan Penduduk dan ciri-ciri asas demografi 2000 (Julai 2001), Penduduk tahun 2002-berdasarkan unjuran penduduk semulajadi (kohort), Jabatan Perangkaan Malaysia.

para pelancong dan boleh dibangunkan sebagai '*Living Museum'* disusuli dengan beberapa kawasan yang menarik seperti Pulau Banding dan lain-lain.

3.4 Peluang untuk Membangunkan Kawasan Masyarakat Setempat

Kawasan projek koridor ekologi CFS yang ingin dibangunkan ini mempunyai pelbagai khazanah sumber biodiversiti hutan yang boleh menggalakkan pelbagai aktiviti seperti perhutanantani, industri herba dan tumbuhan ubatan, kraftangan dari hasil hutan dan sebagainya. Dengan adanya khazanah-khazanah seperti ini, ianya membantu membangunkan sesebuah kawasan atau perkampungan di kawasan CFS tersebut.

3.5 Penghargaan Masyarakat setempat terhadap Projek Koridor Ekologi CFS

Menerusi maklumbalas yang diterima melalui tinjauan ini, penduduk setempat yakin projek koridor ekologi CFS tidak akan merosakkan alam sekitar serta tidak menggangu habitat flora dan fauna. Sebahagian besar penduduk bersedia untuk menjadi sukarelawan dan sahabat dalam melaksanakan projek ini serta bersedia untuk membuat laporan ke atas pencerobohan haram ke kawasan hutan. Ini menunjukkan tanda penghargaan masyarakat setempat terhadap pelaksanaan projek koridor ekologi CFS di Gerik, Perak.

4. CADANGAN PEMBANGUNAN SOSIO EKONOMI MASA HADAPAN

Setelah melihat dan mengambil kira faedah-faedah yang diperolehi menerusi pelaksanaan projek koridor ekologi CFS ini, beberapa cadangan pembangunan sosio ekonomi telah dirangka iaitu:

i. **Pembangunan Pulau Banding** dimana kawasan ini dilihat dapat menawarkan produk eko-pelancongan, pelancongan rekreasi dan pelancongan sukan. Selain itu pelbagai aktiviti boleh dilakukan seperti memerhati gajah di waktu malam serta menjalankan aktiviti sukan lasak dan rekreasi air seperti *Royal Belum Cross-Country Challenge* dan lain-lain*;*
ii. **Pembangunan Hutan Simpan Temenggor dan Tasik Temenggor** di mana kawasan ini merupakan tarikan utama bagi produk eko-pelancongan, pembelajaran, penyelidikan dan sebagainya;
iii. **Pembangunan Kawasan Perkampungan** di mana bagi memajukan ekonomi kawasan kampung, fokus untuk pembangunan ekonomi perlu melalui pendekatan satu mukim satu produk. Pemilihan produk untuk program ini adalah berdasarkan jenis aktiviti dan perusahaan sedia ada.;
iv. **Pembangunan Skim Pertanian Produktif** seperti Konsep Agrolancongan (Pertanian dan Pelancongan), Taman Agroperhutanan (Pertanian dan Perhutanan), Ternakan Intergrasi (Pertanian dan Ternakan) dan Skim Pertanian Berkelompok (Pertanian dan Usahawan Tani) dibangunkan;
v. **Pembangunan Perdagangan** di mana kawasan Bandariang dikenalpasti sebagai pusat pertumbuhan baru yang menyediakan perkhidmatan dan barangan peringkat rendah dan sederhana kepada penduduk di kawasan sekitar dan pengguna laluan Lebuh raya Timur-Barat;
vi. **Pembangunan Perindustrian** di mana kawasan kajian dikenalpasti bagi industri berasaskan perkayuan dan produk kayu termasuk perabot. Zon perindustrian yang dikenalpasti bagi menggalakkan aktiviti perindustrian ialah di koridor kecil Gerik-Bandariang. Projek pembangunan yang disyorkan adalah berbentuk Industri Kecil dan Sederhana (IKS) dan industri perkhidmatan;
vii. **Pembangunan Sosio Ekonomi Orang Asli** di mana pembangunan Orang Asli lebih tertumpu kepada pembangunan ekonomi dan pembangunan insan. Pembangunan ekonomi tertumpu kepada aktiviti pertanian seperti tanaman kelapa sawit, getah, pisang, dusun buah-buahan dan tanaman herba; dan
viii. **Pembangunan Insan bagi Orang Asli** di mana menyediakan program pembangunan minda dan kursus atau latihan khas seperti Kursus Bahasa Inggeris, Pengurusan dan pemasaran hasil kraftangan bagi memberi peluang kepada Orang Asli menceburi bidang eko-pelancongan.

5. RUMUSAN

Secara keseluruhannya, pelaksanaan projek koridor ekologi CFS merupakan satu langkah jangka panjang bukan sahaja bertujuan untuk memelihara dan memulihara kawasan berhutan serta menjaga kepentingan biodiversiti flora dan fauna malah dapat memberi prospek masa hadapan yang baik kepada masyarakat setempat. Dengan melihat unjuran penduduk negeri Perak bagi jangka masa 2000-2020, jumlah penduduk di kawasan ini dijangka meningkat kepada 118,794 orang pada tahun 2020 menunjukkan bahawa pembangunan projek ini berpotensi untuk membangunkan kawasan Gerik, Perak dengan menawarkan faedah-faedah sosio ekonomi yang memberansangkan kepada Kerajaan Negeri umumnya dan masyarakat setempat khususnya. Sekiranya konsep

pembangunan kawasan projek koridor ekologi CFS dibangunkan dengan berasaskan garis panduan seperti mengambil kira kepentingan biodiversiti, koridor hidupan liar, pengekalan warisan khazanah alam, faktor geografi, kawasan tadahan air dan pendekatan pembangunan yang lebih mesra alam dan berdensiti rendah maka pembangunan sosio ekonomi di kawasan koridor ekologi CFS akan terlaksana dengan jayanya.

RUJUKAN

Memorandum Bersama daripada Menteri Sumber Asli dan Alam Sekitar dan Menteri Perumahan dan Kerajaan Tempatan; Central Forest Spine: Pelan Induk Koridor Ekologi dan Pelaksanaannya di Semenanjung Malaysia.

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Lampiran I

Bil	Perkara	Penemuan Tinjauan	Rumusan
1.	Profil Ketua Isirumah	Hasil tinjauan menunjukkan dari 592 responden yang ditemubual, seramai 421 responden atau 71.1% terdiri dari penganut agama Islam. Ia diikuti oleh fahaman Animisme seramai 138 atau 23.3% iaitu terdiri dari kalangan orang Asli, Kristian seramai 18 orang atau 3.0% iaitu dari RPS Banun dan Kemar, Buddha pula 1.4% dan Taoisme hanya 1.2% iaitu dari Kg. Kuala Rui.	Dari jumlah 275 Orang Asli, sejumlah 138 orang atau 50.2% berfahaman Animisme. Sementara 119 orang atau 43.3% beragama Islam. Selebihnya adalah penganut agama-agama lain.
2.	Tahap Pendidikan	Dapatan tinjauan mendapati seramai 301 responden atau 50.8% mendapat pendidikan sekolah menengah. Ia diikuti oleh responden berpendidikan sekolah rendah seramai 155 orang atau 26.2%. Jumlah ketua isirumah yang tidak bersekolah seramai 108 orang atau 18.2%. Hanya 28 responden atau 4.8% mendapat pendidikan sekurang-kurangnya peringkat Sijil. Kesemua jumlah tersebut datangnya dari kelompok Kg. Tradisi.	Tahap pendidikan responden di kawasan kajian adalah sederhana. Peratusan mereka yang tidak bersekolah adalah tinggi di kalangan Orang Asli iaitu 38.5% atau hampir 4 dari 10 ketua isirumah Orang Asli tidak bersekolah.
3.	Status Gunatenaga	Seramai 511 responden atau 86.3% adalah mereka yang bekerja sendiri. Ini diikuti oleh mereka yang bekerja di jabatan kerajaan iaitu 29 orang atau 4.9% dan di pihak swasta seramai 28 orang atau 4.7%. Mereka yang tidak bekerja seramai 6 orang atau 1.0%.	Sebahagian besar responden tergolong dalam sektor pekerjaan.
4.	Pekerjaan Utama	Daripada 592 ketua isirumah, seramai 397 orang atau 77.7% bekerja di sektor pertanian. Ia diikuti pula oleh kegiatan ekonomi yang berasaskan hasil hutan seramai 90 responden atau 17.6%. Sejumlah 19 orang atau 3.7% dari responden melibatkan diri dalam bidang perniagaan. Selebihnya samada terlibat dalam bidang perikanan atau pertukangan.	Majoriti dari responden bekerja dalam bidang pertanian dan hampir 18% terlibat dalam sektor hasil hutan
5.	Pendapatan Purata	Pendapatan purata isirumah Orang Asli adalah sebanyak RM573.30 sebulan. Pendapatan purata isirumah bagi kaum Melayu adalah sebanyak RM1,483.50. Manakala pendapatan purata isirumah bagi kaum Cina pula menjangkau RM1,566.70 sebulan.	Pendapatan purata Orang Asli adalah jauh lebih rendah daripada pendapatan purata kaum Melayu dan Cina.
6.	Pendapatan Perkapita	Pendapatan perkapita isirumah Orang Asli adalah sebanyak RM124.63 sebulan. Pendapatan perkapita isirumah bagi kaum Melayu adalah sebanyak RM322.50 sebulan. Manakala pendapatan perkapita isirumah bagi kaum Cina adalah sebanyak RM340.59 sebulan.	Pendapatan perkapita Orang Asli adalah jauh lebih rendah daripada pendapatan perkapita kaum Melayu dan Cina.
7.	Tahap Pendapatan Sebulan	Dapatan tinjauan mendapati 73.3% peratus atau 434 responden berada di luar paras garis kemiskinan. Seramai 205 orang atau 34.6% berada dalam kategori RM1001-RM2000 sebulan, diikuti oleh pendapatan RM764-RM1000 iaitu 28.8% dan 10.6% berada dalam kelompok RM2001-RM3000 sebulan.	Hampir 45.0% dari penduduk kampung tradisi mendapat pendapatan melebihi RM1001.Seramai 6 responden atau 6.5% dari Orang Asli RPS Dala mendapat pendapatan melebihi RM2001 sebulan.
8.	Kadar Kemiskinan Dan Miskin Tegar	Jumlah Orang Asli yang berada dalam kategori miskin ialah 133 orang atau 48.4%. Daripada jumlah tersebut, seramai 53 orang atau 19.3% berada dalam kelompok miskin tegar. Jumlah miskin bagi kaum Melayu ialah 25 orang atau 7.6%. Peratus kemiskinan bagi kaum Cina ialah sifar.	Hampir separuh dari ketua isirumah Orang Asli berada dalam kategori miskin. Jumlah Orang Asli miskin tegar juga tinggi berbanding jumlah keseluruhan responden iaitu 9%.

9.	Kadar Kemiskinan Mengikut Kampung	Kampung-kampung yang termasuk dalam kelompok miskin antaranya ialah Kg. Sg. Papan, Kg. Sg. Banun, Kg. Sg. Raba, Kg. Desa Ria, Kg. Kabel, Kg. Desa Permai dan Kg. Pengkalan Permai, Kg. Sg. Tiang, Kg. Berket, Kg Tebang dan Kg. Sg. Chiong	Semua kampung yang tergolong dalam kelompok miskin berada dalam RPS Banun kecuali Kg. Sg. Papan berada di kategori Kg. Pinggir Orang Asli.
10	Tahap Kesihatan	Dapatan tinjauan menunjukkan sebahagian besar dari responden iaitu 500 orang atau 84.5% tidak mengalami masalah kesihatan. Sebaliknya seramai 92 orang ketua isirumah atau 15.5% menghadapi masalah kesihatan yang memerlukan rawatan berterusan di pusat kesihatan. Dari jumlah tersebut, seramai 62 responden dari kalangan perkampungan tradisi dan 30 responden dari kalangan Orang Asli mengalami penyakit kronik.	Penyakit kronik adalah tinggi di kalangan responden kampung tradisi berbanding dengan responden dari kelompok Orang Asli. Secara puratanya, bagi setiap 10 orang di kalangan Orang Asli, seorang akan mengalami penyakit kronik sedangkan 2 orang bagi setiap 10 responden dari kampung tradisi.
11.	Perbelanjaan Sebulan	Perbelanjaan untuk makanan adalah tinggi untuk semua responden iaitu dalam linkungan RM101-RM300. Perbelanjaan untuk pakaian, pendidikan dan kesihatan bagi semua responden adalah kurang dari RM100. Hanya 18.4% dari responden berbelanja lebih dari RM100 untuk kesihatan.	Perbelanjaan semua responden untuk makanan dan pendidikan adalah tinggi sementara untuk pakaian dan kesihatan adalah sederhana.
12.	Kemudahan Asas	Kemudahan air paip di kesemua kampung tradisi adalah baik dengan min 4.0. Di kesemua perkampungan Orang Asli, tahap kemudahan air graviti adalah tidak baik dengan min 2.0. Kemudahan akses bekalan elektrik melalui pencawang juga adalah baik dengan min 3.96 di perkampungan tradisi dan min 4.0 di RPS Banun manakala di kampung pinggir Orang Asli dilaporkan sebagai sederhana dengan min 3.18. Kemudahan elektrik yang mengguna generator hanya 4 sampel isirumah di perkampungan Orang Asli Banun. Kemudahan tandas pam digunakan oleh keluarga di kampung tradisi dalam kawasan kajian adalah dalam keadaan baik dengan min 4.0. Di perkampungan Orang Asli yang kebanyakannya menggunakan tandas curah berada dalam keadaan tidak baik ke kurang baik dengan min antara 1.0 ke 2.0 Kemudahan jalanraya di perkampungan tradisi adalah baik dengan min 3.8. Di kawasan perkampungan Orang Asli pula, kemudahan jalanraya adalah tidak baik dengan min di antara 1.0 ke 1.29. Kemudahan sekolah, kesihatan dan rumah ibadat adalah baik. Kemudahan internet masih lagi tidak meluas kerana semua perkampungan Orang Asli tiada akses internet.	Kampung Orang Asli di Kg Sg Tekam dan Kg. Pulau Tujuh menghadapi masalah kualiti bekalan air graviti yang kurang baik kerana pencemaran air hasil dari kegiatan pembalakan. Kemudahan-kemudahan yang lain berada pada kategori sederhana atau baik. Akses internet perlu disediakan untuk penduduk di perkampungan Orang Asli.
13	Ancaman Gajah	Secara umumnya ancaman gangguan gajah berlaku di RPS Banun iaitu di Kg. Sg. Banun, Kg. Sg. Raba, Kg. Kabel, Kg. Semelor, Kg. Desa Ria dan Kg. Desa Permai. Bentuk ancaman ini adalah sangat serius kerana kekerapan ianya berlaku adalah sekali dalam seminggu. Ancaman tersebut adalah daripada gajah luar yang dibawa masuk oleh Perhilitan.	Ancaman gajah luar yang dibawa masuk oleh Perhilitan adalah serius di sebahagian besar perkampungan Orang Asli khususnya di RPS Banun dan Kemar.
14.	Waktu Ancaman Gajah	Daripada 226 responden yang menyatakan waktu gangguan dari gajah sebahagian besarnya berlaku pada waktu malam iaitu 84.1% dan selebihnya 15.9% berlaku pada waktu siang.	Kebanyakan dari ancaman gajah liar berlaku pada waktu malam.

15.	Bentuk Ancaman Gajah	Semua kampung menghadapi ancaman gajah yang merosakkan tanaman dan mengancam nyawa penduduk kecuali di Kg. FELDA Bersia, Kg. Umbut, Kg. Bandariang, Kg. Bersia Lama, Kg. Kuala Rui dan Kg. Perah. Bentuk ancaman gajah yang paling serius ialah mengancam nyawa penduduk iaitu 48.0%, diikuti oleh kerosakan tanaman 43.2%. Bentuk ancaman ini dirasai oleh kelima-lima perkampungan yang dikaji.	Ancaman gajah berlaku hampir di keseluruhan kawasan Orang Asli. Ancaman gajah amat serius terutama ianya mengancam nyawa penduduk.
16.	Anggaran Nilai Kerosakan Oleh Gajah Mengikut Kampung	Anggaran nilai kerosakan akibat dari gangguan gajah pada dasarnya melibatkan nilaian kurang dari RM1000. Di RPS Banun, nilai kerosakan di antara RM1001-RM2000 ialah di Kg. Sg. Banun, Kg. Sg. Raba dan Kg. Kabel. Sementara itu, Kg. Desa Damai mengalami kerugian melebihi RM2000.00 bagi setiap kejadian.	Anggaran nilai kerosakan oleh gajah adalah serius di perkampungan Orang Asli. Usaha dan tindakan perlu dilakukan untuk mengatasi masalah ini.
17.	Tindakan Terhadap Ancaman Gajah	Kesemua kampung yang menghadapi ancaman gajah mengambil tindakan dengan membuat aduan kepada pihak berkuasa iaitu Jabatan Perhilitan dan ada juga membuat aduan kepada World Wildilfe Fund (WWF). Sejumlah 22.0% membuat aduan kepada pihak berkuasa sementara 5.7% berusaha menghalau gajah dengan cara membuat bising.	Penduduk tidak berupaya menyelesaikan masalah ancaman gajah secara persendirian. Pihak berkuasa perlu mencari jalan mengatasinya.
18.	Ancaman Harimau Malaya.	Ancaman Harimau Malaya dilaporkan berlaku sebulan sekali oleh penduduk Orang Asli di RPS Banun, RPS Dala dan RPS Kemar. Ancaman harimau hanya dilaporkan oleh penduduk Orang Asli di Kg. Sg Tekam iaitu kekerapan gangguan berlaku kurang dari sekali sebulan. Hanya dua buah penempatan tidak diancam oleh Harimau Malaya iaitu perkampungan tradisi dan kampung pinggir Orang Asli. Dari segi masa gangguan pula, kampung yang terlibat dengan ancaman ini ialah RPS Banun dan RPS Dala yang menghadapi gangguan pada waktu malam sedangkan gangguan di waktu siang hanya terjadi di RPS Kemar.	Ancaman harimau adalah tidak serius di kawasan kajian kecuali di Kg. Sg Tekam. Kekerapan kehadiran Harimau Malaya berlaku antara tempoh sebulan sekali dan setahun sekali.
19.	Bentuk Ancaman Dan Nilai Kerosakan	Bentuk ancaman adalah tidak serius kerana hanya 5.4% responden berkata ia mengancam nyawa sedangkan 1.9% lagi menyatakan harimau merosakkan tanaman. Nilai kerosakan pula adalah kurang dari RM1000 iaitu 0.7% dari responden yang menyatakan demikian.	Nilai kerosakan tanaman dari ancaman harimau adalah kecil.
20.	Ancaman Babi Hutan	Dapatan tinjauan menunjukkan 93.6% dari responden mengalami gangguan dari babi hutan. Selebihnya 6.4% menyatakan tiada gangguan dari babi hutan. 80.6% daripada responden menyatakan gangguan dihadapi sekurang-kurangnya sekali sebulan manakala 11.1% menyatakan gangguan yang lebih kerap iaitu sekali seminggu.	Ancaman babi hutan adalah serius dan melibatkan anggaran kerosakan tanaman yang tinggi.
21.	Bentuk Ancaman Dan Nilai Kerosakan	89.5% dari responden menyatakan babi hutan merosakkan tanaman selain dari ia mengancam nyawa. Nilai kerosakan dari ancaman babi hutan agak tinggi iaitu dalam anggaran RM1001 ke RM2000. Nilai kerosakan yang tinggi dicatatkan di RPS Banun iaitu 11.1% dan perkampungan tradisi iaitu 5.7%. Tiada laporan dibuat oleh responden kecuali menghalau binatang tersebut atau membiarkan sahaja perkara itu berlaku.	Ancaman dari babi hutan sangat serius kerana ia merosakkan tanaman dengan nilai kerosakan yang tinggi. Penduduk tidak membuat laporan ke pihak berkuasa.
22.	Ancaman Monyet	Gangguan daripada monyet juga berleluasa di setiap kampung yang ditinjau. Dilaporkan 82.3% dari responden mengaku gangguan dari monyet berlaku sekali setiap minggu. Gangguan monyet kebanyakannya berlaku pada waktu siang. Haiwan ini merosakkan tanaman dengan nilai kerosakan kurang dari RM1,000.	Ancaman monyet adalah sangat serius kerana gangguan berlaku setiap minggu. Hanya seorang sahaja dari 531 responden yang membuat laporan kepada pihak berkuasa.

23.	Ancaman Harimau Bintang	Ancaman harimau bintang berlaku di kawasan di RPS Banun, Dala dan Kemar. Penduduk menyatakan harimau bintang ini mengancam nyawa mereka. Kehadiran harimau ini berlaku sekali sebulan khususnya di waktu siang. Kehadiran harimau bintang ini tidak mendatangkan kerosakan pada tanaman. Oleh itu responden tidak membuat laporan kepada pihak berkuasa.	Kehadiran harimau bintang mengancam nyawa penduduk RPS Banun, Dala dan Kemar. Tidak berlaku kerosakan tanaman.
24.	Ancaman Seladang	Seladang turut memasuki ke perkampungan Orang Asli di RPS Banun, Dala dan Kemar. Kekerapan haiwan ini memasuki ke perkampungan ini pada puratanya sebulan sekali dan berlaku pada waktu siang. Haiwan ini tidak memberi ancaman kepada penduduk maupun kerosakan di ketiga-tiga penempatan Orang Asli tersebut. Tindakan yang diambil oleh penduduk di atas kehadiran haiwan ini adalah dengan melapor kepada pihak berkuasa.	Kehadiran Seladang tidak mengancam nyawa mahupun merosakkan tanaman.
25.	Ancaman Beruang	Beruang ada memasuki kampung Orang Asli di RPS Banun dan Dala. Kekerapan haiwan ini memasuki ke perkampungan antara sebulan sekali dan setahun sekali dan keadaan ini berlaku pada waktu malam. Haiwan ini merosakkan tanaman penduduk. Tindakan yang diambil oleh penduduk ialah dengan membuat bising untuk menghalau kehadiran haiwan ini.	Ancaman dari beruang memang ada tetapi hanya merosakkan tanaman penduduk.
26.	Kampung Yang Dicerobohi Pemburu Haram Dan Tindakan Yang Diambil.	Kampung-kampung tradisi yang dicerobohi pemburu haram dilaporkan oleh penduduk Kg. Bongor, Kg. Umbut, Kg. Sira Panas dan Kg. Ulu Kapak. Semua kampung Orang Asli menyatakan terdapat pemburu haram mencerobohi hutan di pinggir kampung mereka. Sejumlah 16.3% penduduk kampung telah melaporkan kepada pihak berkuasa. Kebanyakan mereka tidak berpuas hati kerana tindakan agak lambat. Hanya 15.9% berjumpa dan menegur pemburu secara sendirian. Mereka menyuarakan kebimbangan untuk menegur pemburu yang bersenjata. Sejumlah 9.2% responden mendiamkan diri.	Pencerobohan pemburu haram adalah serius. Laporan yang dibuat oleh penduduk kepada pihak berkuasa serta teguran kepada pemburu haram adalah rendah kerana faktor keselamatan.
27.	Kampung Dan Ancaman Pembalak	Kampung-kampung yang dicerobohi pembalak haram dilaporkan oleh penduduk dari kampung Orang Asli sahaja. Hanya 4.6% penduduk melaporkan kegiatan pembalakan haram kepada pihak berkuasa.	Pencerobohan pembalak berlaku di perkampungan Orang Asli sahaja dan laporan daripada mereka adalah pada tahap rendah.
28.	Pengetahuan Mengenai CFS	Hampir kesemua responden kurang berpengetahuan mengenai Projek Koridor Ekologi CFS. Penduduk kampung tradisi lebih mengetahui tentang CFS berbanding dengan penduduk kampung Orang Asli. Kebanyakan dari responden tidak mengetahui objektif CFS di mana min yang diperolehi hanya 1.68. Majoriti dari responden tahu berkenaan kawasan CFS dengan nilai min 2.31. Responden kurang berpengetahuan terhadap projek-projek yang dijalankan di kampung mereka.	Pengetahuan penduduk di kawasan kajian terhadap Projek Koridor Ekologi CFS adalah sederhana. Penduduk RPS Kemar mempunyai tahap pengetahuan yang baik tentang CFS berbanding kampung-kampung yang lain.
29.	Persepsi Penduduk Terhadap Projek CFS	Hampir semua responden mempunyai persepsi yang positif terhadap semua faedah dan peluang yang akan dibawa melalui Projek Koridor Ekologi CFS. Penduduk berharap, peluang mempertingkat ekonomi mereka dengan purata nilaian persepsi ialah 3.11. Ini diikuti oleh aspek minat dan sokongan terhadap semua projek-projek CFS iaitu masing-masing dengan nilai min 2.99 dan 2.98. Harapan responden ialah menambahkan pendapatan orang kampung, menambahbaik keadaan fizikal kampung dan menggalakkan pembangunan ekonomi kampung mereka dengan purata nilaian persepsi 3.34.	Persepsi penduduk di kawasan kajian terhadap projek terhadap Projek Koridor Ekologi CFS adalah positif.

30.	Jangkaan Kesan Projek Mengenai CFS	Kepercayaan masyarakat setempat terhadap Projek Koridor Ekologi CFS akan merosakkan hutan di kawasan sekitar koridor adalah pada tahap rendah dan sangat rendah. Peratus kerosakan terhadap hutan, sungai dan tanaman adalah rendah dengan masing-masing mempunyai min 2.12, 2.15 dan 2.23. Begitu juga dengan gangguan terhadap ternakan dan haiwan juga adalah rendah. Projek Koridor Ekologi CFS ini juga tidak akan memberi kesan ke atas suhu di kampung-kampung yang terlibat dengan aktiviti CFS	Penduduk di kawasan kajian yakin Projek Koridor Ekologi CFS tidak akan merosakkan alam sekitar serta tidak akan mengganggu habitat flora dan fauna.
31.	Kesediaan Responden Menjadi Sukarelawan Sahabat Koridor CFS	Kesediaan penduduk di sekitar kawasan Projek Koridor Ekologi CFS untuk menjadi sukarelawan sahabat Koridor Ekologi CFS adalah tinggi. Dari jumlah 592 responden, seramai 494 orang atau 83.4% bersedia untuk menjadi sukarelawan. Kampung tradisi mewakili peratusan tertinggi dengan 43.6% ingin menjadi sukrelawan, diikuti oleh RPS Banun, Kemar dan Dala.	Sebahagian besar penduduk bersedia menjadi sukarelawan dan sahabat Projek Koridor Ekologi CFS.
32.	Kesediaan Responden Membuat Laporan	Kesediaan responden membuat laporan mengenai ancaman binatang liar, pembalak, pemburu dan pemungut haram dari hasil hutan adalah sangat memuaskan. Seramai 495 orang atau 83.9% dari responden bersetuju serta bersedia untuk membuat laporan kepada pihak berkuasa. Sementara 16.4% dari responden tidak bersedia untuk buat aduan. Secara puratanya 8 dari setiap 10 responden dari kampung tradisi, RPS Dala dan Kemar bersedia untuk membuat aduan. Sementara 9 dari setiap 10 atau 91.1% responden dari RPS Banun bersetuju untuk membuat laporan.	Majoriti penduduk bersedia untuk membuat laporan ke atas pencerobohan haram khususnya responden dari RPS Banun, RPS Dala, RPS Kemar dan kampung tradisi.
33.	Syarat Bayaran Saguhati Sebagai Sukarelawan Sahabat Koridor CFS	Dapatan tinjauan menunjukkan 40.0% atau 198 responden meletakkan syarat bayaran saguhati sebagai sukarelawan sahabat Projek Koridor Ekologi CFS iaitu kurang daripada RM500. 162 responden atau 32.7% responden meletakkan syarat bayaran antara RM501 hingga RM1000. hanya 11 responden atau 2.2% tidak meletakkan syarat untuk membuat aduan.	Lebih dari separuh penduduk bersedia menerima bayaran saguhati yang rendah sebagai syarat menjadi sukarelawan sahabat koridor.

INFORMATION PAPERS

IP 1: NEW BEETLE SPECIES OF MT. TRUS MADI, SABAH, MALAYSIA

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INTRODUCTION

The second highest mountain in Sabah, Mt. Trus Madi, is a complex high montane forest up to the summit at 2,642m (8,668ft). This area is one of the most important sanctuaries for the biodiversity in the world and is still covered with huge tropical rainforests. The flora and fauna are considered among the richest in Sabah. Such high diversity, with many endemic species of animals and plants have been described and recorded from this area. Besides large animals, people often forget the smaller animals, including insects.

The biggest group of insects is beetles (Coleoptera). Most beetles have two pairs of wings, their front wings are modified into wing covers. These wings are to protect the hind wings, which can be folded beneath them when not in use. Some species are wingless, but most beetles are able to fly. Beetles are found in abundance in the tropical rainforests like Mt. Trus Madi. The entomological fauna of this area is one of the richest of the world. The most recent estimates of some 70% of Sabah insects have been recorded in this area are beetles. Most beetles live high in the canopy. Others live among the tangled vegetation halfway up tall trees, or among the decaying plants and fungi of the forest floor. Some are brightly coloured and most other in green, black or brown colour. Some beetles use cryptic coloration to hide from predators. It is not uncommon for males to have elaborate structures on their heads that are analogous to antlers. For example only males have horn and all females are without horn.

RESEARCH WITH SABAH FORESTRY DEPARTMENT

Since the last few years, a collaboration has been established with the Sabah Forestry Department to study the beetle fauna of Trusmadi Forest Reserve, in which Mt. Trus Madi is located. The team has discovered more than a hundred new beetle species. These include several new genus and species endemic to Trusmadi Forest Reserve. Major research includes studies on the family of Long-horned Beetles (Cerambycidae), Flower Beetles (Cetonidae) and Stag Beetles (Lucanidae). In the results, twenty of them are new endemics to Mt. Trus Madi. The new genus and new species only occur at the elevation between 800 to 1200 m a.s.l.

In the recent years, the number of beetle species known from Mt. Trus Madi has significantly increased. However, the reference literature is fragmented, obscure, inaccurate, or out-of-date which creates confusion for researchers, coleopterists, and curators. Some unidentified or undescribed taxa are noted for reference, particularly when they represent new genera or species in Borneo. Due to differences in opinion among specialists, and because many genera have not been adequately studied, it is impossible to place all tribes and genera in a classification that everyone will agree with. Species distributions are compiled from literature and recent, unpublished collection records. Small, offshore islands (i.e. Labuan, Banggi, Pulau Tiga, Balambangan Island) are included with Sabah. Some literature records may be based on misidentified specimens because errors are common when dealing with species from an area which has numerous undescribed and poorly known species. Future studies will uncover many new species and determine that some taxa are synonyms. Six new genera were described from Mt. Trus Madi. At present, 3 new genera of Long-horned Beetles (Cerambycidae), 1 new genus of Flower Beetle (Cetonidae) and 1 new genus of Stag Beetle (Lucanidae) were described. Twenty new species were recorded and are endemic to Mt. Trus Madi.

NEW GENUS AND NEW SPECIES FROM MT. TRUS MADI

1. Family: Cerambycidae (Long-horned Beetles)

Long-horned Beetles (Cerambycidae) are among the most numerous beetles in this area. The beetles usually possess long-to-very-long antennae. They vary much in size and colour, some species attaining a length of 0.6 mm to several inches and usually brilliant metalic and pigmented colors are common in this family. Since 1998, there is a list of over 1600 described Cerambycidae recorded from Borneo in literature and about 1200 species have been recorded from Sabah, with about 600 from Mt. Trus Madi. In the recent years, there are 800 species recorded from Mt. Trus Madi and approximately 100 new species were first described and recorded from this area. The estimated number of Cerambycidae which occurs in Sabah has significantly increased to 2000 species. About 70% of the Long-horned Beetles are active in day time. In the results, we have discovered three new genera and sixteen new species of Cerambycidae which are also recorded as endemic to Mt. Trus Madi only. Among the new endemic species of Sabah from Trusmadi Forest Reserve are:

Gressittichroma ***sammannani*** **n. sp.** Vivas, Bentanachs & Steven Chew, 2009. This new species was named after Datuk Sam Mannan, Director of the Sabah Forestry Department.

Chloridolum federikikugani **n. sp.** Vivas, Bentanachs & Steven Chew, 2009. This new species was named after Mr. Frederick Kugan, The Deputy Director (Forest Sector Planning) of the Sabah Forestry Department.

2. Family: Cetonidae (Flower Beetles)

From the recent years, about 140 species of Flower Beetles (Cetonidae) have been recorded from Sabah, with about 100 species from Mt. Trus Madi. One new genus and three new species were documented from Mt. Trus Madi. Most flower beetles are common during day time and very often come to flowering trees, except several species that are active during night time (i.e. *Pseudochalcothe spathulifera* Bates, 1889, *Plectrone lugubris* Janson, 1833, *Protaetia ciliata* Olivier, 1785). Most Flower Beetles (Cetonidae) are brilliantly coloured, some with metalic green colour. Only several species have horn, especially the genus *Theodosia* and all males in this genus have horn (i.e. *Dicheros bicornis borneensis* Nagai, 1985 & *Mycteristes bicornnnatus* Jordan, 1894). Among these, two new species, also endemic to Sabah have been recorded from Trusmadi Forest Reserve:

Pseudochalcotheomima sammananni n. sp. 2009, Legrand & Steven Chew. This new species was named after Datuk Sam Mannan, Director of the Sabah Forestry Department.

Heterorhina rahimi **n. sp.** 2009, Legrand & Steven Chew**.** This new species was named after Rahim Sulaiman, the Deputy Director (Management) of the Sabah Forestry Department.

3. Family: Lucanidae (Stag Beetles)

About 120 species have been recorded in Sabah. Most of the of Stag Beetles are strikingly attractive, and only male Stag Beetles have mandibles that resemble a pair of antlers. In fact, these mandibles are used in very much the same way like a male deer uses his antlers in combat to fight with its rival. Most female Stag Beetles have short mandibles or very much smaller. For example, *Cyclommatus chewi* Mizunuma, 1994 is an endemic species to Sabah. The male can measure up to 87 mm, compared to the female, with only 24 mm in length. Most of the beetles in this family are brown with black wing cases. Some are greenish brown, red and even gold in colour. *Allotopus moellenkampi* ssp. *fruhstorferi* Nagel, 1925 is among the most popular species with golden colour.

In Trusmadi Forest Reserve, about 100 species have been recorded. From the study, only one new genus and new species was discovered, namely *Chewlucanus hirasawai,* Ikeda & Katsura, 2000. It is confined to Trusmadi Forest Reserve.

Table 1. List of new genera of beetles, endemic to Trusmadi F.R.

New genera	Year of Description / Family
Genus ***Pingblax***	Komiya-Drumont 2001, Cerambycidae
Genus ***Borneochroma***	Bentanachs-Vives-Chew 2008 , Cerambycidae
Genus ***Bornesalpinia***	Vives 2011, Cerambycidae
Genus ***Chewia***	Legrand 2004, Cetonidae
Genus ***Chewlucanus***	Ikeda 2000, Lucanidae

Table 2. List of endemic beetles, confined to Trusmadi F.R.

Borneochroma shutae , Bentanachs-Vives-Chew 2008
Bornesalpinia itoi , Vivas 2010
Bornestathes trusmadianus Vives-Heffern 2012
Pingblax rufescens Komiya-Drumont 2001
Crassichroma viridis 2009
Nortia fuscipes 2005
Hayashichroma legrandi 2009
Elacomia joanivivesi, Vives & Heffern 2001
Elacomia trusmadiana Vives 2003
Xoanodera serrticornis, Holzschuh 2001
Comusia metallica, Holzshuh 2003

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IP 2: INSECTS OF MILIAN LABAU FOREST RESERVE IN SABAH, MALAYSIA

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ABSTRACT

A survey was carried out in July, 2010 in Milian Labau F.R. to document the insect fauna under the Heart of Borneo programme, and to investigate the threats affecting insect diversity, as well as to provide recommendations that would contribute towards biodiversity conservation of the study area. It is a Class VI Forest Reserve (Virgin Jungle Reserve), gazetted in 1984, covering an area of 2,712 ha, within the district of Keningau in Sabah. The nocturnal insect diversity was moderate, with less than 85 macro insect species in a square metre. Although it is a Virgin Jungle Reserve, the timber stand was rather poor, due to illegal harvesting and forest fire in the past. A few endemic moth species were recorded, i.e. *Adites hosei*, *Auriculoceryx pterodactyliformis*, *Aethalida borneana* (all Arctiidae), *Problepsis borneamagna* and *Spaniocentra megaspilaria* (both Geometridae). The common but Bornean endemic Three-horned Beetle, *Chalcosoma moellenkampi* was also recorded. Other interesting insects included the rare Emperor Moth *Antheraea jana*, the intriguing Fiddle Beetle *Mormolyce castelnaudi* and the Blue Banded Peacock Butterfly *Papilio palinurus*. A total of 55 butterfly species and over 20 dragonfly species were recorded.

More effort is needed to protect the forest from further encroachment and forest fire in future. The insect diversity data from this survey provide important information to support the effort in biodiversity conservation. At present, Milian Labau F.R. is fragmented and the forest patches are very far apart, surrounded by agricultural crops. Hence, it is crucial to establish connectivity among the forest patches and with other forest reserves as well. This connectivity is the prime means of physically linking wildlife habitat and allows some species to move between otherwise isolated area. It can help to replenish isolated populations. Ideally, the connectivity itself also meets some or all of the needs for shelter, protection, food and breeding sites. Cooperation with relevant stakeholders and local communities in protecting the forest, such as monitoring and enforcement, and promotion of environmental awareness are among the recommendations to mitigate the threats in Milian Labau F.R.

1. INTRODUCTION

Milian-Labau FR is located within the Keningau District, at the northeast of Nabawan Town. The total area of the reserve is about 2,712 ha and is divided into four blocks. The reserve is administrated by the Sook District Forest Office, and classified as Class VI Virgin Jungle Reserve (VJR) in 1984. It is divided into 4 blocks: Block A is the largest and appears as rectangular block of land; Block B & C are situated along Sg. Labau and Block D is a small isolated square block of land which is almost inaccessible (see Figure 1). The forest types in the reserve are disturbed lowland mixed dipterocarp forest and kerangas forest. The cause of disturbance is mainly due to logging activities and occurrence of forest fire in the past.

Blocks B, C & D are very hilly with amplitudes in excess of 300 m and slopes are normally greater than 25°. Ridge crest and valley bottoms are narrow and landslips are common. The mountains are formed of interbedded sandstone and mudstone. These areas are quite unsuitable for agricultural development largely because of the steepness of the majority of slopes. Block A has a more complex topography. Areas with kerangas forest comprise of low terraces and floodplains. Some terraces are composed of tiered deposits of alluvium, with coarse-textured, sometimes pebbly, alluvium normally at the surface. Parent materials comprise deposits of sand which are normally underlain by medium- to fine-textured alluvium at depths of 90 to 150 cm from the surface. Kerangas forest with stunted, often decaying, trees occurs naturally on the terraces. It passes sharply into dipterocarp forest at the terrace edges.

Block B, C & D were severely affected by fires during the 1997-98 drought and the vegetation cover was mainly small shrubs and pioneer species. The vegetation of Block A of Milian-Labau VJR is mainly lowland mixed dipterocarp forest and kerangas forest. The kerangas forest can be further divided into 2; *Dacrydium pectinatum-Tristianopsis* sp. type and *Shorea venulosa-Hopea pentanervia* type (Anon. 2010). Thus far, there is only a few plant related research, and possibly none on wildlife, conducted within or adjacent to the reserve.

This study was conducted as part of the Milian Labau F.R. expedition under the Heart of Borneo (HoB) programme of the Sabah Forestry Department from 12th to 17th of July, 2010. The expedition base camp was at the Nabawan District Forestry Quarters (N 05^0 03.00' E 116^0 26.08' at 474 m. a.s.l.).

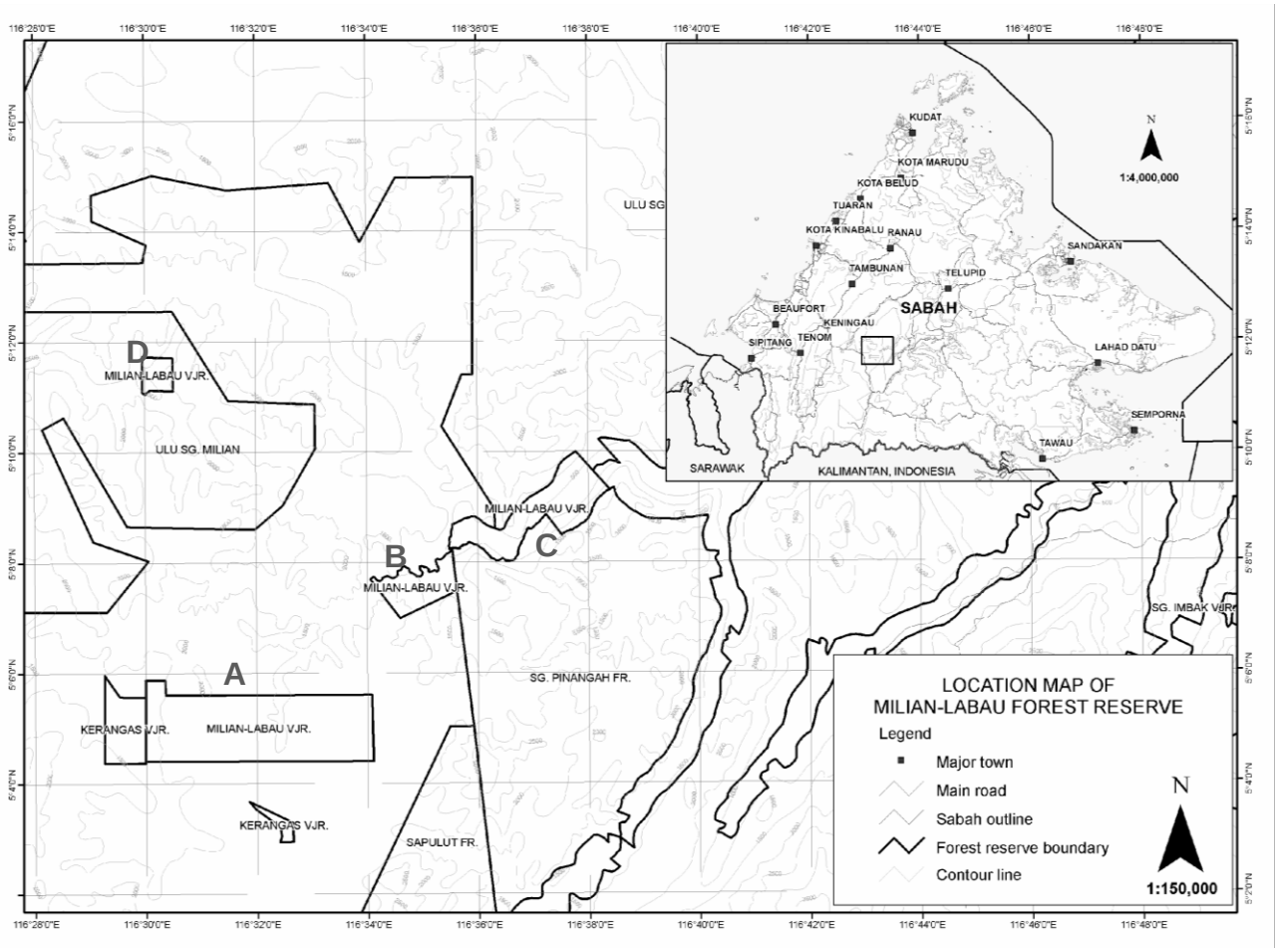

Figure 1: The location of Milian Labau F.R. (Blocks A, B, C & D) within the Keningau district in Sabah.

2. MATERIALS & METHODS

Light trap was used to sample nocturnal insects while sweep net and manual collecting (with forceps) were used to sample diurnal insects.

2.1 Light trap

The trap consists of a vertical white sheet (2 X 2 m) illuminated by a 250W mercury-lithium bulb. The trap was set up in an open area facing the forest reserve, from 7:00 to 9:00 p.m. A GPS (Model: Garmin GPSMAP 60CSx) was used to determine the coordinates of each sampling site. To evaluate diversity of the sampling area, insect species and individuals (≥ 5 mm) within the 1 X 1 m square of the white cloth were enumerated from 8:30 to 9:00 pm. This is a rapid biodiversity assessment method because by the end of the sampling time, species and individual numbers can be obtained, and the data can be used to calculate diversity indices, i.e. Shannon Wiener, Simpson and Fisher Alpha, using a diversity analysis software by Henderson & Seaby (1998). This method is simple, fast and can be carried out by non-insect specialist. To avoid compounding human error, the same staff was assigned to count the species and individual numbers throughout the sampling period, and also for other sampling sites.

Light-trapping sites are shown in Table 1. Sites B, C & D were outside but adjacent to Block A of the the Milian Labau F.R. It was not possible to have all sampling sites within the reserve because of the very bad road condition and the difficulty to get to the reserve at night. Light-trapping was not possible at Block B, C & D during the survey, also due to the same reason.

Table 1: Light-trapping sites at and adjacent to Block A of Milian Labau F.R.

No.	Sampling site	Coordinates	Elevation (m)	Sampling date	Remarks
1	A	N 05^0 05.538’ E 116^0 35.325’	440	13 July, 2010	Cloudy but calm evening.
2	B	N 05^0 05.610’ E 116^0 29.471’	474	14 July, 2010	Cloudy and slightly windy. Kerangas VJR.
3	C	N 05^0 05.812’ E 116^0 29.567’	476	15 July, 2010	Cloudy. Stumping area facing Kerangas VJR.
4	D	N 05^0 03.786’ E 116^0 30.617’	475	16 July, 2010	After rain. Kerangas area.

2.2 Sweep net & manual collection

Sweep nets were used to collect flying insects, such as butterflies and dragonflies while other insects were sampled using fine forceps. Butterflies and dragonflies were put in triangle papers while other specimens were put in vials with 75% ethanol solution. Sampling was conducted along the trails established by the Botany and Ecology Sections of the Forest Research Centre.

Table 2: Daytime sampling sites in Milian Labau F.R.

No.	Sampling site	Starting point coordinates	Elevation (m)
1	A (Milian Labau), Block A	N$05^0$05.538’ E$116^0$33.325’	440–453
2	B (Kerangas VJR), adjacent to Block A	N$05^0$05.610’ E$116^0$29.471’	474
3	C (Milian Labau), Block A	N$05^0$04.342’ E$116^0$31.519’	467
4	D (Sg. Labau & Sg. Saub), Block B	N$05^0$08.180’ E$116^0$35.654’	160
5	E (Milian Labau – Dipterocarp), Block A	N$05^0$05.616’ E$116^0$30.477’	495

2.3 Insect specimens and identification

In this survey, focus was given to certain insect groups, i.e. butterflies, moths, beetles and dragonflies. Only the interesting and potential indicator insect species were sampled, as to minimize the workload at the laboratory in preparing the specimens for identification. Photographs were taken with a DSLR Nikon D300 to facilitate

identification. Common insects were not sampled but photographs were taken for record purposes. In some cases, the foraging and feeding behaviour of certain insect groups were captured on a Sony HDR-CX550 handycam.

Selected specimens were dry-mounted and sorted to family and some to the generic and species level. Many of the identifications are still tentative while some are to be identified later. The specimens sampled from this study are deposited at the Forest Research Centre, Sepilok, Sabah. Dry-mounted specimens were identified based on the FRC Entomology Collection and various reference materials, e.g. Otsuka (1988 & 2001) and Corbet & Pendlebury (1992) for butterflies; Holloway (1983, 1985, 1986, 1988, 1989, 1993, 1996a, 1997, 1998a & b, 1999, 2001, 2003, 2005, 2008 & 2009) and Robinson *et al.* (1994) for moths; Mizunuma & Nagai (1994), Makihara (1999) and Tung (1983) for beetles; Orr (2003) for dragonflies. The UMS practical students, Kerisha and Ridhwan identified the dragonflies sampled based on Orr (2003), as part of their assignment.

3. RESULTS & DISCUSSION

3.1 Overall insect diversity

The nocturnal insect diversity was moderate, compared to the diversity recorded from Gg. Lumaku F.R. in Tenom and Bukit Hampuan in Ranau (Table 3). Less than a hundred species were recorded in all sampling sites, as sampled with light trap. At least 5 Bornean endemic moth species were recorded and listed in Table 4.

Table 3: Insect diversity within a one-metre-square, as sampled through light-trapping in Milian Labau F.R. compared to Bukit Hampuan and Gg. Lumaku F.Rs.

No.	Sampling site	Species	Ind.	Shannon	Simpson	Fisher Alpha
1	A	79	122	4.05	45.56	97.03
2	B	50	74	3.78	73.00	67.68
3	C	41	65	3.44	33.02	47.66
4	D	84	97	4.36	258.67	298.72
5	Hampuan 1	125	286	3.73	9.69	84.64
6	Gg. Lumaku (Site 5)	124	163	4.56	90.43	236.60

Table 4: Bornean endemic insect species recorded from Milian Labau F.R. during the survey.

No.	Species	Order	Family	Subfamily
1	*Adites hosei*	Lepidoptera	Arctiidae	Lithosiinae
2	*Auriculoceryx pterodactyliformis*	Lepidoptera	Arctiidae	Syntominae
3	*Aethalida borneana*	Lepidoptera	Arctiidae	Arctiinae
4	*Problepsis borneamagna*	Lepidoptera	Geometridae	Sterrhinae
5	*Spaniocentra megaspilaria*	Lepidoptera	Geometridae	Geometrinae

The distribution of nocturnal insect species from the light-trapping sites is reflected in the species-rank abundance curves in Figure 2.

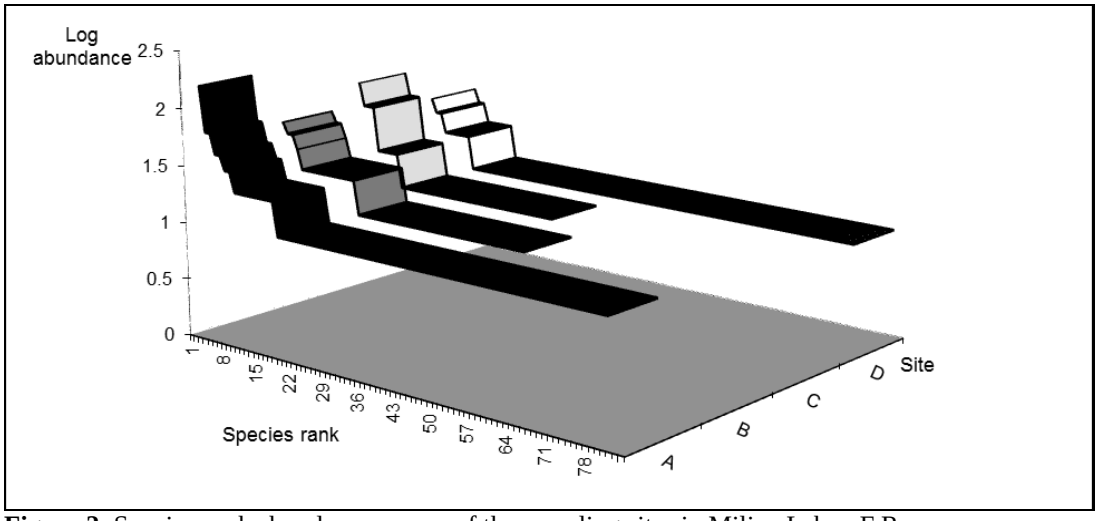

Figure 2: Species-rank abundance curves of the sampling sites in Milian Labau F.R.

Although Milian Labau is a Virgin Jungle Reserve (VJR), the forest is relatively poor in terms of timber stand because of illegal logging and forest fire in the past. There are not many big trees in the surveyed areas. Moreover, Milian Labau F.R. is fragmented and surrounded mostly by oil palm plantations. All these parameters could have contributed to the moderate diversity of nocturnal insects.

3.1.1 Butterfly (Lepidoptera) diversity

A total of 55 butterfly species were recorded from Milian Labau F.R. Although more butterfly species were sampled in Milian Labau F.R. compared to Bukit Hampuan and Gg. Lumaku F.Rs. (Table 5), the diversity as indicated by the indices was lower because of the high abundance of the Pieridae *Catopsilia pomona pomona* at the Sg. Labau-Sg. Saub. Interesting butterflies recorded from this survey was the Papilionidae *Papilio palinurus palinurus*, from Sg. Labau-Sg. Saub and a Rajah Brooke's birdwing *Troides brookiana brookiana* was spotted at the Kerangas VJR.

Table 5: Comparison of butterfly diversity among Milian Labau F.R., Bukit Hampuan F.R., Gg. Lumaku F.R. and Imbak Canyon Conservation Area.

Sampling site	Method	Species	Ind.	Shannon	Simpson	Fisher Alpha
Milian Labau F.R.	Sweep net & observation	55	146	3.23	10.83	32.10
Bukit Hampuan F.R.	Sweep net & observation	42	78	3.48	31.95	37.09
Gg. Lumaku F.R.	Sweep net & observation	52	106	3.56	29.76	40.37
Imbak Canyon*	Fruit bait, sweep net & observation	72	133	4.09	70.22	64.10

* Source: Lim-Hasegawa & Chey (2009)

3.1.2 Moth (Lepidoptera) diversity

Various moth species were attracted to the light trap set up at four locations facing the forest of Milian Labau and its adjacent forests between 400 m to 500 m. At least 5 Bornean endemic moth species were recorded from this survey. Among these, *Problepsis borneamagna* (Geometridae: Sterrhinae) was the most interesting species in terms of its appearance which resembles the face of an owl. Another slightly bigger and commoner species, *Problepsis plenorbis* was also recorded here. Other remarkable moth species recorded from the survey were *Antheraea jana* (Saturniidae) and *Sundwarda dohertyi* (Noctuidae). *A. jana* was the largest moth sampled, with a wing span of 170 mm, and it is considered a rare species (Holloway 1998b).

3.1.3 Beetle (Coleoptera) diversity

A total of 30 species of macro-beetles were recorded. Among the intriguing species was the fiddle beetle *Mormolyce castelnaudi* (Carabidae). During the survey, the dung rolling behaviour by *Paragymnopleurus* sp. (Sacarabaeidae) was observed and recorded on a handycam.

3.1.4 Other insects

More than 20 dragonfly species were recorded from this study, and this number was more than those recorded from the surveys in Gg. Lumaku and Bukit Hampuan F.Rs. This was due to the conducive riverine environment (in the Sg. Labau-Sg. Saub area) and stagnant pools of water suitable for dragonflies within the Milian Labau F.R.

It is interesting to note that many wild honeybees *Apis dorsata* and the solitary black leaf-cutting bees *Megachile* sp. (identified by Haruo Matsuzawa) were found feeding on salt and minerals on the river banks of Sg. Labau-Sg. Saub, besides the Pieridae butterfly *Catopsilia pomona pomona*. The megachilid bees defoliated some of the forest tree seedlings at the adjacent nursery set up for the forest restoration programme. The bees cut the leaves forming a semi-circular shape from the edge inwards. It is believed that leaves are used for the construction of its nest.

On the first night of light trapping at Site A, swarms of the Asian army ants, *Aenictus* sp. invaded the site, attacking light-attracted insects that dropped onto the ground. There were at least a few thousands of them. They were quite aggressive and attacked almost any invertebrates within their foraging trails. Their bite was quite nasty but not as painful as the sting from the ponerine ants.

Termites from the genus *Hospitalitermes* and *Dicuspiditermes* were recorded from the surveyed sites. They are common termites found inside the rain forest. *Hospitalitermes* was easily recognized through its organized foraging pattern while the presence of *Dicuspiditermes* was recorded through its soil pillar nests.

3.2 Threats and recommendations for insect diversity and conservation at Milian Labau F.R.

Timber harvesting in the past (illegal) and forest fire could have affected the diversity of insects in the forest, as reflected in the insect light-trapping during the expedition. Since the status of the forest is a Virgin Jungle Reserve (VJR), it is rather disappointing to see the poor timber stand within the reserve. More concerted effort has to be deployed to protect from further encroachment of the forest reserve in future. Ongoing rehabilitation of the degraded areas within the forest, e.g. Sg Labau area, would help to restore and enhance the forest biodiversity.

As Milian Labau F.R. is very much fragmented and surrounded by other form of development, especially agricultural activities, it is therefore important to establish corridors and connectivity among these forest patches. Corridors in the form of buffer zones or riparian reserves along the rivers or forest pockets within the plantations would greatly assist the well-being of the wildlife within this area.

Illegal poaching is also threatening wildlife in this reserve. Empty bullet shells and also hunting shelter were found within the forest. Although the poachers were going for the bigger animals, such human activities would also indirectly affect other fauna as well, including insects. Monitoring and enforcement would have to be conducted on a more regular basis to reduce such activities. Perhaps this could be enhanced with the establishment of the honorary forest warden programme under the Sabah Forestry Department.

The establishment of oil palm plantations with human settlement adjacent to the forest reserve could adversely affect the wildlife fauna. The changed and monoculture environment of the plantation has limited microhabitats for many of the wildlife species. Thus, those that cannot survive outside the forested environment may eventually die and thus, the decrease in biodiversity.

Forest fire has also occurred in the past in this reserve, and it is among the most serious problems affecting biodiversity in all the forest reserves in Sabah. To prevent further damage by fire, the DFO and his staff would have to be more alert, and to work together with the kampung folks on this matter, e.g. appointment of honorary forest wardens.

4. CONCLUSION

The nocturnal insect diversity in Milian Labau F.R. was moderate. Although it is a Virgin Jungle Reserve, the timber stand was rather poor, due to illegal harvesting and forest fire in the past. More concerted effort has to be deployed to protect the forest from further encroachment in future. The insect diversity data from this survey provide important information to support the effort in biodiversity conservation. At present, Milian Labau F.R. is fragmented and the forest patches are very far apart, surrounded by agricultural crops. Hence, it is crucial to establish connectivity among the forest patches and with other forest reserves as well. This connectivity is the prime means of physically linking wildlife habitat and allow some species to move between otherwise isolated area. It can help to replenish isolated populations. Ideally, the connectivity itself also meets some or all of the need for shelter, protection, food and breeding sites. Constant monitoring, enforcement, cooperation with relevant stakeholders and local communities, and promotion of environmental awareness are among the recommendations to mitigate the threats, e.g. illegal encroachment and forest fires, in Milian Labau F.R.

ACKNOWLEDGEMENTS

This is part of the Heart of Borneo (HOB) Programme with funding from the 9th Malaysian Plan through the Ministry of Natural Resources & Environment (NRE). Within the Sabah Forestry Department, this programme is managed under the Deputy Director (Forest Sector Planning), Frederick Kugan and his staff. We thank the fieldtrip coordinators, Dr Reuben Nilus and Suzana Sabran for logistic support and information pertaining to the surveyed sites. Various other sections (Entomology, Botany, Ecology & Biotechnology) in FRC also contributed to the insect survey. We also thank the DFO Nabawan (Petin Kilou), DFO Sook (Ag. Ismail Ag. Tuah) and their staff for logistic and field support during the survey. The FRM Division (Valeria Linggok) and Jumri Abd. Hamid of FRC provided the maps. The Deputy Director (R&D), Dr Lee Ying Fah and Head of FRC Insect Diversity Programme, Dr Chey Vun Khen are also acknowledged for their support.

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IP 3: PROPAGATION OF BEGONIAS ENDEMIC TO SABAH: *BEGONIA POSTARII, B. LAMBII* AND *BEGONIA* SP.

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INTRODUCTION

A few of the Begonia (Begoniaceae family) species in this study are known to be endemic to Sabah. The Begonias are generally recognized by their attractive asymmetric leaves and these unusual looks help to enhance their potential as ornamental plants (Kiew, 2001). Examples are *B. lambii* which has decorative magenta leaves and purple-magenta hairs (Kiew 2001) and the new *Begonia* sp. found in Mount Andrassy, Tawau, which displays rare white spots on its leaves.

Begonias are mostly found in undisturbed understory areas. Their preferred habitats are moist grounds amongst debris and large boulders. Most Begonias are sensitive to habitat disturbances which can affect their growth and survival and can even lead to species extinction. Chong *et al*. (2012) noted that through field observation, Begonias are sensitive and not able to survive if the surrounding habitat becomes dry. Most of the Begonias found in their survey are endemic, so protection and conservation is important.

The propagation of Begonia has been a significant step for the conservation of rare and endangered Begonias (Bowes & Curtis, 1991). Therefore, efforts to propagate Begonias have become important especially for ex-situ conservation purposes. Propagation of these three Begonias was carried out by using both conventional and tissue culture methods. The aim of this study is to examine the possibility of propagating Begonias by cuttings and tissue culture. Since hybridization of Begonias species is easy, propagation by cutting will retain their original characteristics.

MATERIAL AND METHODS

Seeds of *Begonia postarii* were collected from the Rainforest Discovery Centre, Sandakan. The mother plant was previously collected from Kinabatangan District. Seeds of *B. lambii* and *Begonia* sp. were collected from Imbak Canyon, Tongod and Mount Andrassy, Tawau, respectively.

Begonia seeds were soaked with 20 % (v/v) commercial Clorox for 10 minutes and treated with 70% (v/v) ethanol. These seeds were then rinsed thrice with double distilled water and cultured in half strength MS medium. The medium was sterilized by autoclaving at 121^{o}C and 15 p.s.i. for 20 minutes and the pH adjusted to 5.8. The seed cultures were kept in the growing room with temperatures ranging from 24^{o}C to 29^{o}C for 16 hours of photoperiod. Seeds began to germinate within 8 to 9 weeks.

All explants for micro-cuttings and leaf cuttings were obtained from two month old aseptically germinated seedlings. Shoot tips, nodal segments and leaves with petiole were cultured on full MS medium supplemented with BAP for shoot induction and multiplication. These multiplied shoots were excised and subcultured in a fresh medium every two or three months. Three-month old Begonia plantlets were transplanted into black polybags containing 100% of top soil and acclimatized for two weeks before transferring to the nursery. The plantlets were then used as stock plant for conventional propagation through stem and leaf cutting.

The cutting scions were taken from healthy stock plants, where the length of petiole of leaves and stem cutting was 4 to 6 cm and the leaves were trimmed to about 60% of their laminar area. The cuttings were planted in black polybags containing mixed top soil, sand and sawdust in a 5:2:1 ratio, placed in a misting chamber of 50% shade. Misting frequency was 10 minutes for every 1 hour.

RESULTS AND DISCUSSION

All three species of Begonia micro-cuttings successfully rooted and produced shoots within two to four weeks in medium supplemented with BAP. In nodal culture, new shoots appeared; in leaf cuttings and the new plantlets appeared around the laminar of leaves.

In conventional propagation, the leaf cuttings of *B. postarii* showed new plantlets around the area in between leaf and petiole within four to seven weeks. *Begonia* sp. and *B. lambii* leaf cuttings with petiole rooted within two to six weeks and new shoots only appeared later (to 8 weeks). Due to lack of plant stock, the stem cutting for *B. lambii* was not used. However stem cuttings of *B. postarii* and *Begonia* sp. rooted and produced new shoots within four to seven weeks.

CONCLUSION

In the conventional method, both stem and leaf cuttings formed new plantlets within seven weeks. Micro-cuttings and leaf cuttings of these three Begonias rooted easily in tissue culture medium. Overall, *Begonia* species are easily propagated through both conventional and tissue culture except for *B. lambii*, which is found to be more sensitive and needs extra care during the acclimatization stage.

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IP 4: PREDATION ON MANGROVE PROPAGULE UNDER FOUR LIGHT INTENSITY HABITATS IN KABILI-SEPILOK AND ELOPURA FOREST RESERVES, SABAH

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Mangroves generally occupy a narrow niche between the marine and terrestrial environment. In this environment, seed predation is more important than microsite competition because it determines the plant population. A study on propagule predation, especially to look into the mortality percentages of mangrove tree species is important in order to find out the factors that affect the establishment of mangrove seedlings. Four study sites were established at the Kabili-Sepilok & Elopura riverbanks. Six species, namely *Bruguiera sexangula*, *B. parvifolia*, *B. gymnorrhiza*, *Ceriops tagal*, *Rhizophora apiculata* and *R. mucronata* were investigated. Within each site, four replicates of 5 x 5 m plots were established with 6 individual propagules randomly selected from each species and planted vertically. The survival status of propagules, namely eaten, washed away and no changes were observed and recorded in a period of 45 days. The study sites selected were naturally found to have small gap 7 × 7m, big gap 15 × 15m, closed canopy 50% and shaded canopy 80%. Our findings showed mortality percentages of propagules caused by predators have the least in small gap 7 × 7m < big gap 15 × 15m < closed canopy 80% <shaded canopy 50%. Propagules of *Bruguiera sexangula* and *B. parvifolia* were the most consumed. In conclusion, propagule predators, mainly crabs were the major cause of mortality and this predation is less serious in smaller gaps.

INTRODUCTION

Mangrove forest is the most species rich salt-tolerant forest ecosystems harboring over 70 true mangrove trees and shrubs that highly adapted and grow on the intertidal land areas (Kevin *et al.*, 2001 and Giesen *et al.*, 2006). The distribution of mangroves are normally restricted within the narrow strips along the tropical and subtropical shorelines distributed up to 118 countries with geographical of 42%, followed by Africa (20%), North and Central America (15%), Oceania (12%) and South America (11%). About 75% of mangroves are concentrated in just 15 countries in the coverage areas of 5^{o}N to 5^{o}S latitude (Giri *et al*., 2011). Currently, mangrove forests are experiencing a drastic decline (Faunce & Serafy, 2006). The planet has lost 35% of its mangrove forests over the last twenty years. Even more surprising is the fact that the rate of loss of mangroves each year tops the loss of the rainforest at 2.1%. Over the last fifty years, almost one third of mangrove forests have been destroyed due to both natural and unnatural factors. Recent tsunami activity in south-east Asia as well as ongoing human coastal development has destroyed a significant portion of mangroves. This ecosystem has become very threatened due to disturbance and it leads to regeneration constraints.

OBJECTIVE

The objective of this study is to assess the risk of the damage of predation on the mortality of mangrove seeds under four light intensities, particularly canopy gaps and non-gaps.

MATERIALS AND METHODS

Four study sites (0.01ha each) were established in Kabili-Sepilok & Elopura riverbanks (N 5°49'/ E 117°57'). Six species, namely *Bruguiera sexangula*, *B. parvifolia*, *B. gymnorrhiza*, *Ceriops tagal*, *Rhizophora apiculata* and *R. mucronata* were investigated. Within each site, four replicates of 5 x 5 m plots were established with 6 individual propagules randomly selected from each species and planted vertically. The survival status of propagules, namely eaten (E), washed away (W) and no changes (N) were observed and recorded in a period of 45 days. The study sites selected were naturally found to have small gap 7 × 7m, big gap 15 × 15m, closed canopy 50% and shaded canopy 80%.

RESULTS AND DISCUSSION

Our findings showed mean for mortality of propagules caused by predators were significantly different among the four different light intensity areas, namely small gap 7 × 7m, big gap 15 × 15m, closed canopy 80% and shaded canopy 50% (Fig. 1). Means showing significant differences were sorted into groups by using Tukey's Studentized Range Test ($P < 0.05$).

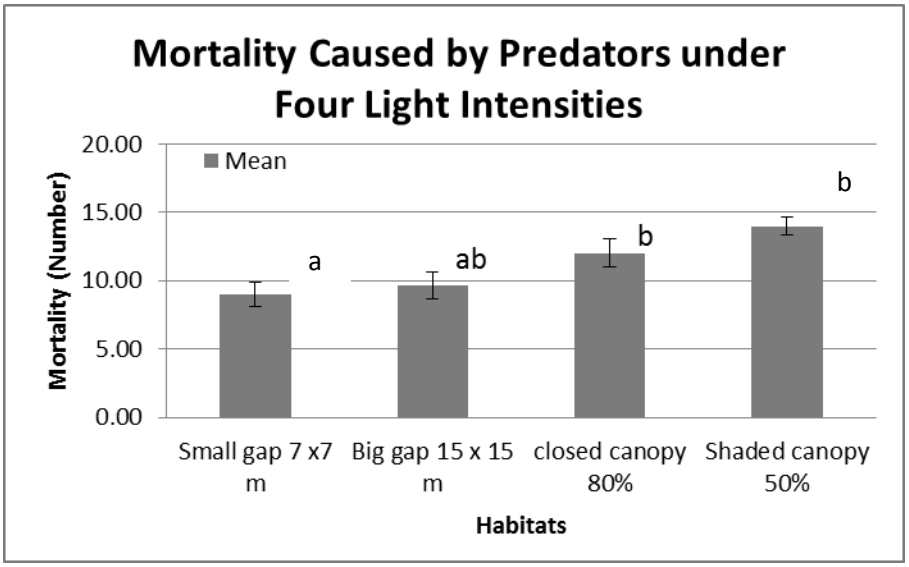

Figure 1: Mean of mortality of propagules caused by predators under four light intensity areas. Mean of the different letters were significantly differed from each others.

Shaded canopy 50% and closed canopy 80% recorded the highest level of predation (84% and 79% respectively). The level of predation was affected by the level of light condition (Fig. 2). The propagules of *Bruguiera sexangula* and *B. parvifolia* were the most consumed, followed by *B. gymnorhiza* and *Ceriops tagal*, while the least percentage of predation was *Rhizophora mucronata* and *R. apiculata*.

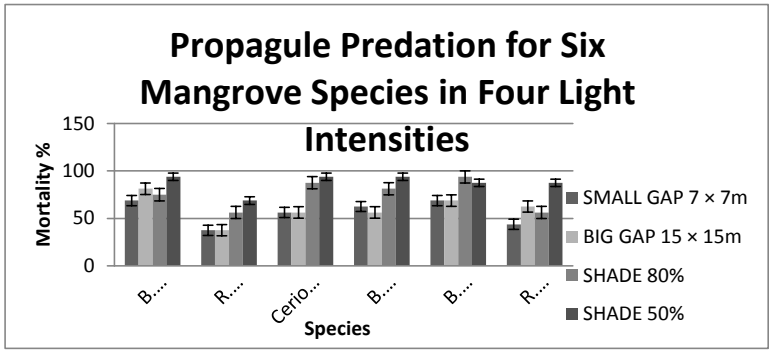

Figure 2: Mean of propagule predation for six targeted mangrove species under four light intensity habitats in Kabili-Sepilok and Elopura Forest Reserves, Sabah.

CONCLUSION

In conclusion, predators have caused serious impacts in the number of successful individual plants to reach mature stage. Propagules of *Bruguiera sexangula* and *B. parvifolia* were the most consumed. Propagule predators, mainly crab species were the major cause of mortality and this predation is less serious in smaller gaps.

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IP 5: BIODIVERSITY CONSERVATION IN PAHANG THROUGH ESTABLISHMENT OF HIGH CONSERVATION VALUE FOREST (HCVF) AREAS

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ABSTRACT

Malaysia has adopted the High Conservation Value Forest (HCVF) concept in line with the requirement as specified in Principle '9' in the Malaysia Criteria and indicators for Forest Management Certification (MC&I 2002). The MC&I 2002 is a standard used for assessing forest management practices of the Forest Management Unit (FMU) level for purpose of certification. HCVF is a concept first used by the Forest Stewardship Council (FSC) in 1999. It is applied globally and found acceptable within FSC-accepting global trade networks, NGOs and governments. In general the key to the concept of HCVF is identification of HCVs area. The definition of HCVs encompasses exceptional or critical ecological attributes, ecosystem services and social functions. This paper highlighted initiative taken by the Pahang state Forestry Department in establishing HCVF areas within the selected Permanent Forest Reserves (PFE) in the state. To date four HCVF areas have been established in four forest reserves in Pahang and one new HCVF area is being proposed. To properly manage the HCVF areas, four sets HCVF Management Plan for the respective sites have been prepared and implemented by the Forestry Department. Among others, the establishments of HCVF in Pahang are related to the importance of conserving biological diversity of the flora in the natural forest in particular endemic and threatened species such as *Shorea bentongensis*. As such it is anticipated that by taking this important initiatives, it will promote the conservation of biological diversity in the PFE of Pahang.

INTRODUCTION

Pahang possesses about 2.07 million ha of forest, more than 75 percent (1.56 million ha) of which is in the Permanent Reserve Forest (PRF) while about 5 percent and 19 percent are located in the stateland and Wildlife Sanctuary/National Park respectively (JPNP 2011). This consists of various forest types and ecosystems ranging from mangroves, coastal vegetation to hill and montane forest.

Forest areas in this state safeguard enormous biological diversity while providing crucial benefits and services for the sustainable development of human communities. They are highly significant globally, both for their diverse and threatened species and as representative unique ecosystems. In order to promote the conservation and sustainable management of forest in this country, the Forestry Department (FD) is using ITTO guidelines on managing the forest under the Sustainable Forest Management practice (SFM). The fundamental principles of Sustainable Forest Management (SFM) in Pahang are the sustained provision of products, goods and services; economic viability, social acceptability and the minimization of environmental/ecological impacts.

With increased awareness and recognition of the importance of Tropical forests and biodiversity in the global environment, efforts have been made to classify forests and natural areas with unique values or properties in a universally accepted scale. The concept of High Conservation Value Forest (HCVF) Areas has been developed and used to rate areas into 6 classes (Jennings & Jarvie, 2003) according to the following criteria:

a. Globally, regionally or nationally significant concentrations of biodiversity values (HCV1),
b. Globally, regionally or nationally significant large landscape-level forests (HCV2),
c. Forest areas that are in or contain rare, threatened or endangered ecosystems (HCV3),
d. Forest areas that provide basic services of nature in critical situations (HCV4),
e. Forest areas fundamental to meeting the basic needs of local communities (HCV5) and
f. Forest areas critical to local communities' traditional cultural identity (HCV6).

HCVF is a concept first used by the Forest Stewardship Council (FSC) in 1999. It is applied globally and found acceptable within FSC-accepting global trade networks, NGOs and governments. In general the key to the concept of HCVF is identification of HCVs area. The definition of HCVs encompasses exceptional or critical ecological attributes, ecosystem services and social functions. The HCVF concept has been adopted in Malaysia and included as Principle '9' in the *Malaysia Criteria and indicators for Forest Management Certification* (MC&I 2002). The MC&I 2002 is a standard used for assessing forest management practices of the Forest

Management Unit (FMU) level for purpose of certification. The Forestry Department Peninsular Malaysia has also prepared a guideline related to the establishment of HCVF areas in the PRF of Peninsular Malaysia (JPSM. 2012).

In line with the state biodiversity conservation efforts and strategy, the Pahang state Forestry Department as one of the Forest Management Unit (FMU) in Peninsular Malaysia has taken initiative to establish HCVF areas within the selected Permanent Forest Reserves (PFE) in the state. Currently, most of the HCVFs established are related to the importance of conserving biological diversity of the flora in the natural forest. It is part of the ongoing activities undertaken by the Forestry Department to promote the conservation of biological diversity in the PFE of Pahang.

APPROACH

The process of identifying the HCVF areas was adopted based on the standard procedure defined in the MC&I 2002. Under the MC&I 2002, HCVF is included in the Principle '9' which needs to be appropriately managed in order to maintain or enhance the identified HCVs. For the purposes of certification, identification and demarcation of HCVF has to pass assessment by the qualified auditors.

In general, the identification and management of HCVF at the FMU level requires the following steps:

1. Interpret the global definition
2. Identify potential HCVF - preliminary assessment
3. Identify specific HCVF components in the field & through consultation
4. Zone HCVF areas, buffer zones and note compartments
5. Identify limits of acceptable change (LAC) for maintaining HCVF
6. Prepare management plan for HCVF compartments
7. Implement management activities
8. Monitor impact of management activities
9. Evaluate impact of management activities
10. Adapt management where appropriate

HCVF IN PAHANG

To date four HCVF areas have been established in the state of Pahang and being monitored closely base on the management prescription prescribed in the HCVF Management Plan document. The areas are the Lata Jarum HCVF in Gunong Benom FR, Raub District; the Padang Tujuh HCVF in the Endau Rompin State Park in Rompin District; the Lentang HCVF in Lentang FR, Bentong and the Pontian Mangrove HCVF in Rompin. In addition there is one more HCVF area that is being proposed which is the Paya Pasir FR in Temerloh for the conservation of *Eurycoma longifolia* species. Figures 1 – 4 show the location of the HCVF areas identified and established in Pahang as of 2014. Brief information about the HCVF areas in Pahang is shown in Tables 1 – 5.

Table 1: Facts about the Lata Jarum HCVF forest, Gunong Benom FR Pahang.

	Item	**Note**
1	Category: HCVF 2 - Forest areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occuring species exist in natural patterns of distribution and abundance.	The forest is rich in biological diversity and a habitat for the unique *Rafflesia cantleyi* Solms-Laubach species.
2	Location	Compartment 11 Gunung Benom Forest Reserve
3	Acreage of the Forest Reserve	23,671.00 ha
4	Acreage of Compartment 11	220.73 ha
5	HCVF Plot	4.35 ha
6	Forest District	Raub/Cameron Highland
7	Forest Renj	Raub
8	Date of establishment	2009
9	Elevation	430 – 515 m
10	Topography	Undulating
11	Forest Type	Hill Dipterocarp
12	The flora	Family: Rafflesiaceae Genus: *Rafflesia* Species: *cantleyi* (*Rafflesia cantleyi* Solms-Laubach) Local name: Bunga Pakma Endemic to Peninsular Malaysia

Table 2: Facts about the Padang Tujuh HCVF forest, Rompin, Pahang.

	Item	**Note**
1	Category: HCVF 3 - Forest areas that are in or contain rare, threatened or endangered ecosystems.	Heath Forest
2	Location	Padang Tujuh within the Endau Rompin State Park, Pahang
3	Total area of the State Park (Endau-Rompin)	31,797 ha
4	Forest District	Rompin
6	Forest Renj	Rompin
7	Date of Establishment	2012
8	Elevation	Less than 1,000 m msl
9	Topography	Hilly-undulating
10	Forest type	Heath forest and Hill forest
11	Unique ecosystem	Heath forest

Table 3: Facts about the Lentang HCVF forest, Bentong, Pahang.

	Item	**Note**
1	Category: HCVF 2 - Forest areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occuring species exist in natural patterns of distribution and abundance.	*Shorea bentongensis* – endemic species
2	Location	Compartments 13, 14 and 59 Lentang FR
3	Forest District	Bentong
4	Forest Renj	Bentong
6	Topography	Hilly-undulating
7	Forest type	Hill Dipterocarp
8	Flora	Common important species include *Shorea bentongensis, Shorea leprosula, Anisoptera laevis, Neobalanocarpus heimii, Parashorea densiflora* and *Hopea pedicellata*

Table 4: Facts about the Pontian HCVF forest, Rompin, Pahang.

	Item	**Note**
1	Category: HCV1 - Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, and refugia).	High diversity of mangrove species
2	Location	Compartments 12 – 22 Pontian FR Pahang
3	Forest District	Rompin
4	Forest Renj	Rompin
6	Topography	Flat - lowland
7	Forest type	Mangrove forest
8	Ecosystem	Forest ecosystem - *Rhizophora – Bruguiera*, "Dryland mangroves" and *Nypa stand*.

Table 5: Facts about the Paya Pasir proposed HCVF forest, Temerloh, Pahang.

	Item	**Note**
1	Category: HCV1 - Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, and refugia).	High population of *Eurycoma longifolia*
2	Location	Compartment1 Paya Pasir FR,
3	Forest District	Temerloh
4	Forest Renj	Temerloh
6	Topography	Hilly
7	Forest type	Hill Dipterocarp forest
8	Flora	Mixed dipterocarps and non-dipterocarps species

MANAGEMENT OF HCVF AREAS IN PAHANG

For management purposes, HCVF Management Plan for each of the HCVF areas had been prepared. The management of the areas is in line with the overall forest certification requirement adopted and followed by the Forestry Department. Important elements as indicated below were spelled out in the management plans:

a) Map demarcation of HCVF location in the FMP
b) Detail explanation about the HCVF
c) Planning of the HCVF area
d) HCVF management prescriptions
e) Monitoring procedures to evaluate the effectiveness of the plan implementation
f) Updating of the relevant information during the FMP mid-term review

Proper management actions were also highlighted in the management prescriptions. Table 6 shows example of major management actions for the Lata Jarum HCVF area, where as Table 7 shows a brief 10-year management plan of the area.

Table 6: Management and monitoring guidelines of Lata Jarum HCVF area.

Management guide lines	Controlling procedure	Implementing agency
Any form of forest resources extraction including logging and agriculture activity is not permitted	Enforcement by all related agencies	State Economic Planning Unit, Forestry Department, Agriculture Department
HCVF boundary demarcation together with 50 m buffer zone	Boundary survey/maintenance at least once a year	Forestry Department
Inventory of Rafflesia the established plots	Measurement once a month to monitor the Rafflesia growth	Forestry Department, Universities, Research Institutions
Undertaking various studies on Rafflesia for scientific data gathering and collection	To be undertaken by scientists from local universities and research institutions.	FRIM, Universities
To manage and coordinate all tourists and visitors	Preparation of visitors guidelines	Forestry Department and Universities
Undertake consultation with local communities to ensure their support and involvement in management of the area.	Record all discussion notes and meeting minutes	Forestry Department, JAKOA, JKKK, District Office
Prevent any form of plant collection in particular the Rafflesia from the area as well as pouching/hunting of wildlife in the area.	Enforcement of penalty and compound to the law breaker and to organize join patrolling program with the local communities.	Forestry Department, PERHILITAN and JAKOA
To ensure that the HCVF management be included in the state Forest Management Plan (FMP).	If necessary to be evaluated during the FMP mid-term review and updated the status in line with the current progress.	Forestry Department
To form a Technical Committee on HCVF in the state	To be chaired by the State Director of Forestry with members from various government agencies, universities, and NGOs.	Forestry Department, State Economic Planning Unit, NGO's, other government agencies, Universities and FRIM

Table 7: The 10-year Management Plan of the *Rafflesia* HCVF in Lata Jarum, Raub Pahang.

Activities	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Map preparation										
Field boundary demarcation										
Signage preparation										
Buffer demarcation										
Field inventory										
Preparation and report updating										
Boundary surveillance survey										
Monitoring using Satellite data										
Boundary maintenance										
Identification of new similar area										

CONCLUSION

The state of Pahang is very fortunate to be blessed with large forest areas and some of them are a natural habitat for unique plant such as Rafflesia and *Shorea bentongensis*. Known as the biggest flower in the world, the Rafflesia at Lata Jarum has become a tourist attraction not only from local but also from abroad. As such it is the Forestry Department role and responsibility to properly manage and ensure that the population of this interesting Rafflesia is well conserve and protected in their natural environment.

The HCVF concept has been accepted globally as a common approach to advocate for conservation of biological diversity. Hence, the Pahang Forestry Department initiative in establishing HCVF areas in the state is very timely and should be supported by all other state authorities, universities, NGOs as well as local authorities.

While effort is continuously being made by the state Forestry Department to continuously manage the HCVF areas in the state, at the same time, the Forestry Department is also always looking for more forests that can be established as HCVFs areas in line with the government initiatives to ensure the successful implementation of the biological diversity conservation efforts in this country.

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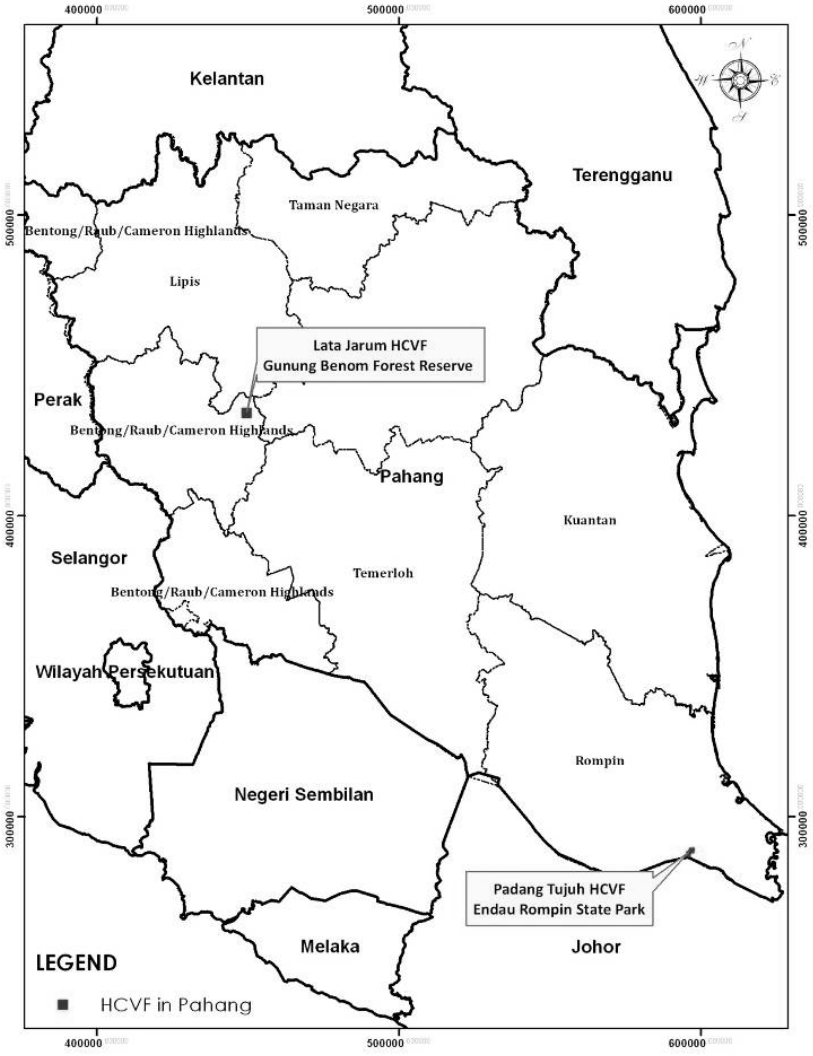

Figure 1: The location of Lata Jarum and Padang Tujuh HCVF areas in the Pahang.

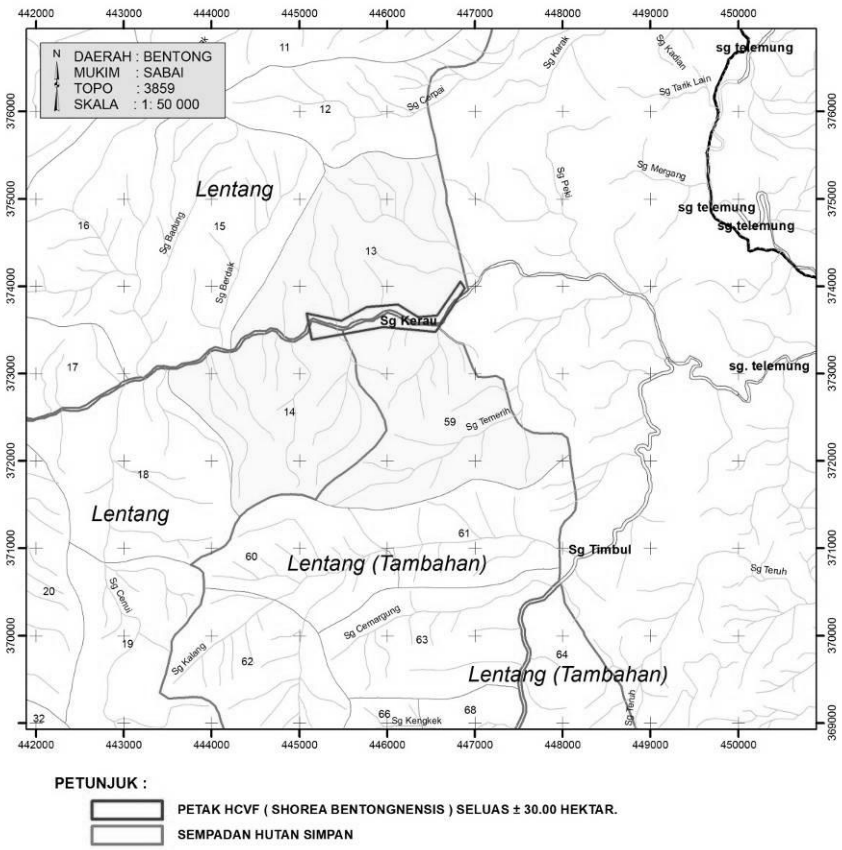

Figure 2: The location of Lentang HCVF forest in Bentong Pahang.

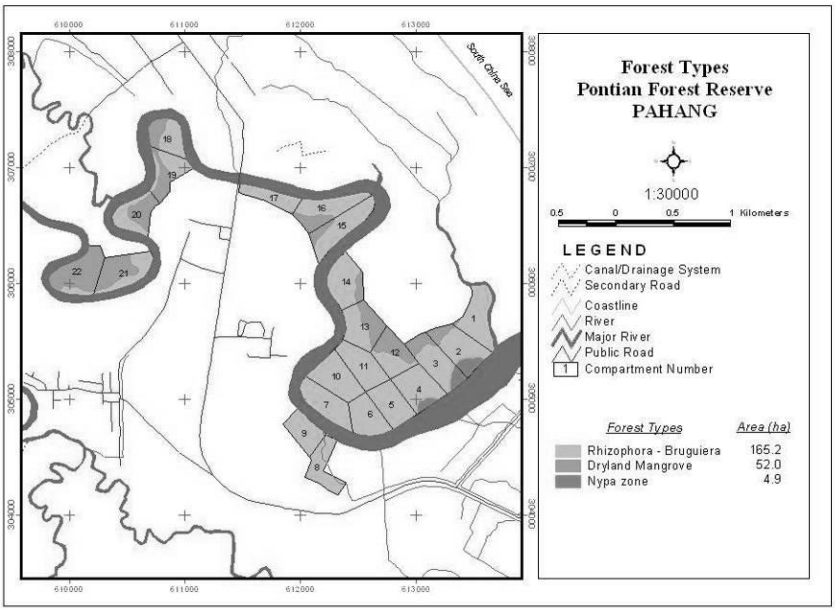

Figure 3: The location of Lentang HCVF forest in Bentong Pahang.

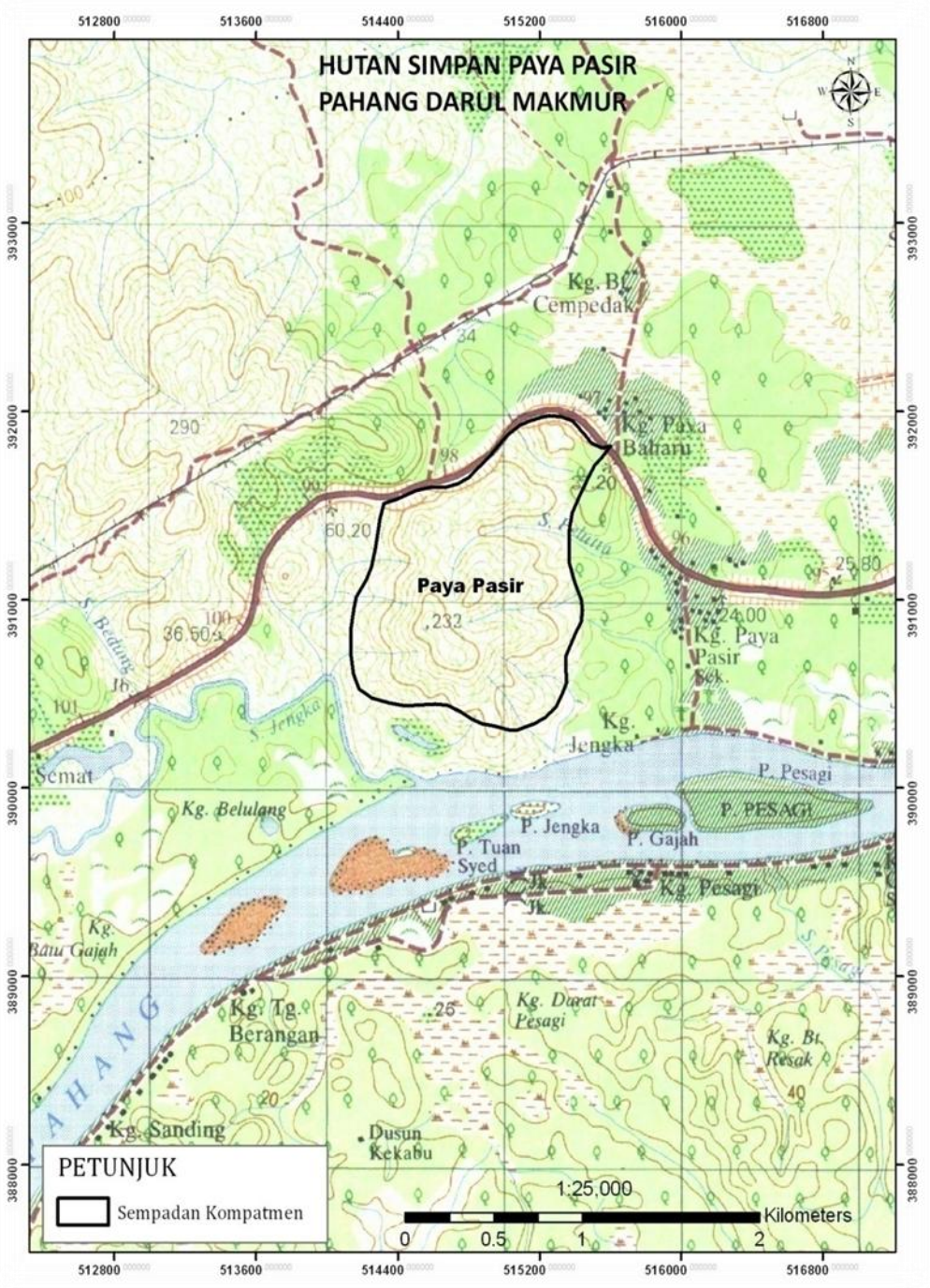

Figure 4: The location of Paya Pasir proposed HCVF forest in Temerloh, Pahang.

IP 6: COMMUNITY FOREST MANAGEMENT IN ANAP SUSTAINABLE DEVELOPMENT UNIT

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ABSTRACT

In the Anap Sustainable Development Unit (ASDU) of Sarawak, local-community participation in forest management is effected through innovative empowerment of stakeholders. This paper reports on the key processes and frameworks used for planning, consultation and implementation.

1. INTRODUCTION

1.1 Sustainable Development Unit

The long-standing problem of land use conflict thrived in the gap between the legal frameworks and uncertain or disputed use rights and responsibilities.

A *Sustainable Development Unit* framework was adopted to define management area, identify stakeholders' needs and role in the formulation of development and management plan, and provide a platform for forestry and other authorities to broker a solution between community livelihoods and forest degradation.

1.2 Anap Sustainable Development Unit (ASDU)

The Anap SDU is located within the western catchment of the Anap River, upstream from Bukit Kana and its tributary of the Muput River. The local communities located within and adjacent to the SDU consists of 17 longhouses with a population of 1990 persons. The landscape of 106,200 hectares, includes a mosaic of 8,000 ha of State land and community use land overlapping forest plantation (LPF) and natural forest timber production area, typical and representative of Sarawak forest landscape.

1.3 Community Forest Manager

Community Forest Management (CFM) provides an innovative platform to address the conflicts between conservation needs and community development in areas designated for sustainable forest management in Sarawak.
ASDU Community Forest Manager is represented by a seven-member Conservation and Community Development (CCD) executive committee elected by the authorized representatives of the 17 communities.
AMC which stands for "Anap Muput Community" was adopted as the community forest management enterprise identity and branding.
Operationally, interactions between the community forest manager and the logging company are over-seen by the forest agencies in the ASDU Liaison Committee.
(Appendix 1: ASDULC and TOR of AMC)

2. FREE PRIOR INFORMED CONSENT (FPIC)

The recognition and empowerment of the community forest manager contributed to resolution of specific aspects related to established forest use rights, legal or customary tenure and customary rights.

Institutionalized community forest management framework improved the efficiency of consultation with the local communities for the fulfilment of the FPIC process.

The most notable FPIC achievement was the acceptance and implementation of the "Term of Reference for ASDU Community Forest Manager" under which ASDU communities had undertaken two elections for the appointment of three successive Community Forest Managers, each serving a three-year term since its inception.

2.1 Adaptive Stakeholder Engagement Framework

Enabling conditions for engagement with the government agencies at different levels of authorities and jurisdictions have evolved through time from *ad hoc* consultations to a formal setup with specially appointed officers as focal persons and specific terms of reference.

A notable output of systematic stakeholder interactions was the formulation of a holistic forest management plan focused on community forest management under the "Innovative Rainforest Conservation & Management (IRCM) Plan" for implementation in ASDU.

The IRCM Plan essentially adapted well-known thematic programs promoted by International Tropical Timber Organization (ITTO) of "Forest Management Certification", "Forest Landscape Restoration" and "Community Forest Management Enterprise" for application onto the ASDU landscape and social-cultural context.

To ensure the successful implementation of the IRCM Plan in ASDU, Forest Department Sarawak, Sarawak Forestry Corporation and the ASDU logging/forest manager signed a MOU in January 2011 to identify the role and responsibilities of each party under an implementation framework for a trial period of five years. ASDU IRCM MOU Steering Committee had since then become the formal setting for ASDU project planning and implementation. (Appendix 2: ASDU IRCM Plan Implementation framework).

FPIC from the ASDU community was obtained after an official IRCM Lab involving the relevant community leaders and representatives in July 2011.

2.2 Land and User Documentation Procedure

Innovative response to the limitations within the legal framework with respect to uncertain use rights and responsibilities was the formulation of a bottom up "Land and user documentation procedure" for systematic identification and registration of interests on land in the SDU. (Appendix 3: ASDU Land and User Documentation procedure)

The acceptance by all key stakeholders of ASDU community of the "Land and User Documentation Procedure" as a tool to determine interests on the land as a pre-condition for any development in fulfilment of FPIC had prompted Forest Department Sarawak to empower community management of cleared areas within the permanent forest estate by issuing:

a. "Farming Permit" for the restoration of idle shifting agriculture land within the Forest Management Unit, and
b. "Forest Plantation Permit" for restoration of idle land within the "License for Planted Forest" area in ASDU.

2. COMMUNITY FOREST MANAGEMENT IN ASDU

The multi-faceted roles played by the ASDU Community Forest Manager included:

3.1 Forest Manager for the certification of Anap Muput FMU

ASDU community forest manager participated in the forest management certification of Anap Muput FMU as a member of the Forest Manager team and largely accounted for criteria and indicators related to "Tenure and Use Rights and Responsibilities", "Indigenous Peoples' Rights", "Community Relations and Workers' Rights", "Benefits from the Forest" as well as "Environmental Impact" and "Maintenance of High Conservation Value Forests" against the MC&I (Natural Forest) under the Malaysian Timber Certification Scheme.

It should be noteworthy that the community forest manager was represented by two different sets of officers during the certification audits between 2012 and 2014.

3.2 Forest Landscape Restoration (FLR) projects

Forest Landscape Restoration represented the ultimate challenge for forest management as it strived to reverse the process of forest degradation by creating value from idle shifting agriculture land to provide an alternative livelihood to the local community for sustainable land use and conservation of the forest.

FLR projects implemented in ASDU included:

2.2.1 Integrated CFM & FLR project 2012

A pilot rubber planting project was introduced as a learning experience for CFM and AMC to test the feasibility of:

i. Land and User documentation procedure
ii. Restoration of shifting agriculture land
iii. Collaboration between stakeholders

The project involved the acquisition of four hectares of idle cleared land by AMC for the planting of rubber trees with bridging loans and assistance from the logging company and forest agencies respectively.

2.2.2 FLR of cleared areas in Anap Protected Forests 2013

Extension of the pilot rubber planting project to cleared areas within the permanent forest estate (PFE) of Anap Protected Forests.

Individual users of cleared areas within the PFE were issued with "Farming Permits" by the Forest Department Sarawak for the planting of rubber with assistance and contributions from other agencies and donors subject to the undertaking by the community against further encroachment into the forests.

2.2.3 Community Forest Plantation Project 2014

Development of existing shifting agriculture land into forest plantation.

The project aimed to enable individual users to expeditiously extract value and benefit from existing resources on the land to encourage them to maintain and develop the idle shifting agriculture land into forest plantations.

3.3 Other CFM projects

AMC Belian License awarded by Forest Department Sarawak (FDS) over the whole ASDU area in 2014 to enhance the social and financial capital of the community forest manager and to promote community wide vigilance against illegal logging and like activities.

3. CHALLENGES AND WORK IN PROGRESS

4.1 AMC Trustee

The lack of legal status of ASDU community forest manager had limited AMC to act as licensee.

The constitution of AMC Trustee under the Companies Act 1965 as "a company limited by guarantee and not having a share capital" with its specific "Memorandum of Association" were finally approved by all interested stakeholders after years of exploration to address the legal status of AMC.

Representative of the community forest manager, logging company and a non-government organization will constitute members of AMC Trustee.

4.2 Policy direction and Institutional organization

In the absence of an official mechanism to enable community forest management and sustainable development, the established consultative frameworks and community forest manager might unravel after the expiry of the MOU for the implementation of the IRCM plan in ASDU.

4.3 Geographical Information & Biodiversity Database

The registry of land and users, historical documents of land use and changes resulting from logging, forest plantation development and landscape restoration projects through time were incorporated in a permanent "Geographical Information & Biodiversity Database" (GIBD) system compatible with the archive maintained by FDS and related agencies.

The maintenance of GIBD would be useful for the government agencies to evaluate land entitlement of individual users and avoid conflicts in the future.

5. CONCLUSION

Community forest management is essential to fill the gap between the legal frameworks and uncertain use rights and responsibilities typical of Sarawak forest landscape.

It has been cost effective as an investment for ASDU to address land use conflict issues and sustainable development options notwithstanding the long and arduous process for dialogues and consultations to achieve understanding and acceptance by all key stakeholders.

Substantial and meaningful progress had been made to overcome the challenges to enable and empower the community forest manager to assume greater responsibilities in ASDU. The lessons and experience learnt in ASDU could be a useful reference for other forest managers in areas designated for sustainable forest management in Sarawak.

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IP 7: SARAWAK DIPTEROCARPS - *DIPTEROCARPUS, DRYOBALANOPS* AND *SHOREA*: IS THERE HOPE FOR SURVIVAL?

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ABSTRACT

Sarawak has the most diverse species of dipterocarps, being represented by 247 species in nine genera. The species of this family are of major importance in the timber trade in the State. However, about 75% of Sarawak dipterocarps are listed in the IUCN Red List of Threatened Species which could have negative implication for the timber business. Due to the concern from the timber industry, a study is carried out to re-assess the conservation status of the three genera of dipterocarps (i.e. *Dipterocarpus*, *Dryobalanops* and *Shorea*) in Sarawak, as they are the major commercial timbers. This paper highlights the findings from this study where 169 species from the three genera were assessed. In the IUCN Red List of Threatened Species 2013, 95% of the species from the three genera are listed as threatened. However, this study provides a more accurate assessment with only 42% of the species under the threatened category. At the same time conservation measures are emphasized particularly for those species that are endemic to Sarawak.

1.0 INTRODUCTION

The dipterocarps family is well known for its important contributions to the socio-economy of Malaysia, in particular and Sarawak, in general. In Malaysia, Sarawak has the most diverse species of dipterocarps, being represented by 247 species in nine genera. Despite the importance of this plant group, according to the IUCN Red List of Threatened Species (2007) more than 70% of the dipterocarp species including those species recorded in Sarawak are considered threatened. Due to this disturbingly high percentage of species that are threatened and the importance of the dipterocarps to the State, a project was initiated in 2008 to re-evaluate the conservation status of the species in the three major Dipterocarpaceae genera (i.e., *Dipterocarpus*, *Dryobalanops* and *Shorea*) in Sarawak. This project, managed by the Forest Department Sarawak, was executed by the SARAWAK FORESTRY and funded in part by the Sarawak Timber Association and the Ministry of Natural Resources and Environment under the 9th Malaysia Plan. The outcome is the publication of the Sarawak Plant Red List: Dipterocarpaceae - Series I (Julia *et al*., 2014). It gives an assessment of the conservation status for all 169 taxa in three genera, i.e., *Dipterocarpus, Dryobalanops* and *Shorea* in Sarawak. Of these taxa, 11 are endemic to Sarawak, five (5) taxa share their range with Sabah alone, 92 share their range with other geo-political entities in Borneo (Sabah, Brunei, and Kalimantan) and 61 also occur in Peninsular Malaysia and/or other regions such as Sumatra or the Philippines.

2.0 METHODOLOGY

The project reviewed existing data, conducted field surveys to source new data and then re-assessed the conservation status of taxa from the three major genera in Sarawak (Julia & Vilma, 2011). These methods were adopted from the work carried in Peninsular Malaysia during the preparation of the Malaysia Plant Red List (Chua *et al*., 2010). The conservation status of species was determined based on the criteria outlined in the IUCN Red List Categories and Criteria version 3.1 (IUCN, 2001). Due to the limitation of the available data, only the first two criteria (A - Population reduction; B - restricted geographic range) were used during the current exercise. Rare (RA) category as defined by Chua (2012) was also applied. In addition, the occurrence of species in the Totally Protected Areas and other conservation areas in the State were also being taken into consideration in the re-assessment. Relevant maps of Sarawak (e.g., land use maps and maps of TPAs) were consulted during the conservation status assessments. The assessments were also evaluated by the dipterocarp specialists Dr Peter Ashton and Dr Lillian Chua, where most specimens were identified in consultation with Dr Peter Ashton.

3.0 RESULT

Based on the re-assessment of the conservation status of species from the three genera in Sarawak, 71 taxa (42%) were categorised as threatened (Table 1). Meanwhile, 96 were categorised as non-threatened (i.e., NT or LC) and two were categorized as RA according to the Malaysian Red List Categories (Chua, 2012).

Table 1: Summary of assessments.

Genus/Category	EX	CR	EN	VU	NT	LC	RA	DD	Total
Dipterocarpus	0	2	5	10	6	11	1	0	35
Dryobalanops	0	1	1	0	0	4	0	0	6
Shorea	0	10	19	23	24	51	1	0	128
Total	**0**	**13**	**25**	**33**	**30**	**66**	**2**	**0**	**169**

Note: EX = Extinct, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, DD = Data Deficient, RA = Rare

Sixteen taxa occurring in Sarawak that were considered threatened in Sarawak are also considered threatened at the national level (Chua *et al.,* 2010), while 14 taxa that are considered threatened at national level were categorized in NT or LC categories in Sarawak. Two taxa that are considered threatened in Sarawak are not threatened at the national level.

Comparing the conservation status assessment in the Sarawak Plant Red List with those in the IUCN Red List of Threatened Species (2013), 92 taxa had their conservation status downgraded to a lower category while two taxa have been upgraded and the assessment for 19 taxa are unchanged. In total, 42% of the taxa of these three genera are categorized as threatened in the Sarawak Plant Red List compared to 95% of the taxa of the same genera in the IUCN Red List of Threatened Species (2013). The list of threatened species of *Dipterocarpus, Dryobalanops* and *Shorea* in Sarawak is in Table 2.

Table 2: List of taxa categorized as threatened in Sarawak.

Threatened category	Species
Critically Endangered (CR)	*Dipterocarpus coriaceus, D. cuspidatus* *Dryobalanops fusca* *Shorea bullata, S. dispar, S. foraminifera, S. inaequilateralis,* *S. induplicata, S. praestans, S. revoluta, S. rotundifolia,* *S. tenuiramulosa, S. virescens*
Endangered (EN)	*Dipterocarpus conformis* ssp. *borneensis, D. glabrigemmatus,* *D. humeratus, D. stellatus* ssp. *stellatus, D. sublamellatus* *Dryobalanops rappa* *Shorea alutacea, S. andulensis, S. calcicola, S. chaiana, S. cordata,* *S. flemmichii, S. guiso, S. hemsleyana* ssp. *glabrifolia, S. lamellata, S. macrantha, S. materialis, S. mujongensis, S. pachyphylla,* *S. pallidifolia, S. platycarpa, S. resinosa, S. teysmanniana, S. uliginosa, S. woodii*
Vulnerable (VU)	*Dipterocarpus applanatus, D. caudatus* ssp. *penangianus,* *D. eurhynchus, D. geniculatus* ssp. *geniculatus, D. gracilis,* *D. mundus, D. pachyphyllus, D. rigidus, D. stellatus* ssp. *parvus, D. tempehes* *Shorea acuminatissima, S. agamii* ssp. *agamii, S. albida, S. almon, S. biawak, S. collaris, S. confusa, S. dealbata, S. domatiosa,* *S. elliptica, S. falcifera, S. flaviflora, S. foxworthyi, S. hypoleuca,* *S. inappendiculata, S. isoptera, S. ladiana, S. macrobalanos,* *S. obovoidea, S. slooteni, S. smithiana, S. splendida,* *S. subcylindrica, S. superba*

4.0 DISCUSSION

4.1 Dipterocarps species in Totally Protected Area

Based on herbarium records and data from ecological plots established in Sarawak's TPAs in the past as well as data acquired from sample plots during this project showed that 88% of the dipterocarp species from the three genera evaluated in this exercise are found in the TPAs network. One taxon, *Shorea cuspidata*, which was listed as Extinct (EX) in the IUCN Red List of Threatened Species (2013), is currently categorised as Near Threatened

(NT) in Sarawak as the species is well represented in the TPA network (e.g., Bako NP, Kubah NP, Santubong NP, Semengoh NR) where it is commonly observed. The laws and regulations that govern the protection of TPAs in Sarawak ensure minimal degree of threats and endangerment to the dipterocarp species and habitats in the TPAs (Ashton, 2004). Nevertheless, some of the species that occur in the TPAs are still categorized in the lower threatened category (e.g., VU or EN) due to the fact that such species only occur in small populations (e.g. *D. appalanatus, D. caudatus* ssp. *penangianus, D. eurynchus, S. almon, S. confusa,* etc.), occupied much localized habitats in the TPAs (e.g., *S. flemmechii, S. foxworthyii, S. inaequilateralis,* etc.) or in the TPAs that are threatened by encroachment (e.g., *D. humeratus* and *S. almon* in Bukit Tiban NP). In such cases where the integrity of the TPA was compromised, stringent enforcement to protect the TPAs is extremely important to safeguard the species survival whereas enrichment planting to increase the small populations could be considered.

Subsequently, almost all species that are considered Critically Endangered in Sarawak are the species that have small extent of occurrence and all their known populations occur outside the network of TPA. These species include *Dipterocarpus coriaceus, D. cuspidatus, Dryobalanops fusca, Shorea bullata, S. dispar, S. foraminifera, S. induplicata, S. praestans, S. revoluta, S. rotundifolia, S. tenuiramulosa* and *S. virescens.* Changes to their natural habitats due to forest conversion for other land uses and exploitation of the species will adversely affect the populations. In such cases, there is a need to conserve their habitats (e.g., as high value forest areas, nature reserves, etc.) to prevent the species from facing extinction in Sarawak. Cooperation among all the stakeholders such as government and private agencies, timber licensees and local communities is important in making sure effective *in-situ* conservation can be implemented in the State.

4.2 Survival of CR dipterocarp species

In maintaining the balance and the needs of both socio-economic development and conservation, prioritizing the species that need immediate attentions are vital. The assessment of conservation status of dipterocarps species in Sarawak provides some ideas on the priority species that need urgent conservation. The detailed survey of the species showed that the populations of two taxa, *Shorea induplicata* and *S. praestans*, that Ashton (2004) reported as possibly Extinct (EX) have been re-located and new localities have also been discovered. *Shorea induplicata* is a much localized species. All its known populations occur in fragmented forest outside the TPA network and the habitats are highly threatened due to forest conversion. *Shorea praestans* is only known from four localities in Mukah and Bintulu Divisions where the populations occur in severely fragmented and disturbed forests, and also in the TPA that is threatened by encroachment. During surveys from 2009 to 2014, only 135 stems ≥1 cm dbh were recorded from the known localities. *Dipterocarpus coriaceous* was announced as extinct in Peninsular Malaysia when the last stands in Bikam Forest Reserve, Perak were totally wiped out for oil palm cultivation. However in Sarawak, it was discovered in a private land in Sri Aman and in the fragmented forest in Kuching Division. All these three taxa are categorised as CR in the Sarawak Plant Red List (2014) as the habitat of these species are threatened by forest conversion. More detailed research on these threatened species (particularly the critically endangered ones) is urgently needed to increase our understanding of the species in order to plan and implement effective measures to conserve the species and consequently to prevent the extinction in line with Aichi's Target 12.

Phenology study and *ex-situ* conservation of some of the CR species (*S. praestans, S. induplicata* and *Dipterocarpus coriaceous*) in Sarawak have been initiated and are on-going. For example, seeds of *S. praestans* were collected since the last three fruiting seasons and were raised at the nursery. Currently >70 seedlings have been planted in an *ex-situ* area. It was reported that generally, some dipterocarps species flower annually but only a few mother trees in the population bear fruits while the majority of dipterocarp species flower at intervals of two to five years (Wood 1956; Burgess 1972). As such, it is important to monitor flowering seasons and to optimize the timing of seed collection for *ex-situ* conservation purposes.

5.0 CONCLUSION

Intensive ground survey carried out during this project duration shed some insight on the state of the dipterocarps species' survival in Sarawak. Standing trees of some of the threatened species, particularly the critically endangered species can still be seen and discovered even though so often, they are on the verge of extinction due to various factors that threatened their habitats. However, to sustain effective conservation programmes as well as to prevent the species from extinction, multi-approaches including *in-situ* and *ex-situ* conservation of the species, continuous monitoring and in- depth research should be carried out urgently. These require cooperation and support of all the stakeholders; otherwise the rate of depletion will be increased and there can be no point of return for species survival in the near future.

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IP 8: THE USE OF DNA TO INFER THE IDENTIFICATION AND GEOGRAPHICAL ORIGIN OF RAMIN SPECIES IN SARAWAK

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ABSTRACT

Molecular DNA technology is rapidly developing and is potentially applicable for the regulation of timber trade especially for endangered species and CITES-listed species including Ramin (*Gonystylus* species). Currently, the verification of the species and origin of the timber is done administratively without the use of advanced technology. This paper discusses the discovery of a unique DNA haplotype that is restricted to some areas in Sarawak and the possibility of using DNA technology for the tracking and tracing of timber species and origin.

1.0 INTRODUCTION

Gonystylus or widely known as Ramin is widely distributed in South East Asia, Nicobar, Solomon and Fiji Island (Figure 1). There are about 30 species of *Gonystylus*, however, *Gonystylus bancanus* has the most commercial importance and in heavy demand in the international market for decorative uses, interior building construction, planks cases, picture frames, billiard cues, blinds and baby cribs. In 1990, Ramin timber production from Sarawak was recorded at 521, 000 cubic meters. However, the production declined drastically to only 67,999 cubic meters in 2000 despite Sarawak Government's initiative to sustain ramin production by banning the export of ramin logs since 1980. Many parties blamed it on the over-exploitation of ramin population in Peat Swamp Forest (PSF) to meet international demand but land use data shows that PSF throughout Sarawak declined from 1,455,000 ha in late seventies (Lee, 2004) to 1,126,834 ha in 1996 (Wong, 2003). Conversion of peat land to agricultural plantation and other land development is one of land use conflicts not only in Sarawak but also in other parts of the world. As PSF is the only habitat of *Gonystylus bancanus*, reduction of the forest automatically affects the ramin population and production.

Apart from the decline in PSF for sustainable harvesting (excluding protected areas such as national parts), concern over illegal logging and encroachment into national parks, the smuggling and "laundering" of illegal-logged Ramin have been reported by NGOs (EIA/Telapak, 2004 and EIA/Telapak, 2006). Following this in 2005, Ramin was uplifted from Appendix III of CITES to Appendix II. The international trade of ramin timber and products thus far has to be regulated under CITES. While the CITES-controlled trading has significantly addressed some of the illegal trade, more measures are needed to improve and enhance the control system.

Usually, timber species are identified by wood anatomy using light microscopy and the timber will only be identified to the genus level (Gasson, 211). During the verification of species by the Customs officers, identification guides and simple hand-held lenses are used to examine the wood structure (TRAFFIC, 2004). However, precise identification to species level and legal origin is needed particularly involving seized timber of CITES-listed species. Molecular DNA technique has been recognised to be useful in human forensic, so similar techniques are also being applied in timber forensic for some species to infer the legality of timber origin and verification of species.

This study was carried out to develop DNA sequence database for the identification of *Gonystylus* species and to assess the geographical pattern of genotypic variation specifically for *Gonystylus bancanus* for tracing the origin of ramin in Sarawak.

2.0 METHODOLOGY

Plant samples for DNA extraction were collected from 21 Ramin species from 13 locations in Sarawak. The DNA was extracted using modified CTAB protocol (Diway *et al*., 2014a). Polymerase Chain Reaction (PCR) amplification of template DNA was carried out using Type-it® Microsatellite PCR kit (Qiagen, Germany). For species identification, one nuclear and three chloroplast DNA regions were used for species identification (Table 1). Details of PCR reaction is described in Diway *et al*. (2014b). Sequencing of DNA was carried out using ABI1310xI Genetic Analyzer (Applied Biosystems, USA) at the genetic lab of the Forest Research Institute Malaysia (FRIM). From the sequence data, the Neighbor-Joining (NJ) tree of Ramin species was constructed

using MEGA5 (Tsumura *et al*., 2011). To test the DNA sequence database generated for species identification, individual sequence of unknown ramin species was blasted to the database using a stand-alone Basic Local Alignment Search Tool (BLAST) from the National Centre for Biotechnology Information (NCBI) (www.ncbi.nlm.nih.gov) (United States of America).

For verification of geographical origin of ramin in Sarawak, only DNA database of *Gonystylus bancanus* was used. The database was generated during the project on 'Development of DNA database of *Gonystylus bancanus* in Sarawak' (Diway *et al*. 2010). Details of data analysis are described in Diway *et al*. (2014c).

3.0 RESULTS

3.1 DNA sequence for species identification

A total of two nrDNA and eight cpDNA regions were tested but only four (one nrDNA and three cpDNA) were variable among Ramin species. The selected regions consisted of trnL (235-241bp), trnH-psbA (293-405 bp), trnF-trnE (375-424 bp) and ITS2 (333-336 bp). The sequences of the four regions were combined and a phylogenetic tree was generated (Diway *et al*. 2014b). Based on the phylogenetic tree, two major clusters were formed. The combined sequences were also used to construct a database that was then used for blasting analysis. The results showed that 17 out of 21 (80.95%) Ramin species were correctly assigned back to the identical species including *G. bancanus*. Four species were not correctly assigned and our analysis showed that these species were clustered in the same clade. The taxonomical investigation also showed that they were very similar. However, our primary concern is the species verification for *Gonystylus bancanus*. Based on ITS2 region, several unique sites were found (Table 1). These specific sites are leads to identify this species genetically. Hence, unknown samples or samples which are suspected to be *G. bancanus* could be screened using this database to solve queries on their identities.

3.2 Identification of timber origin

A total of nine haplotypes (H1-H9) were defined for the five cpDNA in Sarawak (Table 2). A total of 28 polymorphic characters (13 substitutions and 15 insertions and deletions (INDELs)) over the five cpDNA region among the 152 samples were found. The distribution of each haplotype was plotted on the map (Figure 1), showing H1 is the most common and found in all populations. Six haplotyes are rare and restricted to only one population.

Table 1: DNA database for Ramin species from trnL, trnF-trnE, trnH-psbA and ITS2.

Position	ITS2															
	58	67	68-73	89-96	100-103	114	122	142	171-172	191-192	197	203	230	257-259	265-266	270-275	280
G. affinisradlk	A	T	ACC	GGGGG	ACGA	G	A	:	TA	TC	A	:	G	TAA	AC	TATCTA	T
G. areolatus	A	T	ACC	GGGGG	ATGA	G	A	:	TA	TC	A	:	G	TAA	GC	TATCTA	T
G. augescens	A	T	ACC	GGGGG	GTGA	C	A	:	TA	TC	A	:	T	TAA	GC	TATCTA	T
G. bancanus	A	T	ACC	AGGGG	ACGA	G	A	:	A	TT	T	:	G	TAA	GC	CATCTG	T
G. borneensis	A	T	ACC	GGGGG	ATGA	G	A	G	TA	TC	A	:	G	TAA	GT	TATATA	T
G. brunnescens	A	T	ACC	GGGGG	ATGA	A	A	:	TG	TC	A	:	G	TAA	GC	TATCTA	T
G. calophyllus	A	T	GCCACC	GGGGG	ACGA	G	A	:	TA	TC	A	:	G	TAA	GT	TATCTA	T
G. consanguinues	A	T	ACC	GGGGG	ATGA	G	A	:	TA	TC	A	T	G	TAA	GC	TGTCTA	T
G. forbesii	A	T	GCC	GGGGG	ACGA	G	A	:	TA	TC	A	:	G	TAA	GC	TATCTA	T
G. lucidulus	A	A	ACC	GGGGGGGG	ATGA	A	A	:	TA	TC	A	:	G	CAA	GC	TATCTA	T
G. micranthus	G	T	ACC	GGGGG	ATGA	G	A	:	TA	TC	A	:	G	TAA	GC	TATCTA	T
G. othmanii	A	T	ACC	GGGGG	ATGA	G	A	G	TA	TC	A	:	G	TAA	GT	TATATA	T
G. velutinus	A	T	ACC	GGGGG	ATGA	G	A	:	TG	TC	A	:	G	TAA	GC	TATCTA	T
G. xylocarpus	A	T	ACC	GGGGG	GTGA	C	A	:	TA	TC	A	:	T	TAA	GC	TATCTA	T
G. calophylloides	A	T	ACC	GGGGGG	ATGA	G	A	G	TA	TC	A	:	G	TAA	GT	TATCTA	T
G. affinisvarelegans	A	T	ACC	GGGGG	ACGG	G	A	:	TA	TC	A	:	G	TAG	GC	TATCTA	T
G. stenosepalus	A	T	ACC	GGGGG	ATGA	G	A	:	TG	TC	A	:	G	TAA	GC	TATCTA	T
G. eximius	A	T	ACC	GGGGG	ATGA	G	A	:	TA	CC	A	:	G	TAA	GC	TATCTA	T
G. maingayi	A	T	ACC	GGGGG	ATGA	A	G	:	TA	TC	A	:	G	TAA	GC	TATSTA	A
G. costalis	A	T	ACC	GGGGG	ATGA	G	A	G	TA	TC	A	:	G	TAA	GT	TATCTA	T
G. spectabilis	A	T	ACC	GGGGG	ATGA	G	A	:	TA	TC	A	:	G	TAA	GC	TATCTA	T

Table 2: Haplotypes of *Gonystylus bancanus* in Sarawak.

Haplotype	PA4_trnE-T				PA1_trnK-rps16									
	197	198-202	203-206	261-266	81	86	201	375	406	484	485-488	490-494	497	505-509
H1	A	:	ATAT	GTGAT	C	A	A	T	C	:	:	ATAAG	A	:
H2	A	:	ATAT	:	C	A	A	T	C	:	:	ATAAG	A	AAATA
H3	A	:	ATAT	GTGAT	T	G	A	T	C	T	TATT	ATAAG	A	AAATA
H4	A	:	ATAT	GTGAT	C	A	A	T	C	:	:	ATAAG	A	:
H5	:	:	:	GTGAT	C	A	C	T	T	T	:	CTTAT	:	:
H6	A	GAATA	ATAT	GTGAT	T	G	A	T	C	:	:	ATAAG	A	AAATA
H7	A	:	ATAT	GTGAT	C	A	A	T	C	T	:	CTTAT	:	:
H8	A	:	ATAT	GTGAT	C	A	A	T	C	:	:	ATAAG	A	:
H9	A	:	ATAT	GTGAT	C	A	A	A	C	:	:	ATAAG	A	:

Table 2: Haplotypes of *Gonystylus bancanus* in Sarawak. *(cont.)*

Haplotype	PV_psbM-trnD			PX_trnG-rps14		PA5_ycf9-trnG								
	19	49	115	96	302	62	83	119-123	125	126-127	131-135	137-138	183-186	200-203
H1	:	G	C	G	A	C	C	CTAAA	T	TA	TTTAG	AA	:	:
H2	:	G	T	G	A	A	C	CTAAA	T	TA	TTTAG	AA	:	:
H3	T	G	T	G	A	A	A	CTAAA	T	TA	:	:	:	:
H4	:	T	C	G	A	C	C	CTAAA	T	TA	TTTAG	AA	:	:
H5	:	G	T	T	G	A	C	:	A	:	TTTCT	AA	ATTT	ATTT
H6	:	G	T	G	A	A	C	CTAAA	T	TA	TTTAG	AA	:	:
H7	:	G	C	G	A	C	C	CTAAA	T	TA	TTTAG	AA	:	:
H8	T	G	C	G	A	C	C	CTAAA	T	TA	TTTAG	AA	:	:
H9	:	G	C	G	A	C	C	CTAAA	T	TA	TTTAG	AA	:	:

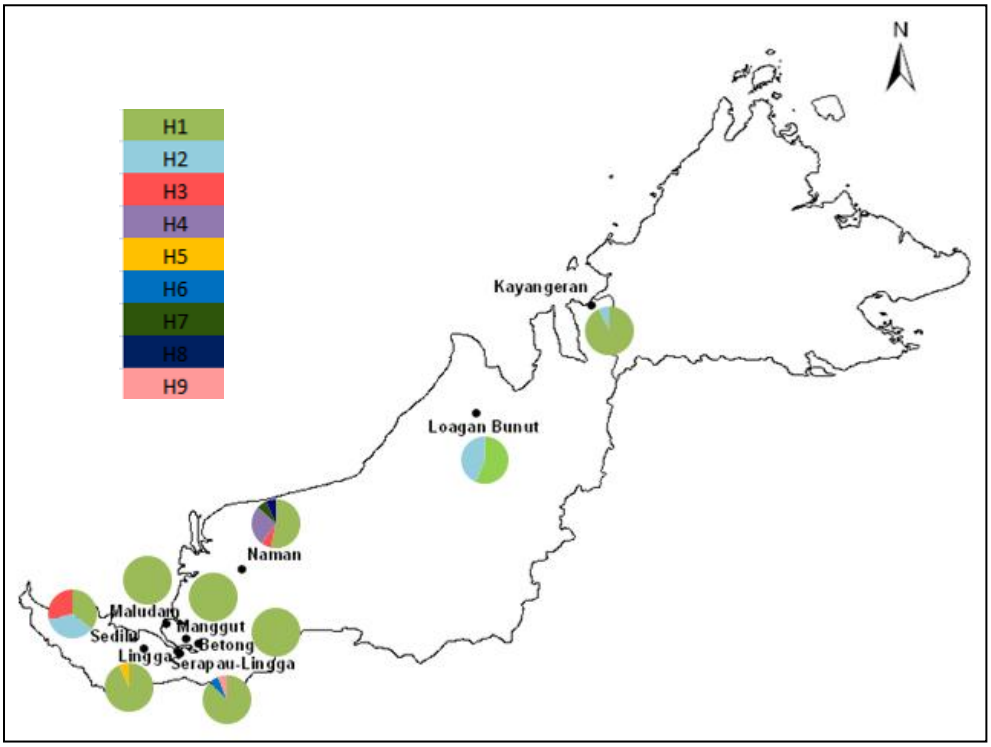

Figure 1: Distribution of haplotypes in Sarawak.

The self-assignment test was done to analyze the capability of the samples to be assigned back to the original populations. All the populations were first analyzed individually and the mean value of the correct assignment rate was 58.8% (Table 3a). The populations were further compiled into larger populations in different combinations (Table 3b, 3c and 3d). The mean percentage of correct assignment rate was increased to 84.0% (Table 3b) and further to 99.7 (Table 3d). This database can be used as a reference for tracking or tracing the possible origin of *G. bancanus* timber or timber products in Sarawak.

4.0 CONCLUSION

The molecular DNA technology for timber forensic although considered expensive, is the most powerful tool in the timber tracing system. From our study, a total of 17 Ramin species, including *G. bancanus*, are genetically distinguishable using the four variable regions of DNA. A DNA sequence database for Ramin species was established and the capability of molecular genetics in the identification of Ramin species in Sarawak was proven. This study also indicated that tracing the timber using DNA markers back to the source or exact origin may be difficult but it is possible to trace to its geographical range (example, Malaysia or Indonesia). This application of DNA technology together with the existing control system in place, can reduce and prevent the illegal timber laundering, and enhance control and enforcement measure of timber trading of endangered species.

Table 3: Self-assignment tests of *Gonystylus bancanus* in Sarawak with different combinations of the populations.

Population	By population
Sedilu	54.84
Lingga	26.67
Serapau-lingga	36.67
Maludam	44.44
Manggut	54.72
Betong	30.00
Naman	83.64
Loagan Bunut	98.02
Kayangeran	100.00
Mean	58.78

(a)

	Population	By genetic cluster
R1	Sedilu	58.24
R1	Lingga	58.24
R1	Serapau-lingga	58.24
R2	Maludam	83.72
R2	Manggut	83.72
R2	Betong	83.72
	Naman	80.00
	Loagan Bunut	98.02
	Kayangeran	100.00
	Mean	84.00

(b)

		By genetic cluster
R3	Sedilu	95.45
R3	Lingga	95.45
R3	Serapau-lingga	95.45
R3	Maludam	95.45
R3	Manggut	95.45
R3	Betong	95.45
	Naman	78.18
R3	Loagan Bunut	98.02
	Kayangeran	100.00
	Mean	92.91

(c)

	Population	By genetic cluster
R4	Sedilu	98.91
R4	Lingga	98.91
R5	Serapau-lingga	98.91
R5	Maludam	98.91
R5	Manggut	98.91
R5	Betong	98.91
R5	Naman	98.91
R5	Loagan Bunut	99.23
R5	Kayangeran	99.23
	Mean	99.07

(d)

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IP 9: PROPERTIES AND UTILIZATION OF *ACACIA MANGIUM* PLANTED IN SARAWAK

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ABSTRACT

Acacia mangium is the most planted tree species in Sarawak. To date, a total of 245,000 hectares have been planted with *Acacia mangium* and its hybrids. With the availability of mature acacia plantation, the utilization of acacia logs beyond pulp and paper has generated great concern. The utilization of any timber species depends on the physical and other properties of the species. This paper examines the basic and working properties of *Acacia mangium* and discusses the effects of these properties on end-use applications. Recommendations are also made on how to enhance the effective utilization of timber species for furniture, outdoor and structural applications.

1.0 INTRODUCTION

The Sarawak State Government's initiatives and coordinated policy to grow trees for future supply of timber has to be lauded. It is not surprising therefore to envisage that the future supply of timber from its natural forest would be greatly reduced and compensated from timber sourced from planted forests in the years to come. It was revealed that as of December 2013, a total of 332,000 hectares have been planted with various fast-growing species of which 245,000 hectares or 70% of the total planted forest areas have been planted with *A. mangium* and its hybrids (Anon., 2014).

Studies carried out on plantation-grown species such as *A. mangium, Gmelina arborea, Paraserianthes falcataria* and *Eucalyptus pellita* in Sarawak so far indicated that though there is a potential for the promotion of some of these fast-grown exotic species in the country, future challenges lie in the proper understanding of the basic and working properties of the material of different age groups, with respect to their end-uses application. Technical problems associated with properties of the material must be given due attention before profitable end-products could be derived. The issues, among others are the tree form and growth stresses of the juvenile materials associated with the recovery of sawn-timbers derived and eventual stability and bonding integrity of the end products manufactured. Generally, juvenile wood tends to possess low density, low strength properties and exhibits a tendency to shrink more along the grain.

The objectives of the study are:

i. To determine the basic and working properties of *A. mangium*
ii. To make recommendations to effectively enhance the utilization of timber species

2.0 MATERIALS & METHODS

Trees of three age groups viz., 7, 10 and 13-year old of *A. mangium* were collected from *Acacia* plantation in Bintulu. The sampling of the trees were based on their health and good form in accordance with the International Tropical Timber Organization (ITTO) harmonized testing methods for plantation grown tropical timbers (Tan *et al.*, 2010). The methods for evaluating basic and working properties of three age groups also followed the ITTO harmonized testing methods and standard laboratory practices where applicable.

3.0 RESULTS AND DISCUSSION

3.1 Anatomical Features

The sapwood is whitish or creamy yellow width ranging from 0.9 to 2.6 cm and sharply differentiated from the heartwood which is light yellowish-brown with olive brown cast to light red-brown. Grain is straight to shallowly interlock, sometimes sloping. Texture is moderately fine and sometimes uneven. Flat sawn surface is present with faint vague growth ring figures and stripe figures on radial surface. Growth rings are absent or vaguely present. Vessels or pores are diffused, moderately small to moderately large. The larger pores are discernable to the naked eye on cleanly cut cross-section. Pores are moderately few to moderately numerous, mainly oval, sometimes round in shape. Mostly solitary and in radial pairs and multiples of up to three; with occasional cluster; evenly distributed with a tendency to align in short oblique manner; deposits are absent; tyloses are absent. Wood parenchyma occurs as scanty paratracheal to thinly vasicentric. Rays are fine. Ripple marks are absent.

3.2 Physical and Mechanical Properties

All the mechanical strength properties perform better in air-dry than in green condition as shown in Table 1. Strength properties in tangential plane seem to perform slightly better than at the radial plane. Most of mechanical properties show significant differences between 7 and 10-year old and also with 13-year old. Based on the Malaysian Standard MS 544 Part 1, 7-year old timber is classified under strength group 6 whilst 10 and 13-year under strength group 5.

Table 1: Physical and mechanical properties.

Age Grp (Yrs)	Cond.	MC	BD	Static Bending		Comp// to grain	Shear // to grain		Hardness		Cleavage		Ten // to grain	Impact Bending	Strength Group
				MOR	MOE		T	R	T	R	T	R			
		(%)	(g/cm^3)	(MPa)	(MPa)	(MPa)	(MPa)	(MPa)	(kN)	(kN)	(N/mm)	(N/mm)	(MPa)	(Joule)	
7	G	121.99	0.45	69.56	10005	34.77	11.03	9.80	3.33	3.26	13.63	12.62	89.49	28.78	
	A	18.29		93.21	11456	47.06	13.61	13.28	3.48	3.36	15.37	12.80	115.06	30.40	SG 6
10	G	122.21	0.51	80.17	11066	36.87	12.21	11.61	3.64	3.55	15.57	14.84	111.76	38.78	
	A	18.42		114.86	14819	56.01	16.22	15.22	4.27	3.99	18.27	15.02	138.64	41.35	SG 5
13	G	122.08	0.49	74.71	10510	36.20	11.70	10.50	3.76	3.72	15.68	14.79	101.15	37.82	SG 5
	A	18.40		95.10	11626	51.48	15.32	14.37	4.29	4.15	17.19	15.52	134.36	38.65	

3.3 Chemical Properties

There is no significant variation in the chemical compositions between 10 and 13-year old, whilst the hot water solubility, ethanol-toluene solubility and hexane solubility in 7-year old trees is slightly lower as shown in Table 2. The younger trees has comparable lignin and holocellulose contents and less extractives content, hence consume less chemicals for pulping and gives higher pulp yield. At age 7-years and below, *A. mangium* is suitable for the pulp and paper industry.

Table 2: Chemical properties.

Age group (Yr)	Lignin (%)	Hollo-cellulose (%)	Hot Water Solubility (%)	Ethanol - Toluene Solubility (%)	Hexane Solubility (%)	Pentosan (%)
7	28.05	79.41	4.13	3.52	0.91	17.19
10	27.53	77.94	5.32	4.95	1.13	18.21
13	27.45	77.67	5.51	4.58	1.04	NA

3.4 Drying Characteristics

Timber from the three age groups does not show any distinctive differences. The timber dries perfectly well by air-drying without any occurrence of wet core or severe drying degrades. However, the duration required to achieve the ideal air-dry condition for 27 mm thick boards varies from 3 to 7 months. This species dries well without major defects and the uniformity of moisture can be attained but is prone to internal checks and high deformation. A mild kiln drying schedule (i.e. low initial dry-bulb temperature and wet-bulb depression) is recommended. Timbers of the three age groups show a moderate shrinkage. The percentage shrinkage and swelling are quite consistent among the three age groups.

3.5 Recovery Rates and Machining Properties

The mean recovery rate for *Acacia mangium* is 37% using the 'Modified Cant' sawing pattern. It is found that recoveries are relatively low and are mainly attributed to the split and fluted shapes of the logs used in the study. End-splitting of the slabs during and after sawing further adds to the low recovery result. The older logs yielded more of the better grades of sawn timber, namely select and better, standard and serviceable. For the three age groups, more than 60% of the sawn timbers are graded serviceable or better. The timber is easy to plan and graded as good to excellent and the age of wood do not affect the planning quality. For quality result, the planning knife is best set at 40° and best feed per knife at 0.38 mm. The timber is assessed as easy to sand as the surface quality from sanding test is consistently graded as good to excellent. However, sanding defect namely fuzzing is observed in some specimens. Timbers are easy to bore, mortise and shape, and the quality of bored surface, finish and shape surface respectively are generally graded as excellent. In addition, it is also easy to turn and the finished surface was graded as good to excellent.

3.6 Finger-Jointing and Lamination

Bending tests conducted on the finger-jointed samples show that all samples bonded with three types of adhesives tested viz., PVAc, EPI and PRF treated to three conditions (dry, water-soak or boil) satisfying the minimum requirements of strength values. Tensile strength under 5 conditions [dry, water-soak, boil, elevated temperature (104°C) or temperature/humidity (65°C & 16% equilibrium moisture content)] with the three types of adhesive meet the minimum requirements of tensile strength except for samples bonded with EPI in boil condition. Shear strength bonded with the three types of adhesive meet the minimum requirements of strength values except for specimens bonded with EPI in boil condition. The delamination test results for all the three age groups treated to the three test conditions show that all the three groups satisfy the required delamination ratio of less than 10% under the test conditions of water immersion for 6 hours except for 7-year old samples bonded with PVAc adhesive. Under water immersion for 24 hours, samples bonded with PVAc did not satisfy the requirement. For boiling water soak condition, only 7 years old samples bonded with EPI and specimens bonded with PRF satisfy the requirement of less than 5% de-lamination ratio.

3.7 Veneering and Slicing

Yield of veneer from rotary peeling is relatively higher than that obtained by slicing. The probable reason is that the available small diameter logs with knots are not suitable for the slicing process. Surface roughness results are fairly uniform across the three age groups and also between peeled and sliced veneer.

3.8 Natural Durability

Seven-year old timber is very susceptible to white rot fungus while both 10 and 13-year old are moderately susceptible. All three age groups are durable against brown rot. It is concluded that the younger trees are more susceptible to white rot decay fungi.

3.9 Wood Treatability

In terms of wood permeability, the timber species are classified as moderately difficult to treat with preservative loadings of 143.8 lit/m^3, 147.1 lit/m^3 and 129.1 lit/m^3 respectively following MS 544: Part 10: 2003 Code of practice for structural use of timber: Part 10: preservative treatment of structural timber classification (Anon., 2003). Permeability is not significantly different between timber of 7 and 10 years however for 13-year old it is significantly lower. The average preservative loadings in terms of copper chrome arsenic (CCA) dry salt retention is 15.8 kg/m^3, 15.3 kg/m^3 and 13.3 kg/m^3 for 7, 10 and 13-year old, respectively. The values fulfill MS 544 Hazard class H 4 requirements minimum (12.0 kg/m^3) for timber used outside in ground contact and subjected to severe wetting and leaching.

4.0 UTILIZATION

The timber species has been reported as incredibly multi-functional. The timber can be used for furniture and cabinet making, light to heavy construction, mouldings, poles, posts, panelling, mining timbers, boat building, carts, joinery, turnery, tool handles, agricultural implements, matches, splints, particle boards, hard board and veneer, as well as for plywood, pulp and paper (Sein and Mitlöhner, 2011). Research findings on the basic and working properties of 7, 10 and 13-year old in this study has attested to that and its suitability as a future raw material supply to the wood-based industry in the country. Knowing the properties, the uses of the timber can be further explored and improved. Some of the possible steps to improve and maximize utilization are deliberated as follows:

4.1 Innovative/Enhancement Processes

4.1.1 Finger-Jointing and Laminates

Fast growing plantation timbers are always associated with lower timber quality like knots and splits which eventually results in shorter piece of usable timber. The three age groups under study do not exhibit any problem in gluing which therefore allows the timber to be finger-jointed to any required length and laminated to the required dimension for structural applications. Probable products include light construction materials and furniture parts.

4.1.2 Wood Treatment

The heartwood of the three age groups of *A. mangium* is classified as non-durable to moderately durable. This implies that while the use of heartwood for indoor applications do not face any problem, usage for outdoors is not suitable. However, the wood can be improved with chemical treatment using CCA wood preservatives. It can fulfill MS 544 Hazard class H 4 requirements, but is more suitable for H3 or lower category and can be used for both outdoor above ground usage subject to wetting and leaching and inside above-ground protected from wetting and leaching.

4.1.3 Landscaping Materials

Use of plantation timber for outdoor applications is deemed not possible because it is naturally non-resistant to fungi decay and insects attack. However, with wood preservative treatment, the use of such timber for a wide range of outdoor applications is possible. The heartwood plank when properly treated can be used for most outdoor above-ground applications such as plank walk and perimeter fencing. Inclusion of sapwood in timber planks and round poles after preservative treatment will absorb much higher amount of wood preservative compared to heartwood alone making it suitable for outdoor ground contact applications such as retention wall and plank walk support.

4.1.4 Aesthetics – Furniture, Decorative Materials and Products

The timber is admired for its aesthetical features such as color, grain, figure and fine textures appearance. Plantation species usually has a lot of knots as a result of more branches. Although knots in timber may not be suitable for some products such as glulam and structural parts that require strength, it can be exploited to produce products where aesthetics is a priority. Similarly the sapwood color being distinctively different from the heartwood blends well together to expose a beautiful and unique attraction. Coupled with its excellent machining properties and workability, it is not surprising therefore that the wood is popular for use in the manufacture of furniture.

5.0 CONCLUSION

Generally, there are no significant differences in terms of basic and working properties between planted *A. mangium* of 7, 10 and 13-year old. Materials from these age groups can be mixed to produce a majority of timber products without much problem with the advancement in wood processing technology. The results shows that with application of innovative and enhancement processes, *Acacia mangium* is suitable both for indoor, outdoor and structural applications apart from pulp and paper. With its excellence machining properties and abundance in supply, the species is popular for use in the manufacture of furniture.

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IP 10: MOVING TOWARDS ZERO LOSSES OF ORANGUTANS AND THEIR HABITATS IN SARAWAK

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ABSTRACT

Much attention has been focused on the orangutans in Sarawak since the 1800s. The science in the early days consisted of killing these animals for taxidermy purposes such as life-size exhibits, skulls and skins for education at museums, and live exhibits at zoos. By the 1960s, due to the continued loss of wild animals to the pet trade and poaching for food, there was increasing worldwide interest in Sarawak's orangutans. That attention and the State's understanding of the need to protect the animal and its habitat culminated in the creation of several protected areas (National Parks and Wildlife Sanctuaries) for orangutans. The underlying philosophy is that Sarawak does not intend to lose its orangutans, nor the habitats of where they are found. It is an ongoing policy with the most recent protected area for orangutans created in late 2013. A discussion of proposed protected areas for orangutans and means to engage local communities is also highlighted.

1.0 INTRODUCTION

Internationally, Sarawak has always been considered an enigma. Sarawak is viewed romantically as remote, jungles and a wild place. The term wild is also used in a different sense, i.e., opinionated, non-conforming and independent.

The romantic aspects were been nourished by adventure stories of the 1800s that included the anthropologically interesting local cultures that involved head-hunting; its beginnings of statehood via an international British traveller and adventurer James Brooke in 1840s; travels by world-renowned naturalists collecting orangutans that included Wallace in 1850s and Hornaday in 1870s; the adventures of Tom Harrison fighting the Japanese during the Second World War, the Sarawak Museum collections and the 'deep skull' and budding scientific research on orangutans between the 1940s to 1960s. By the mid-1980s onwards there was renewed interest in Sarawak and these unfortunately included issues such as Penans and the fights for their forest homes, peatland conversions and the building of hydro-electric dams.

2.0 ORANG-UTANS AND SARAWAK

Orang-utans in Borneo were first mentioned in western records in the 1600s with Jacobus Bontius and Nicholaas Tulp being probably the first few to use the scientific term orang-utan in 1631 and 1641 respectively. There were several variations used, Orang Hutan, Orang-outang, and Orang-autang (page 275, Nicolai Tulpii Amstelredamensis Observationes Medicae, 1641, Book III, 56th Observation, or page 284 of the same book under the Google books http://books.google.co.uk/books?id=0Ao5AAAAcAAJ&ots=5phUYMKAgv&dq=observationes%20medicae&pg=PP1#v=onepage&q&f=false).

Orang-utans became such an attraction that by the end of the 1800s, over 200 orangutans were exported to Europe from Sarawak (Bruen & Haile,1960) by early 1900s. A separate 1950s survey by Harrison (1961) estimated that a further 125 orangutans (minimum) were in captivity of orangutans in private hands in Southeast Asia. Meanwhile, a global estimate by Zoological Society of London in 1960 estimated that there were at least 248 orangutans in captivity in zoos worldwide (Harrison, 1961). As the longevity of captive animals was poor and breeding rates almost non-existent up to the 1960s, most of these animals were harvested from the wilds. By the 1960s, it was assumed that an animal in captivity meant three having died in the process of capture and transport (Harrison, 1961). According to the Sumatran Orangutan Society (http://www.orangutans-sos.org/orangutans/crisis) however, the ratio is actually higher, i.e., for every single orangutan in captivity, at least six to eight died during capture and transport (Sumatran Orangutan Society, 2014) (http://www.orangutans-sos.org/orangutans/crisis). If the 2014 ratio is used, between 1800s and 1960, at least 1,950 to 2,600 Sarawak's orangutans perished in the wilds or during transport as at least 325 animals were reportedly exported (Harrison,

1961). This is a minimum figure as the 325 animals do not include those in the global estimate by Zoological Society of London.

3.0 CONSERVATION BEGINNINGS AND CONSTITUTION OF PROTECTED AREAS FOR ORANGUTANS

The first attempts towards habitat conservation of orangutan landscapes began in 1936, when the proposals for the Lanjak-Entimau Protected-forest [*sic*] appeared in the Sarawak Museum Annual Report (Sarawak Forest Department, 1939). The proposal was made not for orangutan conservation but rather as a means to prevent the spread of shifting cultivation. By April 1938, it was formally proposed as a protected-forest [*sic*] and even after an eight-month wait period, there were no claims to the area by locals (Sarawak Forest Department, 1939).

In the late 1950s, there was grave concern for the long-term survival of orangutans for the following reasons:

- low resident population of orangutans in Sarawak guess-estimated at less than 750 animals (Schaller, 1961) and 700 ± 200 (Harrison, 1961);
- accelerated development (timber extraction and shifting cultivation) and increasing human population on orangutan habitat (Harrison, 1961), and
- past and present collection of live and dead orangutans for zoos and scientific institutions which probably surpassed 200 animals.

Amidst the research and reports by Sarawak Museum, there were also several legal and administrative conservation-enabling events which promoted protection of orangutans, among them the:

- Forest Ordinance (1954);
- National Parks Ordinance (1956);
- Wildlife Protection Ordinance (1958) (administered by the Sarawak Museum until the late 1970s), and
- Sarawak Government's interest in orangutans which led to the Report of the Maias Protection Commission (1960).

By 1983, the first protected area for orangutans was established, i.e., Lanjak-Entimau Wildlife Sanctuary, with an area of approximately 168,700 ha. Over 30 communities were also given rights and privileges to collect non-timber forest produce, fish and hunt along certain catchments. It was also at around this time that the State Legislative Assembly appointed a Special Select Committee on Flora and Fauna to investigate the problems of wildlife losses throughout the state and to make recommendations to the Assembly and to the Executive on solving these issues. The net result of the report of the five sub-committees 1) mammals and birds; 2) fish and reptiles; 3) flora; 4) legislation and 5) finance were recommendations to amend the two legislations and increase the list of totally protected and protected animals. The two legal documents (National Parks Ordinance and Wild Life Protection Ordinance) were subsequently amended by 1990.

The data collection by the Special Select Committee and its reports were deemed the most comprehensive collection of information ever assembled for wildlife in any of the Bornean territories (Caldecott, 1988). The work of the Special Select Committee was followed by three state-wide, applied-conservation-research programs, namely:

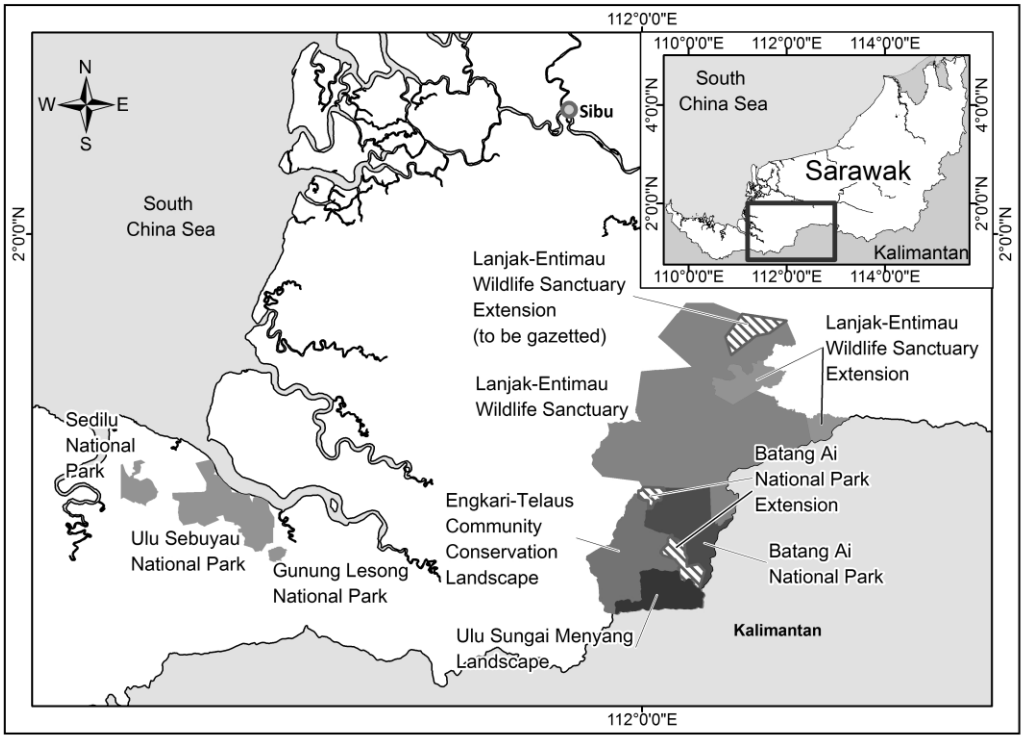
- "Hunting and Wildlife Management in Sarawak" (Caldecott, 1988),
- "A Wildlife Survey of Sarawak" (Bennett, 1992) and
- "A Conservation Management Study of Wildlife Hunting in Sabah and Sarawak" (Bennett et al, 1995).

These three efforts were significant as there was much concern over the roles rural communities played in harvests of wildlife, and whether the exploitation or use of wildlife for consumption and commercial sale was indeed sustainable. To the Directorate of the Sarawak Forest Department and subsequently, the State Secretary's Office, these three reports and the work and recommendations of the Special Select Committee meant a need to formulate a management policy for wildlife conservation, known as "A Master Plan for Wildlife in Sarawak". The policy was to include recommendations on, e.g., tourism in protected areas, staffing of protected areas, enforcement and the legislative issues with delays in creation of protected areas. In 1996, the Sarawak Legislative Assembly unanimously approved of the Master Plan. Among the many changes adopted by Sarawak as recommended by the Master Plan were the creation of the streamlined National Parks and Nature Reserves Ordinance (1998), the Wild Life Protection Ordinance (1998), increasing staff strength, better field enforcement, control over sale of guns and ammunition, a ban on commercial sale of wildlife and a flurry of proposals to create more protected areas for wildlife, including orangutans (Sarawak Forest Department & Wildlife Conservation Society, 1996; Gumal &Tisen, 2010). Due to the need to engage and discuss with the rural communities, 12 protected areas and two extensions were formally constituted during the official Master Plan implementation period between 1997 and 2002. These tended to be the non-complex areas where communities did not have a customary claim over the lands. Constitution of lands where orangutans were found only re-commenced in 2010, after the launch of the Trans-boundary Conservation Area (TBCA) and the former Chief Minister of Sarawak's pledge to protect orangutans during the launching of the International Regional Symposium on Orangutan Conservation in Kuching, Sarawak in 2009. The net effect of the pledge was the creation of two new protected areas for orangutans in 2010, a new protected and two extensions to existing protected areas by 2013 and six extra proposals awaiting final decisions by both State Legislative Assembly (Figures 1). A full list of existing and protected areas can be seen at the following two urls:

- http://www.forestry.sarawak.gov.my/modules/web/pages.php?mod=webpage&sub=page&id=1012&menu_id=0&sub_id=257

- http://www.forestry.sarawak.gov.my/modules/web/pages.php?mod=webpage&sub=page&id=1013&menu_id=0&sub_id=258

Figure 1: Expansion of Sarawak's protected areas for orangutans. Gazettements of the various protected areas included: Lanjak-Entimau (1983), Batang Ai (1991); Ulu Sebuyau and Sedilu (2010), Lanjak-Entimau extensions and Gunung Lesong (2013). The rest are proposals.



The significance of the decision to protect orangutan habitats (lands) is best understood if one compares the changes in intact forests (unlogged) for Borneo in the last 40 years using satellite imagery analyses (Gaveau et al, 2014). In the intervening period between 1973 and 2014, much of Borneo's (Brunei, Kalimantan, Sabah and Sarawak) intact or unlogged forests have disappeared (Figure 2). In Sarawak, Gaveau et al. (2014) reported losses of intact forests along these lines:

- By 2010, Sarawak had the lowest percentage (14.6%) of intact forest in Borneo, compared to Brunei, Kalimantan and Sabah.

- Although Sarawak had the highest losses of intact forest (19.7% left), it does not clear as much of the logged forests into monocultures such as oil palm, as compared to Sabah. Sarawak cleared about 23.1% of its intact forests to non-forest compared to 39.5% for Sabah.

The losses can be spatially illustrated in Figure 3. As illustrated, although intact forests had decline markedly in Sarawak in the intervening 40 years, most of it had been in non-orangutan areas.

Figure 2: Extent of changes to intact/unlogged forest from satellite analyses by Gaveau et al. (2014). As noted much of the intact forests have been logged in all the various regions in Borneo, including Sarawak.

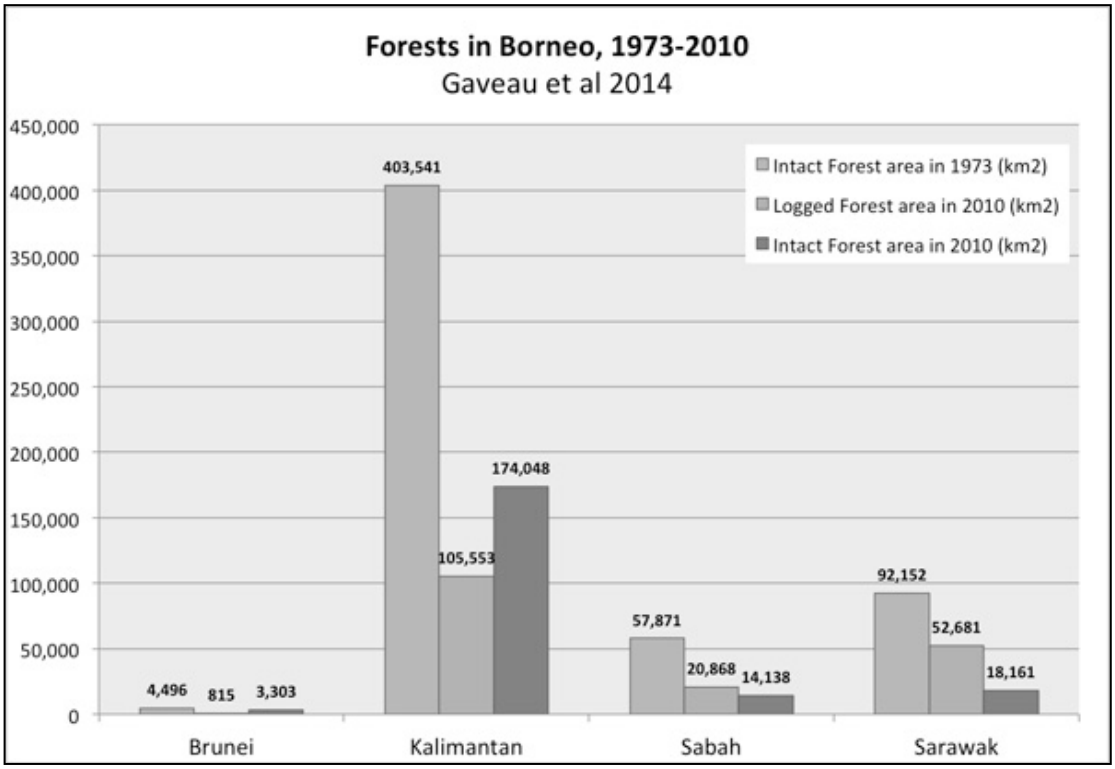
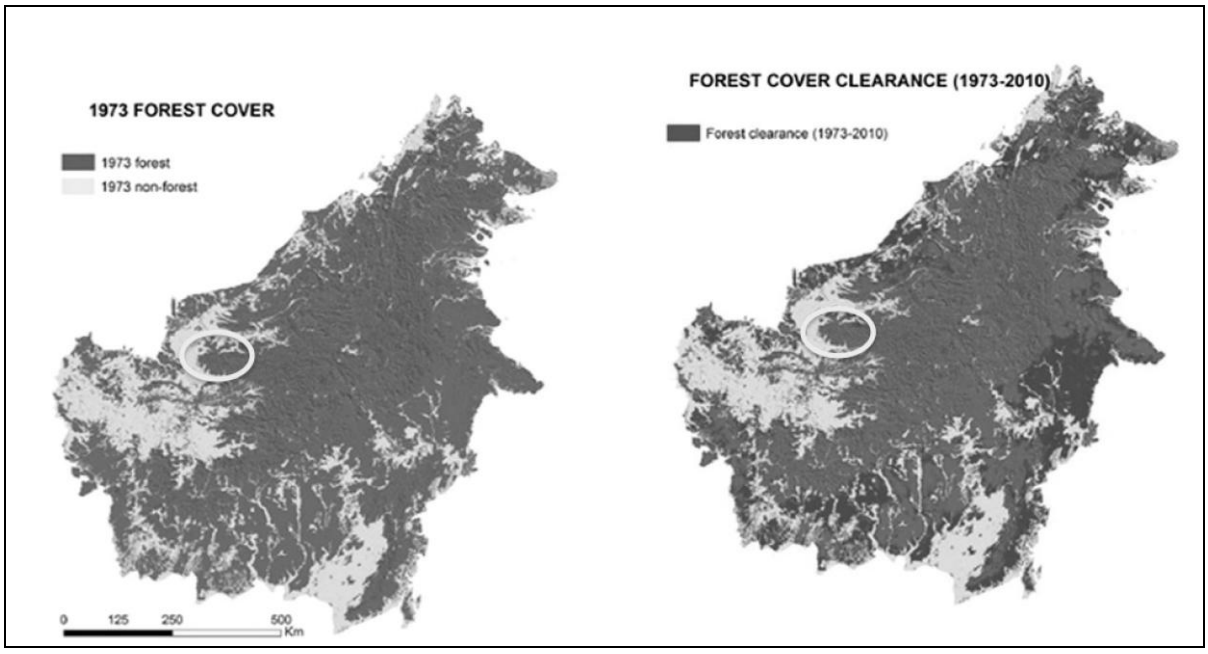


Figure 3: Analyses of intact forest change on Borneo by Gaveau et al. (2014). Highlighted in yellow is the Batang Ai-Lanjak-Entimau landscape where the intact forests have not changed as compared to much of the larger expanses of forests in Sarawak and Borneo.



4.0 PROTECTING ORANGUTANS AND THE PROTECTED AREAS

After the lack of sightings and potential local extinction of the Banteng (*Bos javanicus*) and Rhinoceros (*Dicerorhinus sumatrensis*) in Sarawak since the 1980s, Sarawak is very opposed to potential losses of orangutans. Biologically, orangutans are important animals in Sarawakian forests as they are large-seed dispersers. Culturally it is central to Sarawak Iban's culture, with stories and taboos linked to the species. In terms of being a tourism icon, it is potentially Sarawak's biggest draw in terms of wildlife and there are over 60,000 people each year wanting to personally see orangutans in Semenggoh Wildlife Centre. Close to 5,000 tourists spend over five hours each way, travelling to the longhouses around Batang Ai each year for a rare glimpse of this animal in their wilds.

The intent to protect and save the species can best be illustrated in the case example below where illegal logging was observed in the proposed Ulu Sungai Menyang landscape in 2014. Bulleted below are actual events and responses by the Sarawak Forest Department:

- *April 2014*
  - Report of illegal logging in the Ulu Sungai Menyang landscape by local communities.
  - Sarawak Forest Department and Sarawak Forestry Corporation 'Heart of Borneo' team dispatched to investigate.
  - Internal report done by Sarawak Forest Department and Sarawak Forestry Corporation. Special Branch of Royal Malaysian Police was informed.

- *May 2014*
  - Press report released by The Star newspaper.
  - Three helicopters and 25 personnel dispatched and over 1,000 logs were seized.
  - Sarawak Forest Department maintains a 'zero-logging and land-clearance for oil palm of orangutan habitat' policy and this is supported by the Chief Minister's Office.

- *August 2014*
  - Chief Minister's Office supports a policy of sustainable forest management in areas surrounding orangutan habitats and indicated that all logging companies are to adhere to the new initiative under the 'Heart of Borneo'.
  - Sarawak Forest Department initiates a seven-agency collaborative reconnaissance (recce) research to map out the habitat use by orangutans in the Batang Ai-Lanjak-Entimau Landscape.
  - WCS-Malaysia Program conducts a preliminary survey with communities affected by the mapping exercise outlined in the seven-agency collaborative recce.
  - Recce by the seven-agency group is scheduled for October 2014, although only five agencies will be used at this time. A separate recce in the eastern part of the Batang Ai-Lanjak-Entimau Landscape will be conducted by June 2015.

5.0 DISCUSSION

Undoubtedly, there has been much history into the conservation of orangutans in Sarawak, dating back to the 1800s during the time of exploitation to the 21st century. The speeds in which the creation of protected areas can be slow as some of the sites were only gazetted after 50 years. Among the reasons for the slow gazettement process were legislative issues as there was a cumbersome constitution process till 1998. In the last 15 years, there has been a push to speed up the constitution process, but it has been hampered by customary rights issues over the lands by the local indigenous communities in the area.

Within the Sarawak Government's Executive Agencies of Sarawak Forest Department and its appointed agent, Sarawak Forestry Corporation, the spirit to protect the orangutans has been illustrated by the Director of Forests's maintenance of the zero-loss of orangutan habitats even when there has been proposals for the licensing and land-clearance for oil palm by various political lobbyists, local communities and pro-development agencies. It promises to be a tough conservation stance in light of such impending demands. However, the Government's stand for pro-conservation of orangutans and their habitats are supported by the various international NGOs, among them the Wildlife Conservation Society and World Wide Fund for Nature.

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IP 11: DEVELOPING GUIDELINES FOR FAUNA CONSERVATION AND ECOSYSTEM MANAGEMENT

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Sarawak Forestry Corporation

ABSTRACT

The Malaysian Criteria and Indicators for forest management certification under the Malaysian Timber Certification Scheme require the availability of guidelines for fauna conservation and habitat management. To address this requirement, Sarawak Forestry has set out to produce practical and easy-to-use guidelines that can be used by forest managers and other stakeholders to identify, manage and monitor issues related to wildlife conservation. These guidelines have been developed based on existing and relevant State laws, policies, regulations as well as international practices and conventions.

1.0 INTRODUCTION

Availability of guidelines for fauna conservation and habitat management is required under the Malaysian Criteria and Indicators for forest management certification, currently in use by the Malaysian Timber Certification Scheme. There is no availability of a compilation of such guidelines and sensing the need to have one, Sarawak Forestry Corporation took the initiative to pull together a comprehensive compilation of available guidelines and laws relevant to the subject matter for Sarawak. This document aims to provide a practical and easy to use guidance to forest managers and other stakeholders to identify, manage and monitor issues related to wildlife in Sarawak. However, this document is not meant for managing wildlife in totally protected areas such as national parks, nature reserves or wildlife sanctuaries as there are specific laws on managing wildlife in these areas.

These guidelines are not meant to be exhaustive or prescriptive. The aim is to provide some general principles for reducing the impact on wildlife during operation. The guidelines are derived from existing state's laws, state's policies and relevant directives such as the Wild Life Protection Ordinance, 1998 (WLPO), A Master Plan for Wildlife in Sarawak (MPWS), Guidelines/Procedures for Reduced and Low Impact Harvesting System (RIL), Director of Forest Circular, etc. In the case where such laws, policies or directives cannot provide the warranted guideline, the authors suggest guidance from experts and from literature such as the Common Guidance for the identification of High Conservation Values (2013), Life After Logging, International Union for Conservation of Nature and Natural Resources (IUCN), etc.

Scale and intensity which refer to the appropriateness of the degree of efforts to be carried out is further defined in Appendix 1.

If there is a need to assess species and changes in the population of forest fauna, relevant methodologies are attached in the appendices prescribing how such studies are to be carried out for various groups of species i.e. primates, big mammals, bats, small mammals, amphibians, birds and aquatic life.

2.0 GUIDELINE FOR IDENTIFYING ANIMALS

This guideline is NOT a tool to identify animals. There are guidebooks readily available to facilitate animal identification specific to species found in Borneo or in the region. The following are some examples of these guidebooks.

Table 1: Title of guidebook for animal identification.

Category	Title of Guidebook
Mammals	*A Field Guide to the Mammals of Borneo.* Junaidi Payne and Charles M. Francis
Birds	*Phillip's Field Guide to the Birds of Borneo Sabah, Sarawak, Brunei and Kalimantan.* Quentins Phillipps and Karen Phillipps *A Field Guide to the Birds of Borneo*. Susan Myers *A Field Guide to the Birds of South-East Asia.* Craig Robson
Amphibians	*A Field Guide to the Frogs of Borneo*. Robert F. Inger and Robert B. Stuebing
Reptiles	*A Photographic Guide to Snakes and other Reptile of Borneo.* Indraneil Das *A Field Guide to the Snakes of Borneo.* Robert Stuebing and Robert Inger *Turtles of Borneo and Peninsular Malaysia.* Lim Boo Liat and Indraneil Das
Fishes	*Freshwater fishes of Peninsular Malaysia.* Universiti Pertanian Malaysia, Serdang. Mohsin, A.K.M. and M.A.Ambak. 1983 *Fresh Water Fish of North Borneo.* Robert Inger, Chin Phui Kong. 1962 *Freshwater fishes of Western Indonesia and Sulawesi*. Kottelat, M.A., Whitten, J., Kartikasari, S.N. and Wirjoatmodjo. 1993

3.0 GUIDELINE FOR IDENTIFICATION OF ENDANGERED, RARE AND THREATENED SPECIES OF FOREST FAUNA

Identification of endangered, rare and threatened species (ERT) shall refer to three instruments namely; the Wild Life Protection Ordinance (WLPO)[24], CITES [25] and IUCN Red List of Threatened Species[26] Any species that is categorized under any of the three instruments above will be considered as ERT species. Definition of ERT species is further discussed in Appendix 2.

Totally Protected Animals and Protected Animals are listed under Part I and Part II respectively of the First Schedule of the Wild Life Protection Ordinance 1998, Chapter 26, Laws of Sarawak. Appendix 3 provides the list of Totally Protected and Protected animals in Sarawak.

All species listed under Appendix I and Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are automatically accorded Protected Species under the Wild Life Protection Ordinance 1998 unless the species has already been listed as Totally Protected Species. CITES Appendices are readily available on CITES website.

IUCN Red List of Threatened Species categories species as Critically Endangered, Endangered, Vulnerable, Conservation Dependent, Near Threatened and Least Concerned. For the purpose of Endangered, Rare and Threatened Species, only the first three categories are taken into consideration.

ACTION: To keep a list of Endangered, Rare and Threatened Species of Forest Fauna which is to be updated regularly or whenever necessary. The format below is recommended.

[24] Laws of Sarawak, Chapter 26, Wild Life Protection Ordinance, 1998.
[25] http://www.cites.org/eng/resources/species.html
[26] http://www.iucnredlist.org/technical-documents/categories-and-criteria

Table 2: Format to record list of ERT species.

No.	Species	Local Name	Conservation Status		
			WLPO	CITES	IUCN
	Mammals				
1	*Manis javanica*	Pangolin	Protected	App. II	Endangered
2	*Sus barbatus*	Bearded pig	-	-	Vulnerable
	Birds				
1	*Anorrhinus galeritus*	Bushy-crested Hornbill	Totally Protected	App. II	Least Concern

4.0 GUIDELINES FOR PROTECTION OF ENDANGERED, RARE AND THREATENED SPECIES OF FOREST FAUNA

The followings are guidelines to protect the endangered, rare and threatened species of forest fauna. Most of these are related to hunting and the ban of commercial sale of animal taken from the wild.

Table 3: Guidelines for protection of endangered, rare and threatened species of forest fauna.

Number	Action required (Item)	References/Remark
1	Employees of the Timber Companies not to hunt in the licensed areas while they are in the employ with the Company.	DF Circular 6/99[27], WLMP Signboard to be erected WLMP: Wildlife populations must be conserved throughout Sarawak's Permanent Forest Estate (PFE) Hunting by logging company employees, and hunting by outsiders for sport and trade along logging roads, should be stopped throughout the PFE
2	Company vehicles are not to be used for hunting or carrying meat of wild animals.	
3	Selling of wild animals or meat of wild animals is not allowed in the licensed areas.	
4	Feeder roads are to be closed after the final block inspection to prevent further entry of vehicles. This can be done by taking out bridges or digging trenches across the roads.	
5	WLPO, 1998 & it Rules strictly adhered.	WLPO, 1998 & Rules A copy must be available
6	Wire snares are to be banned throughout PFE.	WLMP
7	Community leaders and camp managers to be appointed as Honorary Wild Life Ranger (HWLR) to assist with the implementation of the WLPO, 1998 & its rules.	
8	Any observation of the highly endangered (flagship or iconic) species such as Sumatran rhinoceros, orangutans or proboscis monkey is to be recorded, continuously monitored and to inform Sarawak Forestry Corporation (SFC)/Forest Department Sarawak (FDS). This occurrence will be treated as a High Conservation Value.	

5.0 GUIDELINES TO ESTABLISH AND PROTECT REPRESENTATIVE CONSERVATION AND PROTECTION AREAS IN FOREST ECOSYSTEM

[27] Director of Forests' Circular 6/99 dated 30 April 1999 is a directive to the regional offices to implement the necessary actions to stop illegal hunting and wildlife trade in FMU as recommended by the Master Plan for Wildlife in Sarawak.

Table 4: Guidelines to establish and protect representative conservation and protection areas in forest ecosystem.

Habitat types	Recommendations/Actions required	References
Keystone mineral resources such as salt springs, mineral licks and mud volcano **Note:** As there are three different recommendations, the size of the buffer should be appropriate to the scale and intensity from a minimum of 100 m width to a radius of 2 km	• Keystone mineral resources should be identified and mapped. • Forest must remain unlogged in at least a 2- km radius around each mineral area. No roads should be constructed in this protected zone. This is to ensure full physical protection of the mineral area, and some protection from hunters for the animals visiting it.	WLMP 4.2.2 (review 2002)
	• A buffer zone of width 100 meters around the perimeter of such critical resources and sites is to be established.	RIL
	• Salt springs, salt earths and sites with clays eaten by animals, should be located and incorporated in the area planning (local people can usually help locate these). They should not be disturbed.	Life after Logging page 158
Caves & limestone block	• A buffer zone of width 100 meters around the perimeter of such critical resources and sites is to be established.	RIL
	• The International Union for Conservation of Nature and Natural Resources (IUCN) published Guidelines for Cave and Karst Protection. A summary of the guidelines is listed in Appendix 4.	IUCN
Dancing ground	• At least 200 meters radius from the edges of the dancing ground. • Should be identified throughout FMU, and mapped with GPS location. • No roads should be constructed in this protected zone. This is to ensure full physical protection of the dancing ground areas and protect from illegal hunters.	Home range of male Argus is at least 150 meters from the edge of the dancing ground
	• A buffer zone of width 100 meters around the perimeter of such critical resources and sites is to be established.	RIL
Nesting sites (i.e. nesting trees)	• All hollow trees with potential for nesting of hornbills should be marked and protected. • At least 200 meters radius from the edges of the nesting trees for all Hornbills. • Should be identified throughout FMU, and mapped with GPS location. • No roads should be constructed in this protected zone. This is to ensure full physical protection of the nesting areas and protect from illegal hunters.	
Roosting areas (i.e. Flying Foxes)	• At least 500 meters radius from the edges of the roosting areas for all Flying Foxes. • Should be identified throughout FMU, and mapped with GPS location. • No roads should be constructed in this protected zone.	Study by Dr. Melvin – 1500 ha required for the protection of roosting sites

Pig wallows, Banteng wallows and rhinoceros wallows	• A buffer zone of width 100 meters around the perimeter of such critical resources and sites is to be established.	RIL

6.0 GUIDELINES FOR THE CONSERVATION OF GENETIC, SPECIES AND ECOSYSTEM DIVERSITY AND GUIDELINES FOR BIOLOGICAL CORRIDORS AND BUFFER ZONE FOR WILDLIFE

Table 5: Guidelines for the conservation of genetic, species and ecosystem diversity and guidelines for biological corridors and buffer zone for wildlife.

Protection of unlogged areas in PFE	A system of unlogged areas throughout the PFE should be established. This can be done either: (1) by making retention of specified unlogged blocks of a condition of the logging licence; or (2) by declaring some blocks as conservation areas under the Natural Resources and Environment (Amendment) Ordinance. Each unlogged area should be clearly marked on logging maps and on the ground. Each unlogged area should be sited well inside Forest Reserves (FRs) and Protected Forests (PFs), not close to the edge. Each unlogged area should be at least 250 ha in size. Between them, they should constitute at least 10% of each FR and PF, not including riparian reserves and Class IV terrain. All hunting in unlogged blocks should be banned.	WLMP 1996

FMU adjacent to TPAs	In practice, the width of the buffer zone will be stated in the forest management plan (FMP) of the timber license.	FMP of timber licence
	Buffer zone of 1 km width adjacent to TPAs.	RIL
	Where the PFE adjoins a TPA, a buffer zone should remain unlogged in the PFE along the TPA boundary. This should be a minimum of 10 chains wide. All felling of trees and hunting in the buffer zone should be prohibited, and its protection should be a condition of the PEC licence.	WLMP

Wildlife management should be incorporated into plantation management	Buffer zones at least 500 meters wide should be established in plantations along all TPA boundaries.	WLMP 2002
	Buffer zones at least 500 m wide should be established in plantations along all riverbanks of rivers running through the plantation which ultimately flow into a TPA.	
	Virgin jungle reserves (VJRs) should be established in plantations throughout Sarawak.	
	Pest control in plantations should be done according to proper planning, and in consultation with Forest Dept.	

River Buffers	Guidelines/Procedures for Reduced and Low Impact Harvesting System recommended a general buffer of 20 meters on both banks of waterways.	RIL

	> 40 meters - 50 meters buffer 20-40 meters - 40 meters buffer 10-20 meters - 20 meters buffer 5-10 meters - 10 meters buffer < 5 meters - 10 meters buffer in Managing Biodiversity in the Riparian Zone: Guidelines for Planners, Decision-maker and Practitioners, Ministry for Natural Resources and Environment (NRE).	NRE
	> 40 meters - 100 meters protect on each side 21-40 meters - 40 meter protect on each side 11-20 meters - 25 meters protect on each side 1-10 meters - 10 meters protect on each side < 1 meter - none	Life After Logging

Biological corridors and buffer zone for wildlife	a) Corridors - strip of forest areas that are reasonably keep intact connecting two or more HCVA (High Conservation Value Areas). The corridor should be at least 500 m in width. b) Harvesting of timber is permitted within corridor however no construction of main roads permitted.	
	a) All HCVAs should have 100 meters buffer zones. b) No harvesting of timbers and construction of road within buffer zones.	
	a) All buffer zones and corridor should be identified and mapped, and with GPS location throughout FMU. b) All buffer zones and corridor must be marked every 20 meters along the outer boundary of the buffer zones and corridors. c) Color used for marking buffer zones and corridors should be different from the existing color used for marking coupe and block.	

7.0 GUIDELINES TO CONDUCT SURVEY TO MONITOR FOREST FAUNA

Examples of survey techniques are given in the appendices. Researches or forest managers are not bound by these techniques as they can choose to use the survey techniques according to their training and professions.

Table 6: Methodology for monitoring of forest fauna.

Indicator species	**Methodology**	**Remark**
Primates	Transect line	Appendix 5
Big Mammals	Line transect (King's Census Method) Camera trapping	Appendix 6
Bats	Harp trap Mist net	Appendix 7
Small Mammals	Trapping (Using live traps)	Appendix 8
Amphibians	Stream transect Quadrate sampling Pitfall Traps with Drift Fences Funnel Traps	Appendix 9
Avifauna (Birds)	Line transect Point counts Sample plot Playback calls Spotlighting owls Mist nets	Appendix 10

Aquatic life	Monofilament gill nets Cast net Hook & Line Electro fishing	Appendix 11

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APPENDIX 1

Scale, Intensity and Risk

Excerpt from the Common guidance for the identification of High Conservation Values. HCV Resource Network (2013) on scale, intensity and risk:

> ***Scale, Intensity and Risk***
> *The larger the scale, intensity and risk of project activities, the more effort should be devoted to detecting, identifying and understanding the characteristics, distribution, sensitivity and vulnerability of HCVs. The assessor must adequately describe the potential impact and scale of proposed operations and ensure that assessment efforts are adequate.*
> ***Defining scale, intensity and risk***
> ***Scale:*** *A measure of the extent to which a management activity or event affects an environmental or social value or a management unit, in time or space. An activity with a small or low spatial scale affects only a small proportion of the area each year, an activity with a small or low temporal scale occurs only at long intervals.*
>
> ***Intensity:*** *A measure of the force, severity or strength of a management activity or other occurrence affecting the nature of the activity's impacts.*
>
> ***Risk:*** *The probability of an unacceptable negative impact arising from any activity in the management unit combined with its seriousness in terms of consequences.*

APPENDIX 2

Definition of Endangered, Rare and Threatened Species

Endangered Species and Threatened Species are defined in MC & I as the following:

> *Endangered species: Any species which is in danger of extinction throughout all or a significant portion of its range.*
> *Threatened species: Any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.*

Common Guidance for the Identification of High Conservation Values by HCV Resource Network (2013) elaborated on RTE as the following:

> *Rare, threatened or endangered (RTE) species refers to species that are at risk of, undergoing or have undergone severe population decline. Although the HCV definition mentions threatened and endangered species, these are often, together with vulnerable, subsumed under the overarching term threatened and endangered in an IUCN Red List context.*
>
> *Rare is scale dependent and includes species that are*
> - *Naturally rare, existing only at very low densities in undisturbed habitat, or*
> - *Rare because of human activities e.g. habitat destruction, overhunting, climate change*
> - *At the limit of their natural distribution (even if they are common elsewhere)*
>
> *Threatened and endangered species can include species classified by IUCN as Vulnerable (VU), Endangered (EN) and Critically Endangered (CR) at a global or regional level, or whose trade is regulated under international agreements (e.g. CITES), as well nationally protected species. IUCN Red Listing remains incomplete and many RTE species have not yet been assessed by the IUCN Species Survival Commission. In some countries, especially those lacking national IUCN red lists or nationally protected species lists, expert consultation is needed to learn if any such species might be present.*

IUCN Red List of Threatened Species categories concerned species as Critical Endangered, Endangered, Vulnerable, Conservation Dependent, Near Threatened and Least Concerned.

Category	**Summary of Definition**
Critically Endangered (CR)	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN)	A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.
Vulnerable (VU)	A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.
Conservation Dependent (CD)	Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which result in the taxon qualifying for one of the threatened categories above within a period of 5 years.
Near Threatened (NT)	Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
Least Concerned (LC)	Taxa which do not qualify for Conservation Dependent or Near Threatened.

APPENDIX 3

FIRST SCHEDULE
(Section 2(1))
PART I
TOTALLY PROTECTED ANIMALS

English Name	*Scientific Name*	*Local Name*
A. MAMMALS		
Slow loris	*Nycticebus coucang*	Ukang; bengkang (I)
Western tarsier	*Tarsius bancanus*	Kera hantu; ingkat (I)
Silvered langur	*Presbytis cristata*	Lotong
Hose's langur	*Presbytis hosei*	Berangad
White-fronted langur	*Presbytis frontata*	Puan
Banded langur	*Presbytis melalophos*	Penetat
Maroon langur	*Presbytis rubicunda*	Lotong merah; jelu merah (I)
Proboscis monkey	*Nasalis larvatus*	Orang belanda; rasong (I)
Bornean gibbon	*Hylobates muelleri*	Wak-wak; empeliau (I)
Orang-utan	*Pongo pygmaeus*	Mawas; maias (I)
Giant squirrel	*Ratufa affinis*	Tupai kerawak
Tufted ground	*Rheithrosciurus*	Tupai squirrel *macrotis*
Clouded leopard	*Neofelis nebulosa*	Rimau dahan; engkuli (I)
Bay cat	*Felis badia*	Kucing merah
Marbled cat	*Felis marmorata*	Kucing dahan
Flat-headed cat	*Felis planiceps*	Kucing hutan
All whales, dolphins and porpoises	All species of Cetacea	Paus; lumba lumbi
Dugong	*Dugong dugon*	Dugong; duyong (I)
Rhinoceros	*Dicerorhinus sumatrensis*	Badak
Wild cattle	*Bos javanicus*	Tembadau
Naked bat	*Cheiromeles torquatus*	
B. BIRDS		
Oriental darter	*Anhinga melanogaster*	
Pacific reef egret	*Egretta sacra*	Ujoh laut
Cattle egret	*Bubulcus ibis*	Burung apuh; burung lima ringgit
Storm's stork	*Ciconia stormi*	Bangau
Lesser adjutant stor	*Leptoptilos javanicus*	Bangau
White-bellied fish eagle	*Haliaeetus leucogaster*	Lang laut
Grey-headed fish eagle	*Ichthyophaga ichthyaetus*	Lang laut
Bornean peacock pheasant	*Polyplectron schleiermacheri*	Ruai
Argus pheasant	*Argusianus argus*	Ruai
Bulwer's pheasant	*Lophura bulweri*	Bekia
Black-naped tern	*Sterna sumatrana*	Burung laut
Bridled/brown winged tern	*Sterna anaethetus*	Burung laut; entala puteh (I)
All phalaropes	*Phalaropus* spp.	Kedidi
All imperial pigeons	*Ducula* spp.	Rawa
Silvery (grey) wood pigeon	*Columbia argentina*	Pergam
White-crowned hornbill	*Aceros comatus*	Sentuku (I)
Bushy-crested hornbill	*Anorrhinus galeritus*	Kakalau (I)
Wrinkled hornbill	*Aceros corrugatus*	Alau buloh
Wreathed hornbill	*Aceros undulatus*	Alau sangoh
Asian black hornbill	*Anthracoceros malayanus*	Alau babi; gagak/rengak (I)
Oriental pied hornbill	*Anthracoceros albirostris*	Alau pedada; bruie (I)
Rhinoceros hornbill	*Buceros rhinoceros*	Kenyalang (I)
Helmeted hornbill	*Buceros vigil*	Tajai (I)

All pittas	*Pitta* spp.	Burung pacat
Straw-headed bulbul	*Pycnonotus zeylanicus*	Barau-barau
Bornean bristle head	*Pityriasis gymnocephala*	

C. REPTILES

All marine turtles	All species of Chelonidae and Dermochelyidae	Penyu-penyu laut
Painted terrapin	*Callugur borneensis*	Beluku
Terrapin	*Orlitia borneensis*	Beluku
Niah cave gecko	*Cyrtodactylus cavernicolus*	Cicak gua Niah
Earless monitor lizard	*Lanthanotus borneensis*	Cicak purba

PART II
PROTECTED ANIMALS

A. MAMMALS

All treeshrews	All species of Tupaiidae	
All bats	All species of Chiroptera excluding those already listed in Part I	
All primates	All species of Primates excluding those already listed in Part I	
Flying lemur/colugo	*Cynocephalus variegatus*	Kubung
Pangolin	*Manis javanica*	Tenggiling
All flying squirrels	All species of Petuaristinae	Tupai terbang
Porcupines	All species of Hystricidae	Landak
Sun bear	*Helarctos malayanus*	Beruang
Bear cat	*Arctitis binturong*	Binturung
All civets and mongooses	All species of Viverridae	Musang
All otters	All species of *Lutra* and *Aonyx*	Memerang
All cats	All species of Felidae excluding those already listed in Part I	Kucing hutan

B. BIRDS

Christmas frigatebird	*Fregata andrewsi*	
All herons, egrets and bitterns, excluding those already listed in Part I	All species of Ardeidae	
All storks, excluding those already listed in Part I	All species of Ciconiidae	
Osprey	*Pandion haliaetus*	Lang; menaul
All falcons	All species of Falconidae	Rajawali; menaul
All scrubfowl, partridges and pheasants, excluding those alreadylisted in Part I	All species of Phasianidae	
All waders, excluding those already listed in Part I	All species of Charadiiformes	
Metallic pigeon	*Columbia vitiensis*	Pergam
Nicobar pigeon	*Caloenas nicobarica*	Pergam
All owls	All species of Tytonidae and Strigidae	Burung hantu
All swiftlets	All species of *Aerodramus*, *Hydrochous* and *Collocalia*	Burung layang

All kingfishers	All species of Alcedinidae	Pekaka
All woodpeckers	All species of Picidae	Belatok
Asian paradise flycatcher	*Terpsiphone paradisi*	Burung sambar ekor panjang
Grackle or hill myna	*Gracula religiosa*	Burung tiong
All parrots and parakeets	All species of Psittacidae	Bayan
White-rumped shama	*Copyschus malabaricus*	

C. REPTILES

Burmese brown tortoise	*Geochelone emys*	Baning
All soft-shelled turtles	All species of Tryonychidea	Labi-labi
False gharial	*Tomistoma schleglii*	Buaya jujulong
Estuarine crocodile	*Crocodylus porosus*	Buaya katak
All monitor lizards	All species of *Varanus*	Biawak
King cobra	*Ophiophagus hannah*	Ular tedung
Common cobra	*Naja naja*	Ular tedung
All pythons	All species of Python	Ular sawa

D. FISH

Arowana (dragon fish)	All species of Osteoglossidae	Ikan seruk; ikan siluk

E. INVERTEBRATES

All hard and soft corals	All species of Hydrozoa and Anthozoa (Actinozoa)	Batu karang
Raja Brooke's birdwing	*Troides brookiana*	

F. ADDITIONAL SPECIES

All species of animals listed in Appendices I and II of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), excluding those already listed in Part I.

PART III
(Section 31)
ANIMALS WHICH MAY BE IMPORTED OR EXPORTED
UNDER LICENCE

All animals, other than totally protected animals

APPENDIX 4

Guidelines for Cave and Karst Protection,
IUCN World Commission on Protected Areas

Prepared by the WCPA Working Group on Cave and Karst Protection

1. Effective planning for karst regions demands a full appreciation of all their economic, scientific and human values, within the local cultural and political context.
2. The integrity of any karst system depends upon an interactive relationship between land, water and air. Any interference with this relationship is likely to have undesirable impacts, and should be subjected to thorough environmental assessment.
3. Land managers should identify the total catchment area of any karst lands, and be sensitive to the potential impact of any activities within the catchment, even if not located on the karst itself.
4. Destructive actions in karst, such as quarrying or dam construction, should be located so as to minimise conflict with other resource or intrinsic values.
5. Pollution of groundwater poses special problems in karst and should always be minimised and monitored. This monitoring should be event-based rather than at merely regular intervals, as it is during storms and floods that most pollutants are transported through the karst system.
6. All other human uses of karst areas should be planned to minimise undesirable impacts, and monitored in order to provide information for future decision making.
7. While recognising the non-renewable nature of many karst features, particularly within caves, good management demands features be restored as far as is practicable.
8. The development of caves for tourism purposes demands careful planning, including consideration of sustainability. Where appropriate, restoration of damaged caves should be undertaken, rather than opening new caves for tourism.
9. Governments should ensure that a representative selection of karst sites is declared as protected areas under legislation which provides secure tenure and active management.
10. Priority in protection should be given to areas or sites having high natural, social or cultural value; possessing a wide range of values within the one site; which have suffered minimal environmental degradation; and/or of a type not already represented in the protected areas system of their country.
11. Where possible, a protected area should include the total catchment area of the karst.
12. Where such coverage is not possible, environmental controls or total catchment management agreements under planning, water management or other legislation should be used to safeguard the quantity and quality of water inputs to the karst system.
13. Public authorities should identify karst areas not included within protected areas and give consideration to safeguarding the values of these area by such means as planning controls, programs of public education, heritage agreements or covenants.
14. Management agencies should seek to develop their expertise and capacity for karst management.
15. Managers of karst areas and specific cave sites should recognise that these landscapes are complex three-dimensional integrated natural systems comprised of rock, water, soil, vegetation and atmosphere elements.
16. Management in karst and caves should aim to maintain natural flows and cycles of air and water through the landscape in balance with prevailing climatic and biotic regimes.
17. Managers should recognise that in karst, surface actions may be sooner or later translated into impacts directly underground or further downstream.
18. Pre-eminent amongst karst processes is the cascade of carbon dioxide from low levels in the external atmosphere through greatly enhanced levels in the soil atmosphere to reduced levels in cave passages. Elevated soil carbon dioxide levels depend on plant root respiration, microbial activity and a healthy soil invertebrate fauna. This cascade must be maintained for the effective operation of karst solution processes.
19. The mechanism by which this is achieved is the interchange of air and water between surface and underground environments. Hence the management of quality and quantity of both air and water is the keystone of effective management at regional, local and site specific scales. Development on the surface must take into account the infiltration pathways of water.
20. Catchment boundaries commonly extend beyond the limits of the rock units in which the karst has formed. The whole karst drainage network should be defined using planned water tracing experiments and cave mapping. It should be recognised that the boundary of these extended catchments can fluctuate dramatically according to weather conditions, and that relict cave passages can be reactivated following heavy rain.

21. More than in any other landscape, a total catchment management regime must be adopted in karst areas. Activities undertaken at specific sites may have wider ramifications in the catchment due to the ease of transfer of materials in karst.
22. Soil management must aim to minimise erosive loss and alteration of soil properties such as aeration, aggregate stability, organic matter content and a healthy soil biota.
23. A stable natural vegetation cover should be maintained as this is pivotal to the prevention of erosion and maintenance of critical soil properties.
24. Establishment and maintenance of karst protected areas can contribute to the protection of both the quality and quantity of groundwater resources for human use. Catchment protection is necessary both on the karst and on contributing non-karst areas. Activities within caves may have detrimental effects on regional groundwater quality.
25. Management should aim to maintain the natural transfer rates and quality of fluids, including gases, through the integrated network of cracks, fissures and caves in the karst. The nature of materials introduced must be carefully considered to avoid adverse impacts on air and water quality.
26. The extraction of rocks, soil, vegetation and water will clearly interrupt the processes that produce and maintain karst, and therefore such uses must be carefully planned and executed to minimise environmental impact. Even the apparently minor activity of removing limestone pavement or other karren for ornamental decoration of gardens or buildings has a drastic impact and should be subject to the same controls as any major extractive industry.
27. Imposed fire regimes on karst should, as far is practicable, mimic those occurring naturally.
28. While it is desirable that people should be able to visit and appreciate karst features such as caves, the significant and vulnerability of many such features means that great care must be taken to minimise damage, particularly when cumulative over time. Management planning should recognise this fact and management controls should seek to match the visitor population to the nature of the resource.
29. International, regional and national organisations concerned with aspects of karst protection and management should recognise the importance of international co-operation and do what they can to disseminate and share expertise.
30. The documentation of cave and karst protection/management policies should be encouraged and such policies made widely available to other management authorities.
31. Data bases should be prepared listing cave and karst areas included within protected areas, but also identifying major unprotected areas which deserve recognition. Karst values of existing and potential World Heritage sites should be similarly recorded.

APPENDIX 5

Methodology for Primate Study
Indicator Species: Primate
Methodology: Distance Sampling Using Line Transect Method

1.0 INTRODUCTION

There are many factors that determine which methods are suitable for estimating animal abundance in the wild, especially in tropical forest. These factors include size and habits of the animals, habitats where they live and the time frame of the research (Marsh & Wilson 1981). Poor visibility conditions may also limit the accuracy of counts. In order to reduce effects of poor visibility one needs to stay close to the animal for a certain period of time to record all information needed in the study. Lines transect sampling (LTS) has been used in many situations (e.g. Dahaban 1996, Johns 1983, Lambert 1992, Zakaria 1994), and the versatility of the method lies in the variety of ways in which a transect line can be traversed. The advantage of this method is that it allows a relatively large area to be covered in a short period of time (Marsh & Wilson 1981) and more habitats or elevations can be covered during the survey (Jones 1998).

In the tropics, the line transect sampling (LTS) method has been used in many wildlife studies (e.g. Blouch 2000, Dahaban 1996, Johns 1983, Meredith 1993, Gurmaya & Sundai 2004, Wilson & Wilson 1975). Since animals are highly mobile and sometimes occur in a relatively low population density, LTS is found to be more useful in estimating their populations in the wild compared to other methods (e.g. point sampling) because LTS is more appropriate when study species that are relatively easy to identify but mobile and occur at low density (Llyod *et al.* 1998). Generally, line transect sampling (LTS) has found its major application in the assessment of wildlife populations.

2.0 ESTABLISHMENT OF LINE TRANSECT

It is good to site the start of transects randomly or through a stratified random technique. However, most of the time, transects are not randomly situated due to logistic and safety reasons. Apart from that, the topographical conditions also greatly influence the position of transects. In places where the topography is rugged with steep slopes, it is almost impossible to have straight line transects (Gurmaya & Sundai 2004, Sundai 2001). Therefore, transects are usually laid out based on a contour or obvious feature in the landscape, such as a track or a river. In order to reduce bias in terms of double counting, transects should be set apart for at least 100m from one another. Transects should be marked at 20, 30 or 50m interval (depending on convenience) to form a station. This is important when transferring locations of observed animals onto a map.

The length of a line transect depends upon how long it takes to get an adequate sample size for the target species and how many habitats are to be sampled. Generally, the longest transect walked in any one day is not likely to be more than 10km because censusing is often restricted to periods of high animal activity with the quality of data collected declining as the observers begin to tire. It is advisable to do many short transects, perhaps around 2 – 3 km, in lieu of a few long transects. By having short lines one can reduce bias due to time of day (Lloyd *et* al. 1998). It is advisable to partition each transect into distance intervals along the transect length. This helps observers to follow the correct track, and also allows habitat information to be collected for specific sections of transect.

3.0 COLLECTION OF DATA USING LINE TRANSECT

On the transect line, observers walk at a fairly constant speed between 500m to 1000m per hour, looking either side of the trail and recording all animals seen. It is not recommended to walk too fast (during survey) because the observer may miss a lot of the samples during observation.

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APPENDIX 6

Methodology for Big Mammals Study
Indicator Species: Big Mammals
Methodology: Standard methods for big mammals' survey

(a) KING CENSUS METHOD (LINE TRANSECT SURVEY)

The method involves cutting of a transect line of 2 – 3 km long, across as many vegetation and habitat types as possible, preferably representative of that for the area. Every 50 m of the line would be marked by using flagging tapes. These marks would be used as observation points on both sides of the transect lines. Animal species sighted would be recorded, so as their number, activities, groups, distance from the line, left or right side of the line, estimated distance and angle between the animal and the transect line would be determined. This is to calculate the perpendicular distance of the animal sighted so that the area coverage could be calculated. Once the coverage has been calculated the density of the animal could then be determined for the area, so as the index of species abundance. The data would also enable the calculation of Species Diversity Index and the Index of Species Richness as well.

Management prescription would be done once the data have been collected.

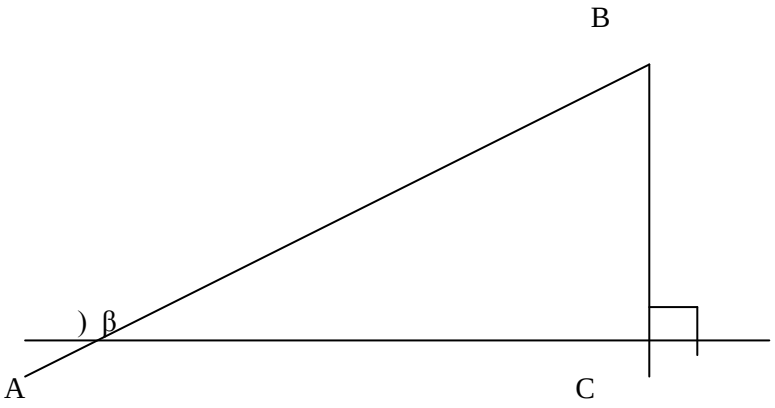
In the event that manpower is not a constraint 2 or 3 transect lines could be put up at three to four km apart from each other. Each transect line should be walked by two or one person, equipped with 10X50 binoculars, a field notebook and a compass. Daylight surveys were done between 0600 hours – 1100 hours at a walking pace between observatory stations of approximately 1 km/hr, stopping for 3-4 minutes at each station to record all sightings and calls of mammals and birds at 360º around each station. Tracks, footprints, feces and scratches on trees, stumps and ground should be noted to assist in species identification where possible. Night surveys are to be done between 1900-2200 hours, once along each transect.

Mammal identifications should follow Medway (1966) and Payne, *et, al.* (1984), while species nomenclature of mammals is to follow the latter. Birds identification should be based on Smythies (1981) and MacKinnon & Phillipps (1993) and Robson (2000) while species nomenclature following the former.

The Divers program, modified by Mr. Charlie Laman (2001) from Krebs (1989) could be used to determine the Species Diversity of mammals and avifauna (birds) detected during the survey. This method enabled the calculation of Shannon-Weiner Diversity Index, Simpson Diversity Index and also Brillouin Diversity Index as well. It also would work out figures for Species Richness and Species Evenness for the mammals and birds detected.

Shannon-Weiner Diversity Index (H')

$H' = \sum P_i \log_{10} P_i$, where $P_i = n_i/N$, n_i = no. of ind. of species $_i$, N = total no. of ind. detected.



Note: A : Observer
B : Animal(s)
AB : Angular Distance
AC : Transect Line
BC : Perpendicular Distance

(b) CAMERA TRAPPING METHOD (for survey of big mammal species)

Commercially made Cam Trakker brand camera trap units (manufactured by Camtrak South, 1050 Industrial Drive, Watkinville, GA 30677. USA) or any other brand of camera traps could be used in the survey. In the event that the Cam Trakker brand is used each unit consists of a plastic casing camera with built in flash, sensors with selectors and a viewing window. Cam Trakker consists of a fully automatic 35 mm camera with a passive infrared heat-in-motion detector. The heat-in-motion sensor operates on a horizontal plane, thus it is important that it is aimed parallel to the ground. When something that moves and gives off heat, a silent electronic switch engages the camera, which takes a photograph. For obtaining clear photographs of animals in the dense tropical rainforest, 400 ASA color print would be used. These units are equipped with a delay selector mechanism that precludes the camera from taking a photograph for a set period of time. The time delay between photographs is set to a minimum of three minutes, which eliminates wastage of film on a single situation. All cameras would be set to be operational for 24 hours a day with no break in monitoring except in instances of malfunction. Time and date would also be recorded for each exposure except during camera malfunction or excessive moisture on the film due to high humidity and condensation.

Five to ten sets of camera traps are recommended to be used and to be set about 500 m apart from each other. This is to reduce possible repetition of capture of similar animals by the different cameras.

The cameras would be checked every 30 days to reload new film rolls (if the camera is of digital type that the pictures should be downloaded into a computer and the batteries are to be replaced with new ones). However, in instances, where the films have been fully consumed before checking, there could be gaps in the record. The same camera locations would be maintained throughout the duration of the study.

Cameras would only be removed or relocated to accommodate changes in local conditions such as tree fall, dense undergrowth, or inundation by rainwater. Due to these factors the trapping effort in each camera trap site would not be similar. However, only the active Camera-Days are included in order to calculate the total number of camera days, which would be accumulated to 1504 camera days.

Total Camera Days (TCD) = Σ cd $_i$ (1)

The Relative Abundance Index (RAI) for each species is also calculated as

$$RAI_{CT} = \Sigma_{I=1}\, d_i\, X100/\Sigma_{i=1}\, cd_I \quad (2)$$

Where *i* is a trap location and *d* is a detection of the species at i^{th} location (Kawanishi *et, al.* 1999). The Relative Abundance Index would only be calculated for mammal species, which would be recorded through the camera traps.

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APPENDIX 7

Methodology for Bats Study
Indicator Species: Bats
Methodology:
A description of bat survey methods can be found in Helman & Churchill (1986). Surveys for bats should be carried out by an experienced bat investigator as (apart from the fruit bats) little is known of their biology or taxonomy and species can be difficult to identify.

Methods not involving animal capture
Ultrasound detectors (for example, the AnaBat ™) can be used to detect bats without any impact and should be used whenever possible.

Methods involving animal capture

General
The following general points need to be considered when trapping bats:

- Whenever possible avoid trapping during the breeding season.
- Bats should be released at the point of capture as soon as possible. However, they should not be released in daylight. Those which cannot be released before dawn should be held until the following dusk.
- When necessary, bats should be held separately in suspended cloth bags in a dark, quiet and warm place.
- Bats may go into torpor in the trap or while held in bags and will need to be re-warmed before release.
- Care should be taken when handling both flying foxes and microbats, due to the zoonotic disease.

Harp traps

Feature: Combination of pocket to catch bats and slender string to lead bat to the pocket. The strings are set up vertically.
Trapping: Set up the trap at entrance of bat colony (cave, tree holes, etc).
Note: Size and trap design are flexible according to study site condition and target bat species.

- Set traps in a sheltered spot in potential flyways.
- Clear within two hours of dusk and again after dawn but before the sun begins to warm the hessian.
- Harp traps must not be used where large numbers of bats could be caught (for example at entrances to roost sites) to avoid the overheating of bats in the collection bag.

Mist nets

Features: Nets made by slender yarn. Same type of net for bird banding study. There are following mesh size. Length of the normal size net is 6m or 12m and height is 2.5m with 5 sections (pocket).

Trapping: Set up the mist nets cross bat fly way or entrance of colony using poles both sides. Experiences are needed for treatment of net.

Mesh sizes	**Target animals**
24mm	Special small birds
30mm	Small birds and small bats
36mm	Small birds (sparrow size) and bats
61mm	Medium size birds (thrush, etc)
121mm	Large size birds (ducks)

Mist nets must only be used by trained and competent personnel.

- Only use mist nets after dark to avoid catching birds.
- The net must be attended at all times and captured bats removed immediately.
- Mist nets should not be used in areas where large numbers of bats could be caught (e.g. at entrances to roost sites).
- Nets should be closed when not attended and during the day.

APPENDIX 8

Methodology for Small Mammals Study
Indicator Species: Small mammals
Methodology: Trapping (Using live traps)
Trapping - general
In general, the following points apply to the use of traps:

- Use the trapping method with the least impact.
- Whenever possible, avoid trapping at times of the year when animals may be susceptible to greater stress, such as during breeding seasons or droughts. If animals are breeding, minimize their time in traps by checking more frequently and releasing pregnant or lactating females as a matter of priority.
- Select the type of trap which is appropriate to the species being targeted.
- Ensure all traps are in good working order and checked immediately prior to use.
- Use bait appropriate to diet of the target species. The bait should not only lure the animal into the trap, but should also replace the food and moisture it would have consumed had it not been trapped. This is particularly important for small mammals which have high metabolic rates.
- Locate each trap to reduce exposure of trapped animals to the sun, wind, rain, etc (for example, place traps under shrubs or beside logs).
- Avoid placing traps in areas of high ant activity.
- Do not trap during periods of inclement weather.
- Ensure all traps are located and checked each time a trap line is checked and that all traps are removed from the field or closed at the end of the trapping period. If individual traps are numbered and set in order, it makes it easier to ensure that all traps are checked.
- For nocturnal species, begin clearing traps at first light and where practical leave the traps closed until late afternoon. During periods of extremely cold weather, cease trapping completely or clear and close traps by 0200 hours each day.
- For diurnal species, have an inspection schedule which minimizes the impact on any trapped animals and locate the traps so as to minimize the possibilities of heat or cold stress.
- Release animals as soon as possible and where they were caught.
- Cease trapping immediately if there has been an unusually high mortality of animals.

METHODOLOGY

The most comprehensive method to survey small mammals is by using captured, marked and released method. Live traps measuring 20 cm X 20 cm X 56 cm long are use in this study. A transect line will be constructed with a total length of 1000 m or 1 km. Each station [20 meter distance from each station] within the transect line will be marked by a red ribbon and 1000 m is equivalent to 50 station. At each station, two live traps will be placed alternatively on the ground and also above the ground (on trees, stumps, and hanging branches) of about four to six feet high, where possible. By setting up the cages in such a way it is hoped that the samples will include terrestrial, arboreal and semi-arboreal species of small mammals.

Traps will be checked twice a day [depend on number of individual captured] between 0700-1000 hours in the morning and 1500-1700 hours in the afternoon and bait will be replaced when necessary. To ensure the capture or the widest possible range of small mammals, a variety and a combination of baits such as ripe banana, oil palm, dried coconut kernel, jack fruit and fish where available are going to be used during each sampling period (Zubaid & Khairul 1997). The duration of the trapping period is 6 days or 25% of the recaptured animals caught.

Parameter

Each individual captured will be anaesthetized with chloroform or diethyl ether [if available] and the following parameter will be recorded; Location, Trap No, Height of capture, Weight, Head and Body Length, Tail length [from anus to end of tail], Hind foot length, Ear length, Sex, Reproductive condition, Species ID, Species (if you identify directly on the ground).

Marking

Every animal caught will be marked by cutting the finger toe using nail cutter (Begon 1972, Paschal, D. 2002). By cutting the finger toe caused slight injury to the animals and may change the behaviour of the animal. According to Begon (1972), theoretically may be it is true but practically no evident to support the statement.

Marking process will begin from the right front leg and follow by left front leg. Most of Roden species only have 4 fingers, so number 9, 19, 29 ….., will be omitted. For the back finger numbering stated from number 10,20,30,40….100.

Data analysis

Species diversity will be analyzed using Shannon-Wiener Index of Diversity [H']. Density [Individual/ha] and Biomas [gm/ha], whereas effective trapping area will be calculated according to Stuebing & Gasis (1989).

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APPENDIX 9

Methodology for Amphibians Study
Indicator Species: Amphibians
Methodology: Standard methods for Amphibian survey

1.0 Stream Transect survey

The transect technique is a common sampling method for amphibians in terrestrial or aquatic habitats (Jaeger 1994). When used to survey stream amphibians, transects are typically linear areas set up either parallel or perpendicular to the stream, including stream channel, bank or both. Various sizes and configurations of transects have been used, and sometimes multiple survey methods are employed along the same transects. Transects can provide species presence/absence data, counts of species and life stages, relative abundance, and density (number of individuals/area surveyed). Capture-recapture or removal estimation techniques can also be used in conjunction with transect surveys. A visual encounter survey technique is typically employed within the transect, in which the observer looks for amphibians on the surface and usually also under rocks, logs, and other debris. All cover objects are returned to their original positions to avoid disturbing the habitat.

2.0 Quadrat Sampling

The quadrat technique is a common sampling method for amphibians in terrestrial or aquatic habitats (Jaeger & Inger 1994). When used to survey stream amphibians, quadrats are small square areas of variable size set up in the stream channel, on the stream bank, or both. As a sampling method, quadrats can be used on their own, but they are often used in combination with other survey methods. In some cases, quadrats are conducted every so many meters along stream transects (e.g. every 5 m along 100 m transects) (Mitchell 1998a,b, 1999, Jung *et, al.* 2000). A visual encounter survey technique is typically employed, in which the observer looks for amphibians on the surface and under rocks, logs, and other debris within the quadrat. Quadrat methods in streams often involve removing all cover objects (rocks, logs, debris) within the quadrat and raking through the quadrat, completely surveying the upper substrate layer and counting all salamanders (Mitchell 1999, Jung *et, al.* 2000). To minimize the overall disturbance to the habitat, all cover objects should be returned to their original positions once sampling is completed. In some cases, artificial quadrats have been created with a set number of cover objects within quadrats to determine relationships between cover object density and salamander density (Davic 1983, Davic & Orr 1987).

3.0 Pitfall Traps with Drift Fences

As a supplementary method pitfall traps with drift fences can be installed. This device is especially useful to determine species richness of epigeic organisms and to detect the presence of rare species (Corn 1994). Capture success may vary greatly between species (Corn & Bury 1990; Dodd 1991). Anurans that are strong jumpers are more difficult to trap than terrestrial species that lack these abilities. An array of fences and traps consists of a central trap (15-liter plastic bucket), that is buried with its opening flush with the surface and two triangular fence segments (8 m length each = 4 m each side of the triangle; 30 cm in height) that run towards it. Setup and design should of course be adjusted to the particular study site and may vary according to the particular question of interest. For construction of drift fences, durable green plastic gauze can be used. Each segment is tightened around a 10-liter plastic bucket with an opening angle of 45°. To prevent animals from passing through, fences should be entrenched in the soil. The ends of each segment are flanked with additional 10-liter plastic buckets, one on either side (Fig.1).

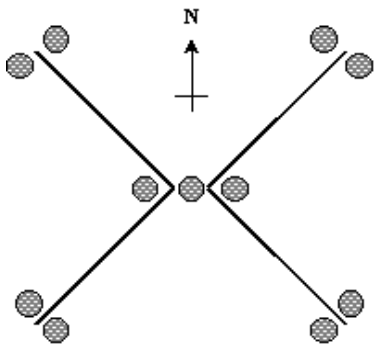

Figure 1: Design for arrays of drift fences. Traps are shaded in gray.

Traps are placed so that no gaps occur between the fence and the rim of the trap. Small openings should be cut in the bottom of each trap to allow water to drain and prevent traps from being driven above the surface by groundwater. Duct tape can be used to reduce the diameter of the buckets and construct funnel like openings in order to impede escaping from traps. Traps should at least be checked on a daily basis, e.g. once every morning and during transect walks.

4.0 Funnel Traps

Funnel traps can be constructed using fine wire mosquito mesh or plastic gauze. For the center part, i.e. the body of the trap a piece 25 cm in width and 60 cm in length has to be bent thereby forming a tube. The edges are than stapled together along the length. Opening rims have to be bent inwards, either on one or on both sides of the opening, forming flexible funnels of approximately 30 mm diameter (Fig. 2). In the latter case one has to consider that at least one opening should allow access to captured individuals. Otherwise, captive specimens can also simply be removed by opening a stapled seam and re-stapling it afterwards. The flexible mosquito mesh allows the funnel entrance to be fitted flush with the ground and if drift fences are used, with the drift fence's wall. When used in combination with drift fences the traps should be placed parallel to the fence. All traps should be covered with leaf litter, branches or bark, etc., not only for camouflage purposes but also to provide shade and thus preventing captured frogs from desiccating. Traps should at least be checked on a daily basis, e.g. once every morning and during transect walks.

Figure 2: Design for funnel traps.

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APPENDIX 10

Methodology for Birds Study
Indicator Species: Birds

METHODS NOT INVOLVING ANIMAL CAPTURE (Direct and Indirect Observations)

Line transect
Line transect is one of the most commonly used survey techniques for determining bird species composition and density. It is done by setting up transect line along a distance of few kilometres. Each sample point along transect line should be marked with flagging tape and assigned with a unique identification number to be recorded onto the birds field data sheet. The distances of each sample point need to be written onto the flagging tape. Bird sightings within the range of 50m to the left and to the right of the sample point (extending 50m on each side of the line) are recorded as data (Whitworth, Newman & Mundkur 2007).

Point counts
A point count is a tally of all birds detected visually or aurally by a single observer from a fixed station during a specified period (e.g. 5 minutes). Counts are made in the morning typically during the breeding season under acceptable weather conditions. In the tally, birds are identified by species and where desired, their sex and age are recorded. Their distance from the observer is listed as four categories; from 0 to 25m (0 to 82 ft), 25 to 50 m (82 to 164 ft), beyond 50m in the habitat, or as flyovers of the habitat, regardless of distance (Hamel *et, al.* 1996). The observer counts the number of individual birds within a circle of a certain radius (e.g. circle with radius of 25m) (Hostetler & Main 2011). Birds observed within the range of the radius are recorded in a data sheet.

Sample plot
Sample plots can provide data indicating species diversity and the abundance of each species within the study area. It should not be limited to counts of actual birds and cannot be used for that purpose where birds move between sample plots during counts. It is most useful when the target species are relatively immobile over the period of survey (e.g. wading birds attending discrete roost sites). The selection of sample plots should be carefully considered when designing a study because plot location can have a strong influence on population estimates. This technique can be used for nest searches, mounds, display areas, characteristic scrapes and scratching. Complete counts of all the animals in sample plots of known size are conducted and the plot density is calculated (Whitworth, Newman & Mundkur 2007).

Playback calls
Playback calls (playing a recording of bird's song) is one of the most powerful tools to see birds in the wild. Upon arrival at each sample station, the observer needs to start timing the sample time of playback calls immediately. The broadcasting of playback call should be done for approximately 1 minute, and then followed by listening for a response for at least 4 minutes. Broadcast of playback calls need to be repeated again up to 3 times at every sample station. The megaphone should be held up at chest height or higher. The call should be aimed in various locations for each broadcast (Hausleitner 2006). Fifteen minutes of survey time is required for each sample station with at least 700m between stations (Palmer 1987). Transect length depends on the objectives of the survey and the home range of bird species. However, prolonged exposure need to be avoided by limiting calling sessions to two 15 minutes periods per session. The use of playback calls during the species' breeding season should be done with care so as not to disrupt the breeding of the resident pair.

Spotlighting owls
This technique is conducted together with playback call. At the completion of playback call, 10 minutes of spotlighting session is carried out to search for owls which may have flown in quietly in the dark. During this session, the observer needs to walk for about 100m along a transect line with a hand-held spotlight (Newton *et,al.* 2002). While spotlighting, avoid aiming the light beams directly at the owls' eyes, as it may temporarily blind them and endanger their flight (Hausleiter 2006). Examples of techniques to census owls can be found in Kavanagh & Peake (1993).

METHODS INVOLVING ANIMAL CAPTURE

Mist nets

Mist-netting is the most versatile and widely used method for catching small to medium-sized wild birds (Whitworth, Newman & Mundkur 2007). It can provide data on the population density and demography (productivity and survival). However, mist nets should only be used where other methods are considered as unsuitable because of the high risk of injury and death to birds. It must only be used by trained and competent personnel. In Sarawak, one needs to apply for license in order to use mist nets (Wildlife Protection Ordinance 1998). Mist nets should be checked at least every one hour and captured birds removed immediately. Breeding and young birds should be released on site. Nets must be closed when not attended especially during bad weather.

GENERAL PRECAUTIONARY MEASURES

- Avoid close range inspection during breeding and feeding.
- Minimize conversation and movement during listening periods.

APPENDIX 11

Methodology for Aquatic Life Study
Indicator Species: Aquatic life

MATERIALS AND METHODS FOR FISH FAUNA SURVEY

Sampling Stations
At least three (3) sampling stations must be established along each river or stream (downstream, middle and upstream) in the Forest Management Area for the freshwater fish fauna inventory/monitoring/survey/study.

Sampling Frequency
Sampling should be conducted at least once a year during dry season in each station along each rivers or stream in the Forest Management Area.

River Characteristic
At each sampling station, the width and depth of the river, surrounding vegetation and percentage exposure of the river to sunlight, bottom substrates, current speed, and water transparency need to be recorded. Current velocity at each station should be measured using Current Meter at an interval of every 0.5 m or 1.0 m depending on the width of the river from left to right side of bank when facing upstream. At each interval, readings must be taken in triplicates at 2/3 depth of water. The transparency of the water must be measured at each station and reading must be taken in triplicates at surface water level using Secchi disc.

Water Quality
Water quality parameters such as temperature, dissolved oxygen, pH, turbidity and conductivity must be measured *in-situ*. At each of station, readings must be taken in triplicates at subsurface water level (0.5 m).

Fishing Method
Monofilament gill nets
Various mesh sizes of monofilament gill nets (0.5'', 1.0", 2.0", 3.0" & 5.0") or trammel net should be placed in deep water pool for a period of 12 hours (1800 hours to 0600 hours).

In the area which influence by tidal, various mesh sizes of monofilament gill nets or trammel net should be placed in deep water pool between 1-3 hours during the lowest tidal stage.

Cast net
Cast nets (1/4" & 3/4" mesh size) should be thrown randomly for 1-2 hours (at least 30-60 throws) at each station.

Hook and line
'Active' hook and line with bait will be used during day time sampling along the small river or stream (2-3 hours sampling time) and/or 'passive' hook and line with bait will be used for night time samplings (3-4 hours sampling time).

Electro fishing
Electro fishing at each station will be carried out for a distance of approximately 50 m (2 hours) at the shallow and fast flowing stretch of river or stream (less than 1 m depth). Fishes that temporary stunt will be collected using small mesh size of seine net, scope net, dip nets or caught by hands.

Fish identification
Fish species can be identified either in-situ or in the laboratory. Specimen from each station that could not be identified in the field should be kept in separate plastic containers containing 10% formalin and then later must be transferred to 75% ethanol for identification in the laboratory.

Inger & Chin (2002), Kottelat *et,al.* (1993), Roberts (1989), and Mohsin & Ambak (1983) can be followed for fish identification.

Fish measurement
Total length and standard length of fish should be measured to the nearest 0.1 cm and the weight must be measured to the nearest 0.01 g on an electronic balance.

Diversity Indices
Diversity indices provide important information regarding the commonness and of rarity of fish structure in a community. One of the several indices used to measure biodiversity is the Shannon-Weiner Index (H'). This index is used to measure the effects of changes in habitat in an ecological system. It takes into account the number of species and the evenness of the species.

Richness is a measure of the number of species present in a particular area, Margalef Richness Index measures the number of different species present in the community. Pielou Similarity Index compares the similarity of the population size of each of the species present.

The values for Shannon-Weiner Diversity Index (H'), Margalef Richness Index (D), and Pielou Similarity Index (J) can be calculated for each station based on the formula below:

Shannon-Weiner Index (H') (Shannn Weaver 1963)

$$H' = \frac{(n \log n - \Sigma f_i \log f_i)}{n}$$

where :

i = 1,2,3.....,S
S = total number of species
n = sample size or total no. of individual sampled
f_i = number of individual for species i

Margalef Richess Index (D) (Margalef 1968)

$$D = \frac{(S-1)}{\log_{10} n}$$

where :

S= total number of species
n = total number of individual

Pielou Similarity Index (J) (Pielou 1966)

$$J = \frac{H'}{\log_{10} S}$$

where:

H' = species diversity
S = total number of species

CATCHES PER UNIT EFFORT (CPUE)

Availability of aquatic resources (stock) at each sampling station or river system can be determined or compared by Catches per Unit Effort (CPUE).

CPUE is the catch of fish or aquatic fauna in numbers or weight taken by a defined period effort. In fisheries most commonly refers to trap-net nights of effort, gill-net nights of effort, or catch over period of time of fishing gear employed.

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IP 12: LOCAL COMMUNITIES' ATTITUDES TOWARD CROCODILES AND HUMAN-CROCODILE CONFLICTS IN SARAWAK

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ABSTRACT

One of the biggest challenges faced by wildlife conservation managers is to garner and maintain stakeholders' support toward conservation policies and in Sarawak, the recent increase in the number of crocodile attacks on people has been associated with the recovery of the estuarine crocodile (*Crocodylus prorosus*) populations. Crocodile related problems including attacks on human, domesticated animals and livestock are now considered as one of the most pressing conservation issues that require both short and long-term effective conflict resolution measures. From 1997 to May 2014, eighty-nine people were attacked by crocodiles in Sarawak. Out of this figure, thirty-eight resulted in fatalities. In Seblak, an area which is considered as a 'hotspot area' eight people has been killed by crocodiles since 1989. Attack on human especially when it occurs at an alarming regularity and involves major physical injury, and loss of people's life, is likely to trigger public outcries and antagonistic attitudes towards crocodiles.

1.0 INTRODUCTION

One of the biggest challenges faced by wildlife conservation managers is to garner and maintain stakeholders' support toward conservation policies and measures (Barlow *et al*. 2010), Brukskotter & shelby 2010). In Sarawak, the recent increase in the number of crocodile attacks on people has been associated with the recovery of the estuarine crocodile (*Crocodylus prorosus*) populations. Crocodile related problems including attacks on human, domesticated animals and livestock are now considered as one of the most pressing conservation issues that require both short and long-term effective conflict resolution measures. The recovery of the Sarawak estuarine crocodile from near its extinction in the mid 1980s (Cox & Gombek 1985), and its subsequent listing under Appendix I, CITES and protection under State of Sarawak Wild Life Protection Ordinance 1998 have been cited as an endangered species success story.

"Sabah and Sarawak should be proud today as crocodiles in the wild have recovered in the two states. However, this has created a new set of problems i.e. the increase in human-crocodile conflict. The challenge now is how we are going to sustain what we have succeeded to protect as now we have a new problem to address[28]". (Dr. Graham Webb 2010).

From 1997 to May 2014, eighty-nine people were attacked by crocodiles in Sarawak. Out of this figure, thirty-eight resulted in fatalities. In Seblak, an area which is considered as a 'hotspot area' eight people have been killed by crocodiles since 1989. Attack on human especially when it occurs with an alarming regularity and involves major physical injury, and loss of people's life, is likely to trigger public outcries and antagonistic attitudes towards crocodiles. Unfortunately, there has been no in-depth study conducted to examine the stakeholders' attitudes especially those who are exposed to the danger associated with crocodiles at any point prior and during the course of the population recovery. Such study is essential as it can provide valuable insights on the level of public support and/or opposition toward the ongoing and proposed management measures to sustain the crocodile populations.

Growing public concerns especially among the peoples who live alongside this widely perceived life-threatening species has prompted the State Government of Sarawak to formulate both short and long-term measures aiming at reducing human-crocodile conflicts and easing human-crocodile coexistence. Among the on-going and proposed crocodile population management and conservation measures in Sarawak include the establishment of 'crocodile free zones' in densely populated areas, creation of crocodile sanctuaries, down listing of Sarawak's estuarine crocodiles from CITES Appendix I[29] to Appendix II[30], conducting a holistic state-wide crocodile

[28]Statement made by Dr. Graham Webb, Chairman of Crocodile Specialist Group in his keynote address at the Human- Crocodile Conflict Workshop in Kota Kinabalu, 23-35 June 2010.

[29]Appendix I contains species that are not necessarily now threatened with extinction but may so unless trade is closely controlled

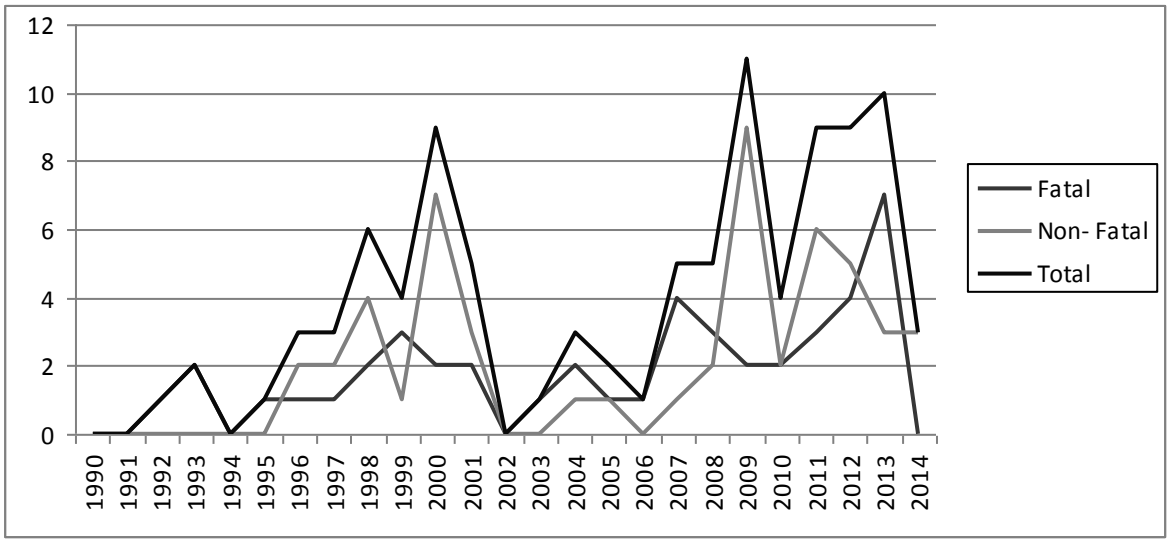
survey covering all the major rivers to determine the present status of crocodile populations and extent of human-crocodile conflicts, intensifying public awareness and education programmes on crocodiles, and formulation of crocodile strategic management plan.

Understanding people's attitude towards crocodiles is essential because it can help to identify factors that influence behaviour toward these species. Persons who possess positive attitudes regarding a species are likely to be more tolerable toward its population, support conservation measures, and less likely to have harmful behaviour toward the species.

This paper discusses the factors which can influence the local communities' perceptions of and attitudes toward the recovery of crocodile populations in Sarawak based on the preliminary findings of the socio-economic component of the recently completed holistic crocodile study for Sarawak[31]. It seeks to present a brief account on the local peoples' beliefs, perceptions and toward crocodiles and crocodile conservation in Sarawak, in the context of local peoples' cultural and historic relationships with crocodiles, local knowledge about crocodiles and recent trends of crocodile population and human-crocodile conflicts.

Discussion of the topic can provide valuable insides on the framework for developing baseline information that can be used to develop and evaluate the success of education and public awareness programmes on the species.

Figure 1: Incidence of crocodile attacks on human in Sarawak (1990-June 2014).



[30]Appendix II lists species (flora & fauna that are the most endangered. They are threatened with extinction and CITES prohibits international trade in specimens of these species.

[31]The other components of the study are; crocodile population surveys, aquatic food resources & water quality, vegetation, terrestrial food resources.

2.0 CULTURAL AND HISTORIC RELATIONSHIPS BETWEEN CROCODILES AND HUMAN

Almost eight decades ago a renowned American museum collector, Henry C. Raven wrote:

"The natives of Borneo fear crocodiles more than they fear other animals".

(Raven 1946)

Like most traditional societies in Southeast Asia and in rural communities of the developing countries, the indigenous peoples of Sarawak had developed specific rules or taboos that revered crocodiles and regulated human relationships with the potentially deadly species (Hose & MacDougall 1901). For example, many people in Sarawak especially the natives do not kill or eat crocodile meat. Doing so is considered an unwise provocation that would anger the crocodiles and drive them to take revenge on the person who has committed the act. Majority of the respondents interviewed during this study claimed that crocodiles do not arbitrarily attack people, and would only do so selectively as a form of punishment against individuals and their family members, who had breached the social order and taboos. In this respect, crocodile attacks on human were considered the victim's own fault. Therefore, it is baseless to be afraid of crocodiles as long as the people do not transgress the taboos or conduct an act which can be construed as harming, disturbing or provoking the crocodiles. Taboos and traditional laws are important factors that have contributed positively toward realizing wildlife conservation goals and objectives (Gadil *et al*. 1993, Horowitz 1998, Berkes *et al*. 2000, Colding & Folke 2001, Berkes 2003, Becker & Ghimire 2003, Moller *et al.* 2004, Peterson *et al.* 2007, van der Ploeg *et al*. 2011).

Many of the older generations of the Iban community still believe that crocodiles hold a prominent position and can wield immense power in their spiritual world. Some of them still hold to the old beliefs that there is a 'special pact' made between their ancestors and the crocodiles, and it is a strict taboo for either party to breach the 'agreement'. Crocodiles play various roles in the Iban traditional way of life including helping in crop production and protection against their potential enemies. In the older days, it was quite common to see, Iban farmers displayed crocodile effigies in their paddy fields to keep pests and diseases away from their crops. Only by strictly observing these 'regulations' and taboos can human continue to share common landscapes and resources.

Because crocodiles are both revered and most feared, the Iban must show respect to the crocodiles. An authority Iban culture, Dato Seri Edmund Langgu anak Saga related an incidence whereby the villagers had suffered a 'curse' and more retaliatory attacks by the crocodiles after they hunted down and killed a crocodile following a fatal attack upon one of the longhouse residents:

"Many years ago people of a longhouse in Miri captured and killed a huge crocodile after it attacked one of the villagers. They hung the skull of the croc and made fun of it. After that there were many attacks on the people of that longhouse which only stopped after the village head performed 'miring' to appease the crocodiles[32]".

Most natives of Sarawak still believe in totemism[33], a system of old belief in which each human is thought to have a spiritual connection or a kinship with another physical being e.g. animal (totem). People generally view the totem as a companion, relative, protector, progenitor, or helper, ascribe to its superhuman powers and abilities, and offer it some combination of respect, veneration, awe, and fear. Most cultures use special names (e.g. the Iban refers to crocodiles as aki to refer to crocodiles) to the totem. There is usually a taboo against killing, eating, or even touching the totem.

[32]Quoted in The Borneo Post dated 21 September 2011.

[33]There two categories of totemism; social or collective totemism most widely disseminated form of this belief system (mystic association with animals with unilineally related groups (lineages, clans tribes) or with families, and hereditary tramsmission of the totems.

Prior to crocodile attack that killed the wife of a headman of Sungai Anak longhouse in June 2011, many Ibans who lived close to Seblak River somehow had underestimated the potential risk associated with crocodiles[34]. Several months prior to the incident one large crocodile was often sighted wading in Sungai Anak, a small tributary of Seblak River fronting the long-house. It was reported that the crocodile had attacked the livestock near the river bank. Believing that there was a 'mutual agreement' not to harm one another, the villagers chose to ignore the crocodile until the unfortunate evening of June 2011 when the 42-year wife of the headman was attacked and killed by what was believed to be the same crocodile while taking her bath at the boat landing place near the longhouse. The incident was witnessed by several people including the victim's husband who together with the other villagers struggled with the killer crocodile for about ten minutes trying to pull out the victim from the reptiles' jaw.

The belief that crocodiles do not simply attack human was shared by the respondents and key informants from Kg. Bako. In addition, some of them believed that crocodiles in Bako River do not harm the 'natives' residents of Kg. Bako. Coincidently the only two persons known to have been killed by crocodiles in Bako River were not the permanent residents[35] of the village.

It has been acknowledged that believed that strict taboos that forbid killing of crocodiles have helped to conserve and recovery of crocodile populations in Sarawak. But some taboos and old beliefs about are contradictory to both Christianity and Islamic teachings, with certain rituals or ceremony to appease crocodiles like *'miring'* are considered as being satanic, it envisaged that belief in taboo will slowly be eroded. If this happens, it will limit the efficiency of the application of these traditional beliefs to crocodile protection measures.

3.0 HUMAN-CROCODILE INTERACTIONS (ENCOUNTERS)

There was no significant difference in terms of intensity of river usage between respondents from rural (Sibuti Niah & Suai) and semi-urban areas (Santubong, Buntal, Semariang, Pasir Pandak & Salak). As expected there was a strong correlation between river utilization and incidence of personal encounters with crocodiles for all study areas (Figure 2). Fishing was not the only activity that makes people dependent on the rivers. Fishing either as a source of household incomes or subsistence activity is not the only reason why peoples in the study areas still dependent on rivers. Rivers remain the source of domestic water supply and means of transportation for residents from several longhouses in Seblak, Sibuti, Niah and Suai areas.

[34]Prior to this fatal attack only two Ibans were known to have been attacked by crocodiles in Seblak River. Both incidences occurred in the earlier parts of the twentieth century. The rest of the victims were Malays.
[35]The 10-year old boy killed by crocodile in 2006 was from a family who rented a house in Kg. Bako. The other victim was an Indonesian sawmill worker.

Figure 2: Correlation between river utilization and personal encounters.

Correlation between river utilization and personal encounters with crocodiles = 0.753. The chances of croc encounter correlates strongly with high frequency of river usage

Correlations

				River_utilization_frequency	Encounters
River_utilization_frequency	Pearson Correlation			1	.753**
	Sig. (2-tailed)				.000
	N			100	100
	Bootstrap[b]	Bias		0	-.001
		Std. Error		0	.061
		95% Confidence Interval	Lower	1	.619
			Upper	1	.862
Encounters	Pearson Correlation			.753**	1
	Sig. (2-tailed)			.000	
	N			100	100
	Bootstrap[b]	Bias		-.001	0
		Std. Error		.061	0
		95% Confidence Interval	Lower	.619	1
			Upper	.862	1

**. Correlation is significant at the 0.01 level (2-tailed).

b. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

4.0 LOCAL KNOWLEDGE ON RECENT CROCODILE POPULATION TRENDS

An overwhelming majority of the focus group participants/respondents in all study areas claimed that they had personal encounters with crocodiles:

> *"There was no crocodile before in our rivers but since about fifteen to twenty years ago they (crocodiles) are everywhere... in the nearby rivers and in the small tributaries".*
>
> (Common revelations made by the participants)

Figure 3: Dependency on rivers and personal encounters with crocodiles in Santubong samples.

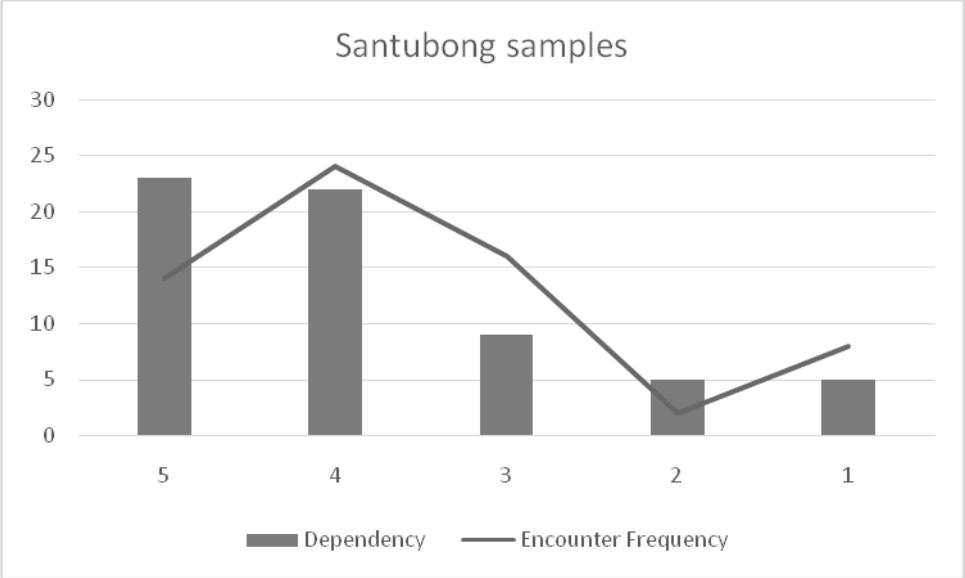


Figure 4: Dependency on rivers and personal encounters with crocodiles in Bekenu samples.

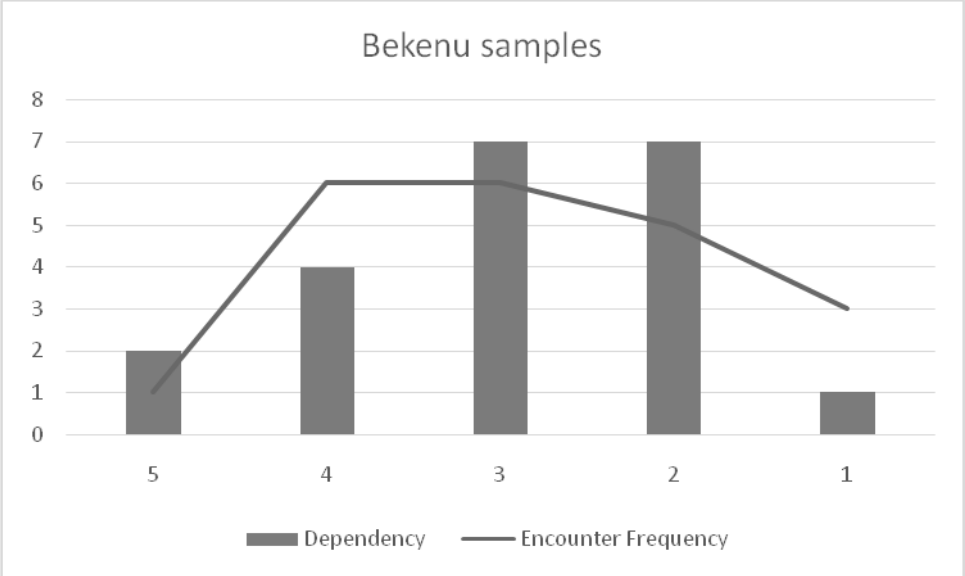


Figure 5: Dependency on rivers and personal encounters with crocodiles in Niah samples.

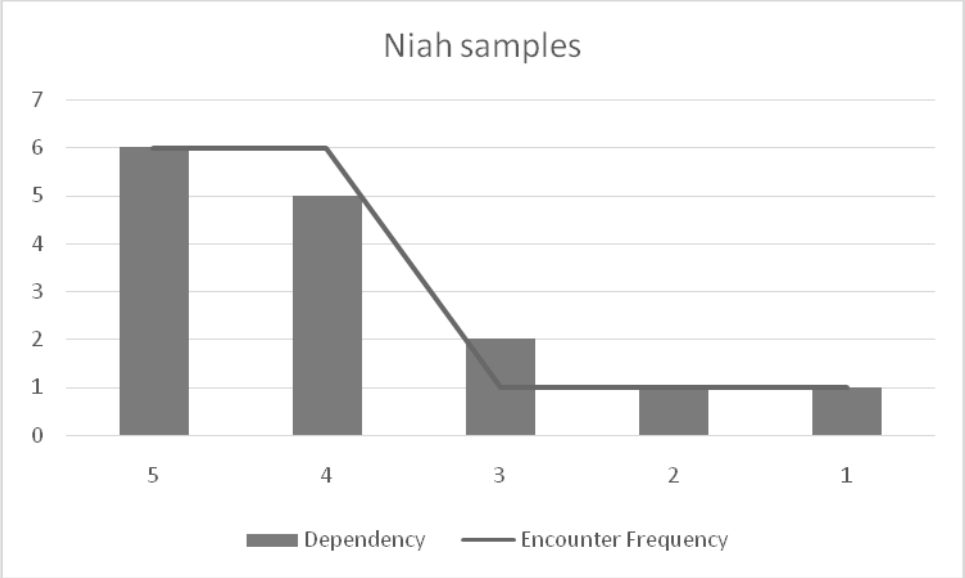
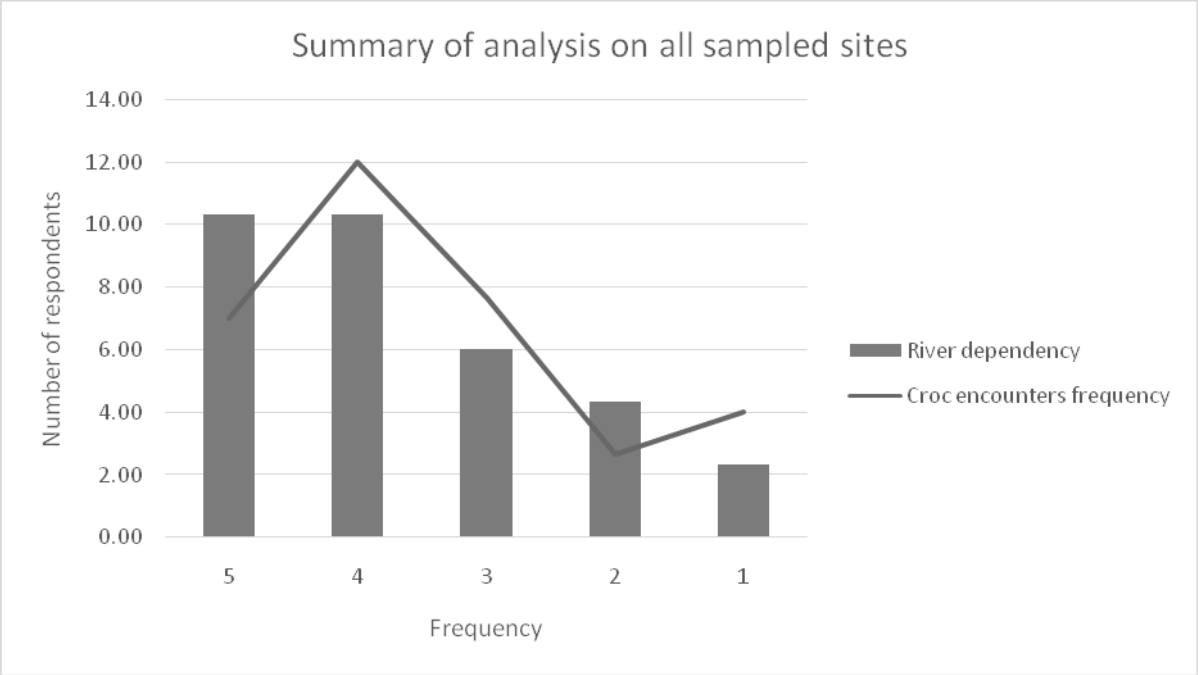


Figure 6: Dependency on rivers and personal encounters with crocodiles for all study areas.



The followings were identified by the respondents and focus group participants as major factors that had influenced the recent and current trends of crocodile populations in the study areas:

a) Legal status of the crocodiles as protected species.
b) Declining in riverine transportation.
c) Massive vegetation clearing associated with plantation development.
d) Rapid urbanization and development of rural and coastal road networks.

5.0 KNOWLEDGE ABOUT CROCODILE

Like most other large predators, one of the major problems facing crocodile conservation efforts is their public image. People often have negative attitudes towards crocodiles and view them as vicious predators, man-eaters or revengeful monsters. In most cases following crocodile attacks on people, local media seem to exacerbate this stereotype image, and in doing so, they provides inaccurate knowledge and melodramatic depictions leading gross misunderstandings, misconceptions, and even hatred toward of the species.

6.0 CONCLUSION

Human-crocodile conflicts will continue to persist as human continues to co-exist alongside the species. Managing wildlife is all about managing people especially those who affect and directly affected by the species. This requires in-depth understanding of people perceptions of and attitudes toward wildlife. Determining human values and attitudes toward crocodiles can provide valuable insights that in turn can help conservation managers to formulate more effective policies and measures that can ease human-crocodiles coexistence.

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FOREST RESEARCH INSTITUTE MALAYSIA

IP 13: LONG-TERM OBSERVATION FROM MODEL PLANTATION OF *DYERA COSTULATA* (JELUTONG) IN KEMASUL FOREST RESERVE, PENINSULAR MALAYSIA: 12 YEARS AFTER PLANTING

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ABSTRACT

The paper evaluates the long-term study from model plantation of *Dyera costulata* (jelutong). The one-year-old saplings were planted in four different stocking density regimes at 1111, 833, 625 & 400 stems ha^{-1}. At 12-years, the average diameter at breast height of the dominant trees (100 largest trees ha^{-1}) was 21.5 cm. The average diameter at breast height and total height of the whole stand varies from 15.8 to 21.4 cm and 10.35 to 12.55 m. The achieved standing volume ranges from 37.99 to 129.15 m^3 ha^{-1}, having an annual volume growth increment at 6.23 m^3 ha^{-1} $year^{-1}$. The lowest achieved volume growth and yield was obtained from an initial density of 400 stems ha^{-1} having the least number of remaining stems at 129 stems ha^{-1} or 32.2% survival as compared with 833 and 625 stems ha^{-1} at 42 and 52.3 percent. The analyses based on growth increments showed initial densities of 833 and 1111 stems ha^{-1} are still favourable having the highest calculated Periodic Annual Diameter Increment (PAI_D) at 1.1 and 1.1 cm. The results obtained have provided the base-line information on the growth and yield, the needs of improved materials for future planting and way forward of the species towards the State's Forest Plantation Industry. The paper suggests that the monitoring will continue to specified rotation age to obtain the actual growth and yield results.

INTRODUCTION

The long term forest plantation project using *Dyera costulata*, a timber species of high commercial value, is currently being undertaken in Kemasul, Pahang determine effective method for future re-planting to boost the declining supply from natural forests. The establishment of the project is based on the past silvicultural experience gathered from the old existing stands at Bukit Lagong Forest Reserve in Selangor within the Forest Research Institute Malaysia main campus (Borhan & Rahman 1987). The projects aims among others are:

a) Commissioning the 10−hectare pilot planting of *D. costulata* with different silvicultural and establishment techniques as part of the Memorandum of Understanding (MoU) between Forest Research Institute Malaysia (FRIM), State Forestry Department, Pahang and STAEDTLER (M) Berhad signed in November 2000;
b) Synthesize current knowledge on the growth and yield, and to better understand the underlying growth behaviour of the species and finally to identify gaps in the current knowledge; and
c) Suggest new observation and findings and to develop a suitable silvicultural and management regime for *D. costulata* for the production of medium-quality timber in 15 to 20 years.

In lieu of the existing project, this information paper highlights the achieved growth and yield and the overall potential of the species and the performance under different planting densities recorded between the years; 2001 and 2013.

Species

Dyera costulata is regarded as one of the promising indigenous timber species for the manufacturing of light-construction including pencil slats, toys and drafting boards (Lopez 1978). It is a fast growing species from the Apocynaceae family and can be found in all states of Peninsular Malaysia (except Perlis and Langkawi), mainly distributed in lowland primary forests up to 300 m (Whitmore 1972), but sometimes found in marshy areas (Burkill 1966). It can attain 40 m in height and 3 m in girth and produces good stem form. The species possess some favourable characters including the ability for open planting, relatively fast growth and available market demand. The species grouped as one of the potential plantation species for future reforestation programme under the Forest Plantation Programme at the State and Federal levels, and fits as monoculture or mosaic planting design. The mosaic or monoculture options is suggested due to the nature of the plantation areas covering a wide spectrum of topographical areas including flat, undulating and even sloping terrain. And in response with the government decision for large scale planting of selected potential species, observation on the overall performance of the species was carried out. Subsequently, the results obtained from this study may help in making decision on the inclusion of the species for future reforestation programme.

MATERIALS AND METHODS

Study sites

The trial planting of *Dyera costulata* on a 10-ha site was established in January 2001 within the Kemasul Forest Reserve, Pahang; a joint-research project between FRIM, State Forestry Department, Pahang and STAEDTLER (M) Berhad. The project site (Figure 1) is located in the centre of Peninsular Malaysia at 102°14' East and 3° 25' North, with mean daily air temperature ranges from 27° to 32°C. The annual rainfall is between 1800 to 2030 mm indicating that the area received precipitation at the lower range of rainfall in the humid tropics (A. Zuhaidi 1993).

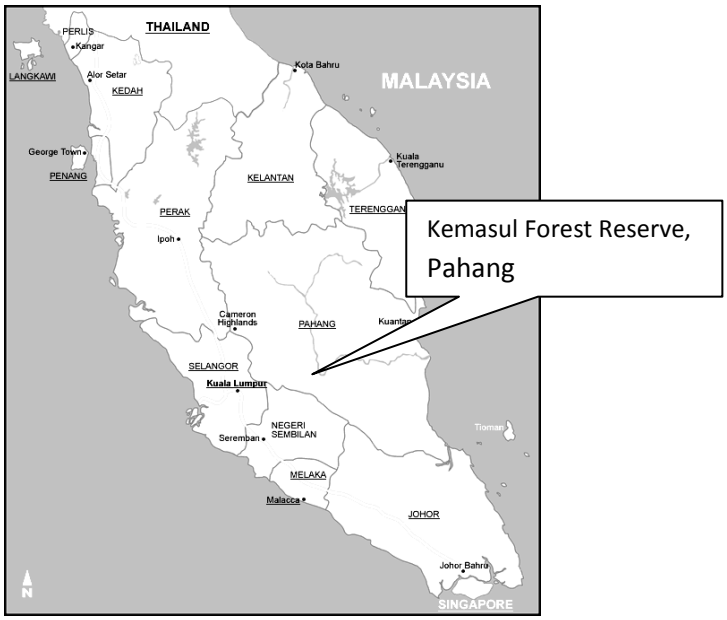


Figure 1: The location of the project site in Kemasul FR, Pahang.

The research area is located at about 80 m above sea level having a topographical terrain of flat to slightly undulating. The soil parent material is sedimentary and metamorphic rocks formed during the Jurassic and Triassic period. The soil texture is sandy clay loam with poor nutrient status, having low soil pH and cation exchange capacity with deficiency in phosphorus (A. Zuhaidi *et al.* 2008). Prior to planting, the old secondary forests were clear felled and sites semi-mechanically prepared. Besides pilot planting of the species, the saplings were trial planted under four different stocking regimes, i.e. at 1111, 833, 625 and 400 stem ha^{-1} as required under the research components of the whole MoU project. In 2001, 14 slashing rounds, 6 fertilizer applications, one selective low thinning and pruning were carried out.

METHODS

The data collected were diameter at breast height measured (1.3 m) from the ground using metallic diameter tape (cm) at 100% enumeration and total height using height meter HAGLOFF Vertex III digital hypsometer with Transponder (m).

The height equation for estimating total height of all trees was developed using height-growth function as in Curtis (1967) and Kozak & Yang (1978).

The equation is total height = $a + b \log (dbh)$ ……...Equation 1

Where n = number of trees measured
dbh = measured diameter at breast height
a & b = equation coefficients

From the height curves the total tree height (*hg*) was calculated.

The basal area was calculated for each tree (*g*); the basal area ha^{-1} (*G*) was obtained by totaling the individual values and converting the results into a ha^{-1} value using the area factor

$G = \sum g_i * 1 / (\text{plot area})$……...Equation 2
$g = ((\pi \times dbh^2)/4)/10{,}000$ ……..Equation 3
reduction factor = 0.7 (to allow for stem taper)
$V = g \times hg \times 0.7$ ……..Equation 4

The volume per ha (V) is the total sum of individual tree volumes and converting the results into ha^{-1} values as in Equation 2.

The above equations were used to produce (i) periodic annual diameter increment and (ii) mean annual increment for diameter and volume. The periodic annual diameter increment (PAI_d) was calculated by dividing the periodic increment by number of years, e.g. stand diameter,

$$PAI_d = (d_{t+k} - d_t) \div k_t$$

Where PAI_d = periodic annual diameter increment
d_{t+k} = standing diameter at the end of the observation period k
d_t = standing diameter beginning of observation period k
k = length of growth period

The mean annual increment (MAId) refers to the total production of the stand up to stand age concerned. It was calculated by dividing the mean increment by the stand age.

$$MAI_d = (d_t + \sum R) \div t$$

Where MAI_d = mean annual diameter increment at stand t
d_{t+k} = standing diameter at stand age t
$\sum R$ = total of removals up to stand age t
t = stand age

Experimental plots

Four study plots measuring 0.2 hectare each in a randomized block design with two replicates were established in January 2001 (Table 1). The plots were located within the same area having similar climate and soil types. Despite having smaller plots than the recommended size (Alder & Synnott 1992), the selection of plot size and distribution was based on available areas of planted stands.

Table 1: Initial Planting Densities and Number of Saplings measured.

Treatments	Density ha^{-1}	Trees measured
1	1111	200
2	833	200
3	625	200
4	400	200

RESULTS AND DISCUSSION

Stand growth and yield

The summary of the of the four observation plots measured at 12th year after planting is as shown in Table 2. After 12 years, and as a result of competition, pests and even diseases and mortality, the density declined to an average of 293 (129–457) stem ha^{-1}. The lowest remaining stem number ha^{-1} (N) was 129 stems obtained from an initial density of 400 stems ha^{-1}. As observed, the stand with the lowest population in 400 and 625 stems ha^{-1} had the lowest basal area and volume ha^{-1}.

Subsequently, the average means achieved for dominant diameter, diameter at breast height and calculated total height were 21.5 cm, 18.7 cm and 11.54 m. The dominant diameter represents the achieved growth and tree sizes of the 100 largest trees ha^{-1} and is significantly higher than the overall stand diameter. Based on the observations made, the stands have reached within the proposed final crop which is between 250 and 350 trees ha^{-1}. In the case of low density regime in 400 and 625 stems ha^{-1}, the actual remaining trees left after 12 years was far below than the required number of final crop trees. Thus the recommendation to established at low density regime with low selection ration may not fit well with forest tree species intended for long term rotation cycle for sawlogs or quality timber production.

The total height of each tree was calculated from the height growth function developed as in Equation 1. The results from the height growth function has the coefficient of determination (R^2) at 0.6780 (n=200, P<0.001). The height growth function was;

$$\text{Total height} = -9.66877+16.69246 * \log(\text{dbh}) \quad \text{.....Equation 5}$$

The average calculated basal area ha^{-1} and volume ha^{-1} were 8.63 and 74.73 (37.99–129.15) m^{3}ha^{-1}year^{-1} equivalent to an annual volume production of 6.23 m^{3}ha^{-1}year^{-1}. The highest volume production obtained from an initial density of 1111 and 833 stems ha^{-1} was at 129.15 and 120.19 m^3 ha^{-1}. Nevertheless, this parameter is not an optimal indicator of good growth due to the high remaining stem number ha^{-1} after 12 years. As such, the suggestion to extend the observation until 15 to 20 year period would suffice to assist in making decision on the right silvicultural regime, rotation age and even potential final crop trees.

Table 2: Stand and stock tables of 12-year-old *D. costulata*, Kemasul FR.

Initial density	N	ddom	*dg*	*hg*	*G*	*V*	MAIv	MAId.	*S*
1111 (R1)	457	21.7	19.4	11.83	14.59	129.15	10.76	1.6	41.2
833 (R1)	305	19.5	16.0	10.49	6.65	52.10	4.34	1.3	36.6
833 (R2)	350	24.5	21.4	12.55	13.19	120.19	10.02	1.8	42.0
625 (R1)	292	21.6	18.8	11.62	8.84	77.27	6.44	1.6	46.7
625 (R2)	327	18.0	15.8	10.35	7.07	56.14	4.68	1.3	52.3
400 (R1)	129	22.8	20.3	12.14	4.32	37.99	3.17	1.7	32.2
400 (R2)	189	22.4	19.3	11.78	5.72	50.24	4.19	1.6	47.2
Average	293	21.5	18.7	11.54	8.63	74.73	6.23	1.6	42.6

Remarks:

R − replicate;
N − stem number ha^{-1};
ddom − 100 largest trees ha^{-1};
dg − average diameter at breast height (cm);
hg − total height (m);
G − basal area ha^{-1};
V − volume ha^{-1};
MAIv − mean annual volume increment ($m^3ha^{-1}year^{-1}$);
MAId − mean annual diameter increment (cm);
S − survival rate

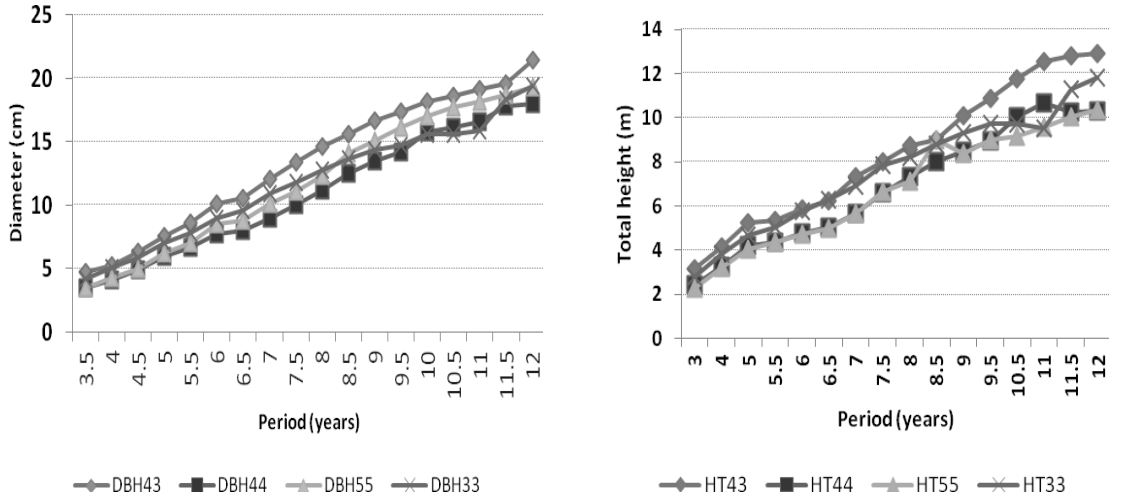
Growth increments

In comparing the performance of the species with different initial densities, and different tree sizes during initial planting, two parameters were used, namely Mean Annual Diameter Increment (MAId) and the Periodic Annual Diameter Increment (PAId). However, the MAId only reflects the overall diameter growth (Table 2) without considering the initial sapling size during initial planting. Instead, the PAId was used, to avoid misleading results on the actual diameter growth. The results showed that initial planting density of 833 and 1111 stems ha^{-1} had the highest PAId at 1.1 cm $year^{-1}$ after 12 years (Table 3). However, there is no distinct difference among the remaining initial density regimes, i.e. between 0.9 and 1.0 cm respectively. These results concur with studies conducted by (Borhan & A Rahman 1987) that *D. costulata* trees grown in estates have diameter growth increment rates of 0.9 cm $year^{-1}$.

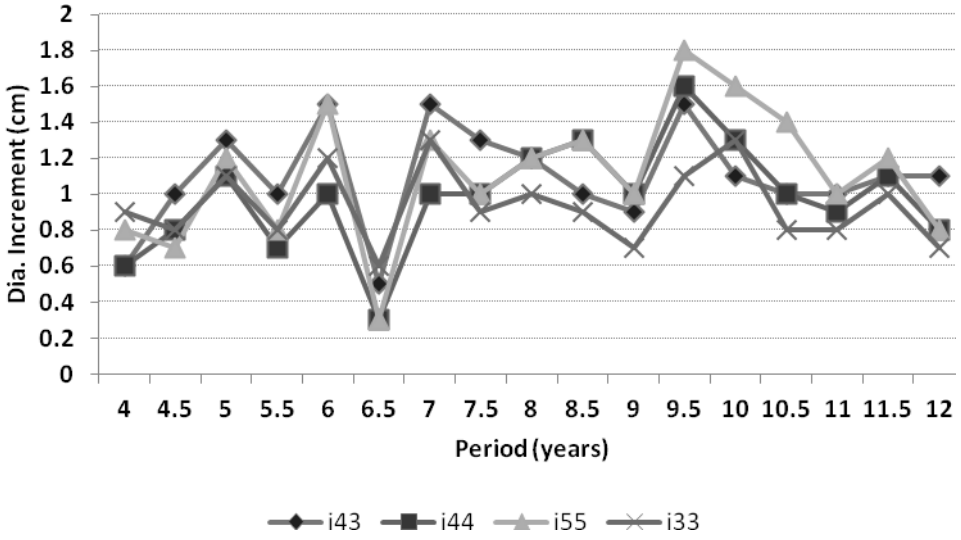
Table 3: Calculated Periodical Annual Diameter Increment (cm) after 12 years.

Age (years)	Ini. Density 833 sha^{-1}	Ini. Density 400 sha^{-1}	Ini. Density 625 sha^{-1}	Ini. Density 1111sha^{-1}	Year
4	0.6	0.6	0.8	0.9	2004
4.5	1	0.8	0.7	1	2005
5	1.3	1.1	1.2	1.3	
5.5	1	0.7	0.8	0.8	2006
6	1.5	1	1.5	1.4	
6.5	0.5	0.3	0.3	0.6	2007
7	1.5	1	1.3	1.3	
7.5	1.3	1	1	0.9	2008
8	1.2	1.2	1.2	1.3	
8.5	1	1.3	1.2	0.9	2009
9	0.9	1	1	0.7	
9.5	1.5	1.6	1.6	1.4	2010
10	1.1	1.3	1.5	1.5	
10.5	1	1	1	1	2011
11	1	0.9	0.9	1	
11.5	1.1	1.1	1	1	2012
12	1.1	0.8	0.8	0.9	2013
Ave. INC	**1.1**	**1.0**	**1.0**	**1.1**	

Subsequent to the above Figure 2 shows the trend in diameter and height growth of all initial densities or treatments. It was observed that both diameter and height are still growing at increasing rate maintaining an annual diameter increment between 0.9 and 1.1 cm. The sharp decrease in the diameter increment for all treatments was observed between 2006 and 2007 due to the lapse of the MoU from Phase I and Phase II. During that period, the plantation stands were left unattended for a period of one year, causing the reduction growth and eventually on the diameter increments. The general maintenance of the stands continued as Phase II of the MoU set in after 2007. However, the reduction in the diameter increments was not distinct as illustrated in Figure 2 (a) and (b) from the diameter growth curves but more significant as in (c).



(a) and (b)



(c)

Figure 2: Diameter and height growth (a & b), and annual diameter increment (c) for 12 years observation period.

Figure 3 shows photos of existing stands after undergoing selective low thinning and pruning treatments (up to 6 m) in November 2013. The results of the thinning treatments will be analyzed in the subsequent measurements in 2014 and onwards.

Figure 3: Stands of *D costulata* in 2013 under 833 stems ha^{-1} initial density regime.

Conclusions

i. The results from the long-term observation at 12 years after planting have indicated that *D. costulata* is a potential indigenous species suitable for reforestation programme either as mosaic planting within the logged-over natural forests or under reforestation programme as monoculture establishment.
ii. An initial planting density at 833 and 1111 stem ha^{-1} gave the highest PAI_d at the end of the observation period, but more observation is required to give more convincing results.
iii. The results after 12 years observation have provided the intermediate directions in particular the initial spacing and soil types for future planting density of the species on commercial scale.
iv. Finally, by extending the observation until 20 year period is thought to be sufficient to assist in making decision on the proposed silvicultural treatments, rotation age and potential final crop trees.

Acknowledgements

The authors are thankful to the Director General of the Forest Research Institute Malaysia, Director of State Forestry Department, Pahang and STAEDTLER (M) Bhd. for providing the necessary facilities and funds to carry out the study. We are also grateful to Mahat Judin, Razani Zakaria and Syapawi Lot for their assistance in field work.

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ABSTRACTS OF POSTERS

P1: DESCRIPTION OF ULTRAMAFIC FOREST IN GN. TINKAR, SABAH, MALAYSIA

Reuben Nilus | John B. Sugau
Sabah Forestry Department

Formerly gazetted under the Sg. Pinangah Forest Reserve (FR) as a Class II production forest, Gn. Tinkar FR was regazetted in 2010 as a Class I protection forest, covering an area of about 10,150 ha for the protection of its watershed, and the maintenance of local environmental and climatic factors. The terrain of the reserve is generally steep, and is surrounded by large oil-palm plantations, titled lands and a sawmill. Edaphic lowland and upland ultramafic forest predominantly cover the reserve. In lower elevation the diperocarp trees dominate the forest structure and associated with trees from the tree family Euphorbiaceae and Anacardiaceae. With increase elevation, though trees from the family Dipterocarpaceae are still dominant, contribution from the Myrtaceae and Clusiaceae trees to the forest structure became more apparent.

P2: BASIC TECHNIQUES IN PROPAGATING PITCHER PLANTS

Richard Majapun | Alviana Damit | Veronica S. Guanih | Eyen Khoo
Sabah Forestry Department

Pitcher plant or scientifically known as the *Nepenthes* has become a revolution in the ornamental industry. With its unique and extraordinary traits, the pitcher plant has cemented its popularity amongst plant enthusiasts all over the globe. Up to date, horticulturists have been experimenting with *Nepenthes* in order to cultivate and preserve them via various techniques. The technique such as conventional propagation by using vegetative part of the plant is proven to be cost effective and easier to maintain. However, in the wake of large scale demand for the plant to be used as an ornamental plant, it has pave way for the utilization of *in-vitro* propagation technique to enhance the multiplication process. Nevertheless, either ways can be used in propagating the *Nepenthes*, especially in preserving those rare and endemic species. This poster will highlight some of selected species and provides the basic techniques in propagating pitcher plants with the insight of maintaining and cares for the plant.

P3: THE SABAH PLANT RED LIST: INITIATIVE TO ASSESS THE CONSERVATION STATUS OF THE FLORA IN SABAH

Joan T. Pereira[1] | Colin R. Maycock[2] | Eyen Khoo[1] | Richard J. Majapun[1] | John B. Sugau[1] | Reuben Nilus[1]
[1] Sabah Forestry Department, [2] Universiti Malaysia Sabah

Sabah sits in the northern portion of the island of Borneo and it is considered as one of the mega-biodiversity hotspots in the world. Current estimate of vascular plants in the state is over 8,000 taxa, of which a third is considered endemic. With the rapid deforestation and also forest degradation faced in Sabah, many plant species will be affected, and when left unchecked, these species will continue to be threatened, which may eventually lead to extinction, if conservation actions are not in place. As a commitment to the Convention on Biological Diversity (CBD), the Aichi Biodiversity Targets (Target 12) aims to prevent the extinction and improve the conservation status of species that are most at risk by the Year 2020 and it calls for the assessment of the conservation status of all endangered species and the development of national Red Lists for threatened species by the Year 2016. At the national level, Target 2 of the Malaysia National Strategy for Plant Conservation also aims to produce preliminary assessments of the conservation status of all known plant species in Malaysia. These conservation strategies have created an impetus to come up with a regional Red List for Sabah. The Sabah Forestry Department, together with the University of Aberdeen and Universiti Malaysia Sabah have spearheaded an intiative to address the goals, with its initial priority on the endemic flora and also, some of the commercially important species of Sabah. This paper will highlight the achievements, the challenges faced and also the outcome expected from this initiative.

P4: VEGETATIVE PROPAGATION OF KARAMUNTING *(RHODOMYRTUS TOMENTOSA)*

Kimjus, K. | Ajik, M.
Sabah Forestry Department

This is a follow up study to further look into the rooting capacity and stockplant management of Karamunting (*Rhodomyrtustomentosa*). Previous studies showed that with the application of hormone (Seradix 3), the number of roots produced was significantly increased. Root formation was also expedited with the use of peat moss as a rooting media. The main objective of this study is to further explore the best vegetative propagation approach for Karamunting that covers all aspects; cutting materials & sources, rooting media and environment. Comparison between the use of mature and juvenile cutting materials is highlighted.

P5: STUDY ON MOSS FLORA OF TRUSMADI FOREST RESERVE IN SABAH

Andi Maryani A Mustapeng [1] | John B Sugau[1] | Monica Suleiman[2]
[1] Sabah Forestry Department, [2]Universiti Malaysia Sabah

Trusmadi Forest Reserve (Trusmadi FR) is located at the central part of Sabah ($5^0$17'15.64" N, $116^0$20'03.83" E), and covers an area of 74,736 ha. Trusmadi FR is gazetted as Protection Class I, where timber-harvesting activities are not permitted since 2010. A survey of mosses on Mount Trus Madi has been carried out in 1996 by Suleiman and Edwards. However, the survey was concentrated only in montane forest of the North Western part of the mountain, which was along the summit trail (1,400 m – 2,600 m). Nonetheless, they reported as total of 153 taxa of mosses from 74 genera and 28 families. This number represents ca. 26% of the mosses reported from Sabah. It shows that this area has a high diversity of mosses. Thus, the main aim of this research is to carry out a comprehensive study on the moss flora of Trusmadi FR. Specimens of mosses were randomly collected in all existing trails and excursions to accessible areas of the reserve, taking into account all the forest types in the reserve. Herbarium specimens from Sandakan Herbarium (SAN) and BORNEENSIS Herbarium (BORH) also included in this study. Specimens were identified by referring to identification keys in books, journals and monographs, and by comparing to authentic specimens in SAN and BORH. This study is expected to increase the existing number of mosses reported for the forest reserve and will provide information on species richness of the area.

P6: THE SANDAKAN HERBARIUM (SAN), SABAH: PRESENT STATUS AND FUTURE DIRECTIONS

Suzana Sabran | John B. Sugau | Joan T. Pereira | Nur Adillah Mohd. Yusof
Sabah Forestry Department

Since its establishment in 1915, the Sandakan Herbarium (SAN) has been a permanent research facility under the Sabah Forestry Department. The role and function are similar to other herbaria i.e., serving as the main plant reference centre in Sabah and Borneo and securing the natural heritage of Sabah's flora. Currently, the herbarium contains about 266, 841 botanical collections predominantly from Sabah, but also many exchange specimens from other herbaria around the world. Much of our knowledge of the floristic diversity can be found from herbarium collections based on botanical expeditions that have been conducted in the region since 1836. This has led to new and updated taxonomic and phylogenetic scientific studies but, most importantly, the contribution has been on the discovery and documentation of new species, varieties and records. The Herbarium and its staff play an important role in documenting the flora of the region with major contributions to projects, such as the Tree Flora of Sabah and Sarawak, and are very active in international taxonomic networks. Such collaborations have also led to the training of departmental human resources technically and intellectually. SAN no longer functions solely as a species reference collection, but is now playing a major role in a broad range of research from biodiversity studies, conservation assessments, and fauna studies such as habitat and diet needs, etc. This paper will take an in-depth look at how the Herbarium contributes not only to the forestry development goals, but also at a state wide and international level and also briefly highlighting its challenges and future directions.

P7: SAWNTIMBER RECOVERY IN THE PROCESSING OF LOGGING RESIDUES IN DERAMAKOT FOREST RESERVE, SABAH

Zamrie Imiyabir | James Josue | Johnny Kissing | Subari Suparlan
Sabah Forestry Department

The extraction of logging residues in Deramakot Forest Reserve (DFR) started in 2003 by Sentosa Jaya Fruit Farm Sdn. Bhd. as part of the Sabah Forestry Department (SFD) research project to optimise the utilisation of timber harvested from the forest. The feasibility to extract logging residues in DFR was reported by Zamrie *et. al.* (2011) based on determination of the quantity, type and species group of salvaged logging residues. This study, therefore, aimed to determine their possible utilisation and their mill recovery derived from the the operating company's sawmill in DFR. The study found that sawntimber was the only product of the logging residues produced by the sawmill. A total of 220.34 m^3 of sawntimber were produced from the 381.20 m^3 of logging residues. This is equivalent to a 57.80 % recovery rate. The highest mean recovery was obtained from the stem type and the Red Seraya Group with 59.14 % and 60.61 % respectively. The mean recovery rate of sawntimber production varied significantly among the species group of logging residues. The lowest recovery of 52.27 % was obtained for the other dipterocarp species group. However, based on the recovery rate of sawntimber production from the normal logs by most sawmills (normally ranging from 42-60 % with an average of about 50 %), this value is still considered high, thus indicating feasibility in the processing of logging residues into sawntimber.

P8: A LOCAL VOLUME TABLE FOR BATAI (*PARASERIANTHES FALCATARIA*) PLANTED AT LUNGMANIS FOREST RESERVE, SABAH

Jaffirin Lapongan | Kelvin Kat Nyen Pang | Anuar Mohamad | Alexander Hastie
Sabah Forestry Department

Nine non-transformation equations and twelve transformation equations were fitted by the method of least squares to volume data compiled from 85 trees of Batai (*Paraserianthes falcataria*) planted at Lungmanis Forest Reserve. Furnival's index was used as the criterion for selecting the best fit regression. The most suitable volume equation was found to be:

$V = 0.183\ D^{1.692}\ H^{1.125}$

Where V is the underbark volume (m^3), D is the diameter at breast height (cm) and H is the total height (m).

P9: AN ASSESSMENT OF ABOVEGROUND CARBON STOCKS UNDER FOREST PLANTATION OF BINUANG (*OCTOMELES SUMATRANA*) IN KOLAPIS A, SABAH

Esther Dyi Ka Mei | Maria Ajik | Jupiri Titin
Sabah Forestry Department

The establishment of forest plantation is a necessity to meet the increasing demand for timber as well as enhanced the production capacity of degraded areas. It has also been acknowledge the role of forest plantation in mitigating the increase of greenhouses gases (GHG) concentration in atmosphere. A study was conducted at Kolapis Research Station, Sandakan to assess the aboveground carbon storage under forest plantation of Binuang (*Octomeles sumatrana*) at different ages (5 and 10 years). Stands were established in year 2004 with planting spacing 3m x 3m, planted seedlings were taken from 6 different seed lot (Kolapis A, Segaliud Lokan, Sg. Babakang, Sg. Muanad, Ulu Sapa Paya and Sg. Maliau). A total of 21 plots (12m x12m) were randomly established in year 2004, all trees within the plot were measured. Additional secondary data of diameter (DBH) and height measurement for year 2009 (5 years) obtained from 48 plots were used in this study. Those plots were in size 6m x 6m, and it according to 6 different seed lots. Allometric equation was used to estimate the aboveground biomass (AGB) value. Result from this study showed the average aboveground carbon density under forest plantation for 5 and 10 years old Binuang stand was 4.25 t C/ha and 6.3 t C/ha respectively. The increment of carbon stocks in a span of 5 years up to 48%. Factors, such as tree health, stand growth performance and different seed lot were the main contributing factors to the varying carbon density between plots.

P10: PANDUAN PENGURUSAN POKOK BAHAYA DI KAWASAN HUTAN LIPUR SEMENANJUNG MALAYSIA

Salleh S. | Zainon N.A. | Zakaria Z. | Khadlan M.F.
Forestry Department Peninsular Malaysia

Keselamatan para pengunjung di kawasan hutan lipur merupakan salah satu aspek penting yang perlu diberi keutamaan. Ianya merangkumi keselamatan pengunjung, petugas, harta benda dan sumber ekopelancongan hutan di kawasan tersebut. Terdapat pelbagai ancaman keselamatan di kawasan ekopelancongan hutan antaranya ancaman keselamatan berpunca daripada pokok bahaya. Ancaman ini boleh mengakibatkan kerosakan harta benda dan kecederaan, malah boleh melibatkan kehilangan nyawa. Antara risiko yang boleh terjadi adalah berpunca daripada dahan mati, patah atau pokok tumbang yang menghempap bangunan dan manusia. Walaupun ancaman tersebut tidak dapat dielakkan sepenuhnya, tetapi ancaman tersebut boleh dielakkan dengan mengadakan satu pengurusan pokok bahaya secara sistematik. Pokok merupakan penyumbang yang berharga untuk kesihatan dan kebajikan kepada manusia, tetapi pokok juga boleh menimbulkan liabiliti kepada manusia. Bagi mengurangkan liabiliti tersebut, satu tindakan yang betul perlu diambil bagi mengurangkan risiko kerosakan dan kecederaan yang berlaku. Penilaian pokok bahaya merupakan satu seni dan sains yang memerlukan seorang yang berpengalaman, berkelayakan, kompeten serta memahami biologi dan fisiologi pokok, struktur pokok dan proses pereputan pokok. Sehingga kini masih belum terdapat garis panduan yang khusus dalam mengurus pokok bahaya di kawasan hutan lipur dan hutan taman negeri. Oleh itu garis panduan ini disediakan bertujuan untuk memberi pendekatan yang teratur dan seragam berhubung dengan pengurusan pokok bahaya khususnya di kawasan hutan lipur dan hutan taman negeri yang sering menjadi tumpuan utama pengunjung. Panduan ini menerangkan langkah-langkah penilaian status pokok bahaya, pengumpulan maklumat asas, langkah-langkah kawalan, pemeriksaan dan penyelenggaraan.

P11: PENGURUSAN KEBAKARAN HUTAN PAYA GAMBUT DI NEGERI SELANGOR: SATU PENGALAMAN

Yusoff bin Muda | Mohd Basri bin Abdul Manaf | Badrol Hisam bin Abdul Rahman | Syed Mohd Adzha bin Syed Khalid | Azuan bin Moh Shukri | Mangsor Mohd Yusoff
Forestry Department Peninsular Malaysia

Keluasan hutan paya gambut di Negeri Selangor meliputi 1/3 daripada keseluruhan kawasan Hutan Simpanan Kekal atau 82,890.38 hektar. Bagaimanapun tekanan ke atas penggunaan tanah untuk tujuan pembangunan dan pertanian di kawasan tanah gambut seringkali mengakibatkan kerosakan kekal kepada ekosistem hutan paya gambut terutamanya pada sistem hidrologi di kawasan tersebut. Penurunan paras *'water table'* akan menyebabkan permukaan atas gambut menjadi kering dan terdedah kepada cuaca panas serta mudah berlakunya kebakaran. Sejak kebelakangan ini hampir setiap tahun berlaku kejadian kebakaran di kawasan hutan paya gambut yang terosot di Negeri Selangor. Kejadian kebakaran ini merupakan salah satu ancaman terhadap kelestarian hutan yang akan memberi impak negatif kepada kesejahteraan hidup manusia, kepelbagaian biologi dan alam sekitar. Kebiasaannya kejadian kebakaran ini berlaku pada musim kering dan kemarau iaitu pada bulan Jan-Mac dan Jun-Ogos pada setiap tahun. Lokasi yang terbakar adalah di kawasan yang biasa terbakar pada setiap tahun iaitu di Hutan Simpan Raja Musa dan Hutan Simpan Kuala Langat. Statistik sehingga Mac 2014 mendapati, keluasan kawasan hutan paya gambut yang terbakar di Selangor ialah 1,780 ha. Kebanyakkan kejadian kebakaran hutan yang dikenal pasti adalah disebabkan oleh aktiviti pembersihan kawasan tanah milik persendirian untuk aktiviti pertanian yang terletak bersempadan dengan kawasan Hutan Simpan Kekal. Bagi membendung kejadian kebakaran hutan paya gambut, pelbagai tindakan telah dijalankan oleh pihak Jabatan Perhutanan Negeri Selangor serta dibantu oleh pelbagai agensi kerajaan dan NGO. Tindakan yang dijalankan adalah seperti penggunaan *Fire Danger Rating System* (FDRS) sebagai sistem amaran awal bagi mencegah kebakaran berlaku. Selain itu di antara tindakan di lapangan yang turut dilaksanakan adalah dengan pemasangan paip air dari kawasan lombong berhampiran ke dalam kawasan Hutan Simpan Kekal, pembinaan *canal blocking* atau *check dam*, dan *clay bund* bagi mengawal paras air di dalam kawasan hutan. Kertas kerja ini akan menerangkan hasil pengalaman jabatan yang diperolehi daripada kejadian kebakaran hutan paya gambut sebelum ini dalam mencegah dan mengawal kejadian rebakan api gambut.

P12: KEBAKARAN HUTAN DAN KESAN KE ATAS EKOSISTEM HUTAN

Ahmad Aizuddin bin Hashim | Ahmad Hamka bin Mohd Yasin
Forestry Department Peninsular Malaysia

Kejadian kebakaran hutan memberikan implikasi negatif terhadap ekosistem hutan. Kemusnahan kepelbagaian biologi, kualiti udara dan struktur tanah memberikan kesan ke atas ekosistem di sesuatu kawasan hutan yang telah terbakar. Kesan yang paling ketara yang dapat dilihat dengan jelas adalah kemusnahan kepelbagaian biologi Terdapat banyak spesies-spesies pokok yang bernilai tinggi yang patut dipelihara telah musnah dalam kebakaran hutan. Perkara ini dilihat telah banyak merugikan negara dalam melindungi kepelbagaian biologi dan ekosistem hutan di negara kita. Kebakaran hutan yang berlaku perlu ditangani dengan lebih efisyen dan sistematik pada masa hadapan dengan menggunakan teknik dan peralatan yang lebih sesuai mengikut pada keadaaan cuaca dan bentuk muka bumi agar kepelbagaian biologi dan ekosistem hutan di negara kita kekal di pelihara pada masa hadapan. Kebakaran hutan yang berlaku juga memberi impak besar kepada suhu di bumi ini dan juga ekosistem di negara kita.

P13: PRODUK PELANCONGAN BERASASKAN ALAM SEMULA JADI HUTAN: SUATU PENGALAMAN DI NEGERI PERLIS

Ridzuan Salleh | Ahmad Fikri Mistar | Muhammad Sayuti Yusoff | Abd Wahab Jamaluddin | Mohamad Saifful Rizal Jusoh
Forestry Department Peninsular Malaysia

Negeri Perlis merupakan negeri yang paling utara di Semenanjung Malaysia dan bersempadan dengan negara Thailand. Sebagai sebuah negeri yang terletak terutara sekali, Perlis mengalami iklim Monsun Tropika di mana terdapat perbezaan yang ketara antara musim hujan dan musim kemarau. Kebiasaannya musim kemarau berlaku pada bulan Disember hingga Mac. Perubahan musim ini banyak mempengaruhi alam semulajadi hutan di negeri Perlis, termasuklah tumbuh-tumbuhan yang unik dari segi ciri-cirinya berbanding tumbuhan negeri lain di Malaysia. Kedudukannya yang berdekatan dengan Thailand juga menyebabkan negeri ini mempunyai spesies tumbuhan yang mempunyai persamaan seperti yang terdapat di Thailand dan Myanmar. Walaupun hanya kira-kira 14.25% daripada keluasan negeri Perlis diliputi hutan, negeri ini terkenal sebagai salah sebuah negeri di Malaysia yang sentiasa memelihara sumber-sumber hutannya untuk pelbagai aspek. Ekopelancongan mempunyai potensi besar sebagai produk utama negeri ini memandangkan sektor perkhidmatan memainkan peranan penting dalam ekonomi negeri, yang mana ia menyumbang sebanyak 59% daripada Keluaran Dalam Negara Kasar (KDNK) negeri untuk tahun 2012. Bersandarkan keunikan dan kepelbagaian topografi serta kontur bukit-bakau, pembentukan semulajadi batu kapur dan aliran air semula jadi beberapa kawasan telah dibangunkan sebagai kawasan ekopelancongan merangkumi kawasan seperti Kompleks Ekopelancongan Gua Kelam, Taman Negeri Perlis, Rimba Herba Perlis, Hutan Lipur Bukit Ayer, Hutan Lipur Bukit Kubu, Hutan Lipur Tasek Meranti, Pusat Pelawat Dirian Jati dan lain-lain. Kehadiran pengunjung ke negeri Perlis kian meningkat seperti direkodkan pada tahun 2009 adalah 448,329 orang dan pada tahun tahun 2013 kehadiran pengunjung adalah 617,436 orang. Alam semulajadi ini telah dikenalpasti berperanan penting dalam menyumbangkan faedah-faedah ekonomi dan sosial dalam sektor ekopelancongan, pendidikan, penyelidikan dan perhutanan masyarakat. Maka usaha-usaha pemeliharaan dan pemuliharaan hutan akan sentiasa diutamakan berdasarkan konsep Pengurusan Hutan Secara Berkekalan.

P14: RIMBA HERBA PERLIS
PRODUK PELANCONGAN BERASASKAN TUMBUHAN HERBA
SUATU PENGALAMAN DI NEGERI PERLIS

Ridzuan Salleh | Ahmad Fikri Mistar | Muhammad Sayuti Yusoff
Forestry Department Peninsular Malaysia

Perlis terletak di utara Semenanjung Malaysia dan bersempadan dengan negara Thailand di bahagian barat laut. Rimba Herba Perlis merupakan salah satu produk pelancongan di negeri Perlis yang sangat istimewa dan unik dalam usaha menggabungkan suasana alam semulajadi hutan yang menempatkan tumbuhan herba serta pada masa yang sama sebagai destinasi pelancongan untuk dimanfaatkan oleh generasi kini dan akan datang. Ditubuhkan pada tahun 1998 dengan keluasan 12 hektar, Rimba Herba Perlis berfungsi untuk menempatkan koleksi tumbuhan-tumbuhan herba yang digunakan oleh penduduk setempat khasnya dan tumbuhan ubatan lain amnya. Ia juga berperanan sebagai sebuah muzium 'hidup' tumbuhan herba di mana Rimba Herba Perlis ini dibuka kepada semua pelawat yang ingin mengenali dan mengetahui jenis kegunaan tumbuhan-tumbuhan herba. Koleksi tumbuhan yang terdapat di sini terdiri daripada tumbuhan herba liar yang sedia ada dan juga tumbuhan herba yang didatangkan dari tempat lain yang telah lama digunakan di negara ini. Sesungguhnya tumbuhan herba merupakan ubat penyembuhan penyakit dan penubuhan Rimba Herba Perlis ini menjadi daya tarikan kepada pelancong ke arah meningkatkan kesedaran mengekalkan khazanah hutan untuk kepentingan manusia sejagat.

P15: PES MECHANISMS THROUGH MINI HYDRO PROJECTS IN THE FOREST RESERVES OF PERAK STATE, MALAYSIA

Hizamri Yasin | Roslan Ariffin
Forestry Department Peninsular Malaysia

Our natural environment, particularly water, provides a variety of services to the wellbeing and economic prosperity. Hydroelectric developers tend to neglect that the conservation and protection of watershed forests by the Forestry Department play essential part in their business. Water, which is sourced from a dedicated watershed forest area, has been undervalued as compared to the value of timber because of the lacking of formal market. Hydro power generation from watershed forest often compromise the income from timber from a same productive forest as hydroelectric developers pay taxes to the Government. More often, the income from government taxes are not directly channeled to Forestry Department to enable them to finance Sustainable Forest Management (SFM). In order to supply sustainable flow of water, both in term of quality and quantity to the hydroelectric plant, the watershed area which situated in productive forest becomes opportunity cost to the Forestry Department. Nevertheless, PES Mechanism implemented by Perak Forestry Department (FD) and Perak Hydro Renewable Energy Corporation (PHREC) is a win-win situation for both parties. Perak FD will ensure water quality (evenness of stream flow and quantity) to generate PHREC's mini hydro turbine, while generating sustainable and predictable income from the protection and conservation of river.

P16: ORCHIDS RESCUED FROM MURUM HYDROELECTRIC PROJECT (HEP) DAM, BELAGA, SARAWAK

Ling Chea Yiing
Sarawak Forestry Corporation

Murum HEP is located about 70 km upstream of Bakun HEP on Sg. Murum, a tributary of Batang Rajang in Belaga district. The rescue work is mostly conducted in logged-over forests especially in small creeks and streams. To date, over 1,200 orchids from 69 genera have been rescued since September 2013. The most abundant genus collected was *Bulbophyllum* with at least 40 species recorded. More than 200 species of orchids were rescued during the first year of the project. Of these, 25 species are endemic to Borneo while one species (*Dendrochilum rufum)* is only found in Sarawak. *Saccolabiopsis viridiflora* is a new record for Borneo.

P17: INSECT PESTS OF *NEOLAMARCKIA CADAMBA* PLANTATION IN SARAWAK

Doreen H.S. Chai | Marfaisal Marzuki
Sarawak Forestry Corporation

Neolamarckia cadamba is widely planted in Sarawak. The species is susceptible to various insect pest attacks. *Arthroschista hilaralis* has been found to be the most common defoliator of Kelampayan in addition to other stem borers which affect 70% of forest plantations under study. Factors triggering outbreaks of insect attacks on Kelampayan as well as recommended silvicultural practices are discussed.

P18: INTERNATIONAL BORNEAN FROG RACE, KUBAH NATIONAL PARK, SARAWAK

Taha Bin Wahab[1] | Suhaili Bin Moktar[1] | Indraneil Das[2] | Pui Yong Min[2]
[1]Sarawak Forestry Corporation, [2]Universiti Malaysia Sarawak

Good responses to the International Bornean Frog Race held at Kubah National Park over the last four years have spurred Sarawak Forestry to develop new eco-tourism products based on frogs. In this poster, the design of the frog race and associated activities are showcased.

P19: LOCAL COMMUNITY INVOLVEMENT IN ECO-TOURISM: THE BAKO NATIONAL PARK EXPERIENCE

Suhaili Mokhtar | Abang Mutalib Abang Tajuddin
Sarawak Forestry Corporation

Bako National Park is the first national park established in Sarawak and the most visited. Various programs have been introduced over the years to facilitate local community participation in the operations of Bako NP. Current programs include the provision of boat ferrying services, canteen operation, hospitality services and park guiding. Efforts are being made to expand local community involvement in additional eco-tourism products based on crocodiles, dolphins and fireflies at the park.

P20: VOLUNTEERISM FOR PROFIT AND CONSERVATION – WOX AND 'ADOPTION' EXPERIENCE

Francis Gombek | Siali Aban
Sarawak Forestry Corporation

The brand of volunteerism at Matang Wildlife Centre and Talang-Talang Turtle Islands in Sarawak requires volunteers to pay for their stints at these two conservation centres. The Matang Wildlife Centre offers to volunteers the unique opportunity to be intimately involved with orangutan conservation activities whereas volunteers at the turtle islands get the rare chance to be physically involved in marine turtle conservation. This poster is about the employment of volunteerism for wildlife conservation management.

P21: SUCCESS STORIES OF URBAN FOREST PARKS IN SARAWAK

Amelia Sima Jimbun | Shirley Lyn Michael Gias | Francis Gombek
Sarawak Forestry Corporation

Nine Nature Reserves have been established in Sarawak, five of which are urban forest parks. Two of these parks, namely Sama Jaya Nature Reserve and Bukit Lima Nature Reserve are considered as "success stories" based on achievement of the stated objectives of their establishment as well as other measurements such as visitation and utilization. The natural attributes and other factors contributing to these success stories are discussed.

17TH MFC RESOLUTIONS
&
CLOSING SESSION

9.0 RESOLUTIONS OF THE 17th MALAYSIAN FORESTRY CONFERENCE

The 17th Malaysian Forestry Conference was held on 11th - 12th November 2014 in Kota Kinabalu with the theme of "A Century of Forest Management: Lessons Learnt & the Way Forward". The Conference was attended by 600 participants and observers.

The Conference was conducted in a Plenary Session, in which the three heads of forestry departments and delegates reviewed the past and present performance and expounded their visions in accordance with the theme of the conference, and six concurrent workshop sessions as follows:

Session I: Forest Management
Session II: Forest Governance
Session III: Forest Biodiversity
Session IV: Plantation Forestry
Session V: Forest Ecosystem Services
Session VI: Social Forestry

A total of 3 keynote addresses, 37 working papers, 6 information papers and 49 posters were presented during the Conference. The Conference has adopted the following resolutions:

1. Recognizing that new technology, innovation and good practices are crucial to realize sustainable forest management, the Conference resolved that:
    - 1.1 Advanced technologies and innovative approaches including the integrated use of state of the art remote sensing and geospatial technology be continually explored and used for conservation, protection and other forestry related activities;
    - 1.2 The mitigation of climate change through the implementation of Sustainable Forest Management (SFM) practices, such as forest restoration and reforestation be further intensified;
    - 1.3 No net loss of biodiversity and preferably a net gain be considered to reduce further biodiversity loss;
    - 1.4 Adequate and sustainable financing be sourced locally and internationally; including appropriate incentives to promote and enhance conservation and SFM activities.
    - 1.5 HCV assessment and monitoring of forests be implemented and strengthened.
    - 1.6 Capacity building in new technologies, innovation and best forest management practices be emphasized and strengthened.

2. Recognizing the role of forest governance in enhancing forest law enforcement to achieve sustainable forest management, the Conference resolved that:
    - 2.1 Forest management certification for promoting responsible management of the forest and ensuring that forest management practices are in compliance with established forestry certification standards, be further encouraged;
    - 2.2 Up-to-date technologies be used to enhance the effectiveness of forest law enforcement;
    - 2.3 The on-going programmes to implement the Forest Law, Enforcement, Governance and Trade (FLEGT) initiatives to tackle illegal logging and illegal timber trade, and to verify legality of timber produced based on Timber Legality Assurance System (TLAS) be further studied;
    - 2.4 Forestry issues in Malaysia in relation to sustainable forest management, biodiversity conservation, environmental protection and trade be addressed in a holistic manner, taking into account the views of foresters, non-government organizations and other stakeholders.

3. Recognizing the importance of conservation of forest biodiversity, the conference resolved that:
    - 3.1 Efforts to collate and document information on rare, endangered and threatened plant and animal species be intensified;
    - 3.2 Sustainable supply of high quality seeds and other planting materials be made available to support conservation initiatives;
    - 3.3 Ecological corridors and forest connectivity among fragmented forests be given due emphasis.
    - 3.4 Law enforcement on the protection of rare and endangered flora and fauna be enhanced;
    - 3.5 More funding be made available for forest biodiversity research and conservation;

4. Recognizing the importance of forest plantations and other sources of timber for sustaining the wood-based industry, the Conference resolved that:
    4.1 Further research be carried out to produce high quality planting materials and to develop appropriate plantation silvicultural practices for enhancing the production of plantation timber;
    4.2 Involvement of the private sector and smallholders in forest plantations development be encouraged with more attractive incentives;
    4.3 Forest plantation development be further intensified;
    4.4 Improved forest engineering practices be adopted to minimize site damages as well as to maintain and to increase productivity;
    4.5 Certification of forest plantations be actively pursued
    4.6 Sharing of R&D findings and germplasm exchange among planters be encouraged.
    4.7 R&D on the utilization of plantation, mangrove and lesser known timber species be further intensified;

5. Recognizing the significant contribution of forest ecosystem services to human health and livelihoods, wildlife habitat and diversity, watershed protection, carbon storage, and recreation, the Conference resolved that:
    5.1 Potential ecotourism areas and opportunities in Malaysia be identified and promoted;
    5.2 Ecological footprints, such as carrying capacity, limits of acceptable change and life cycle analysis be evaluated in the development and management of ecotourism areas, especially those which harbour threatened and/or endangered species;
    5.3 The long term monitoring of environmental services using cost-effective methods and approaches be put in place;
    5.4 Mechanisms for the Payment for Ecosystem Services (PES) be explored and promoted, and the owners and providers of the services be duly compensated;
    5.5 The development and sustainable management of urban forest parks be encouraged;
    5.6 Sustainable financing for forest ecosystem services, such as those provided within the Central Forest Spine of Peninsular Malaysia, Heart of Borneo, and forest recreational sites, be secured;
    5.7 The private sector, including the logging industry, be encouraged to recognize and support ecosystem services of forests and that fiscal incentives be explored to encourage them to contribute financially to the protection and enhancement of ecosystem services of forests.

6. Recognizing the important role of local communities in forest management, the Conference resolved that:
    6.1 Greater participation of local communities / indigenous people in forestry related activities be encouraged;
    6.2 Greater emphasis be given to capacity building and enhancement of public awareness on the importance of forest conservation in upgrading of community livelihood;
    6.3 Innovative initiatives be undertaken to raise funds through suitable mechanisms such as PES for the maintenance and upgrading of recreational forests and nature reserves;
    6.4 Consolidated efforts be given to enhance collaboration among key agencies involved in planning and management of forest resources as well as enforcement through the National Blue Ocean Strategy (NBOS).

7. Recognizing the importance of regulating and providing legal recognition to the forestry profession in Malaysia, the Conference resolved that:
    7.1 The Forestry Profession Bill, which is still being drafted by the Institute of Foresters Malaysia (IRIM) and the Ministry of Natural Resources and Environment, be supported;
    7.2 The assistance of the Ministry of Natural Resources and Environment and the Attorney General Chambers be sought to expedite the introduction of the Forestry Profession Bill;
    7.3 The views of the state governments, which constitutionally have jurisdiction over forestry matters, be given due consideration, including their prerogative to enact their own respective statutes and regulations;
    7.4 Adequate flexibility and provisions be made in the Bill to ensure that it meets the specific needs of the state authorities;
    7.5 All qualified and eligible forestry practitioners be encouraged to join as IRIM members.

10.1 CLOSING REMARKS BY THE DEPUTY SECRETARY GENERAL (ENVIRONMENT) OF THE MINISTRY OF NATURAL RESOURCES & ENVIRONMENT, MALAYSIA, YBHG. DATUK DR. ABDUL RAHIM NIK

YBhg. Datuk Sam Mannan
Pengarah
Jabatan Perhutanan Sabah
Merangkap Pengerusi Penganjur Persidangan Perhutanan Malaysia Ke-17

YBrs. Tuan Haji Sapuan bin Ahmad
Pengarah
Jabatan Hutan Sarawak

YBhg. Dato' Haji Nor Akhirrudin bin Mahmud
Timbalan Ketua Pengarah (Dasar dan Perancangan)
Jabatan Perhutanan Semenanjung Malaysia
Para Peserta dan Pemerhati Persidangan

YBhg. Dato'-dato', Tuan-tuan dan Puan-puan yang saya hormati sekalian.

Assalamualaikum Warahmatullahi Wabarakatuh

Selamat Sejahtera dan Salam 1 Malaysia.

Terlebih dahulu saya ingin menyampaikan salam takzim daripada YBhg. Dato' Sri Zoal Azha Yusof, Ketua Setiausaha Kementerian Sumber Asli dan Alam Sekitar kerana beliau tidak dapat bersama-sama kita pada petang ini atas urusan rasmi yang lain. Saya akan membacakan ucapan bagi pihak beliau seterusnya menutup Persidangan Perhutanan Malaysia Ke-17.

Saya ingin merakamkan ucapan penghargaan dan terima kasih kepada Jawatankuasa Penganjur Persidangan Perhutanan Malaysia Ke-17 kerana sudi menjemput saya untuk menyampaikan ucapan sempena Majlis Penutup Persidangan Perhutanan Malaysia Ke-17 yang bertemakan "A Century of Forest Management: Lessons Learnt and The Way Forward" pada petang ini. Saya difahamkan bahawa persidangan pada kali ini juga bertepatan dengan peristiwa bersejarah bagi tuan rumah iaitu **Sambutan 100 Tahun Jabatan Perhutanan Sabah**. Tahniah saya ucapkan kepada YBhg. Datuk Sam Mannan dan semua warga Jabatan Perhutanan Sabah atas kejayaan sambutan yang amat bermakna ini.

Hadirin yang dihormati sekalian,

Persidangan Perhutanan yang dianjurkan secara bergilir-gilir setiap tiga tahun sekali merupakan forum yang menggabungkan warga rimbawan daripada Jabatan Perhutanan Semenanjung Malaysia, Jabatan Perhutanan Sabah dan Jabatan Hutan Sarawak. Saya difahamkan bahawa para peserta persidangan juga turut terdiri daripada pemerhati daripada agensi-agensi kerajaan, badan-badan bukan kerajaan, wakil industri, penyelidik dan ahli akademik daripada universiti dan institusi penyelidikan lain. Persidangan ini penting kerana mampu menjadi platform perkongsian idea dan fikiran serta pengalaman bagi meningkatkan perancangan, pengurusan dan pembangunan sektor perhutanan di negara ini.

Saya juga mengambil kesempatan ini untuk mengucapkan syabas dan tahniah kepada semua peserta dan pemerhati persidangan pada kali ini atas komitmen yang tinggi dan telah berjaya mengikuti sepenuhnya program persidangan yang telah bermula pada 11 November 2014. Saya telah dimaklumkan bahawa persidangan pada kali ini berjaya menarik penyertaan sejumlah hampir 600 orang peserta dan pemerhati, di mana ia merupakan satu rekod yang amat membanggakan. Tahniah kepada Jawatankuasa Penganjur kerana berjaya menyatukan warga rimbawan daripada pelbagai bidang dan latar belakang dalam persidangan kali ini. Saya amat yakin bahawa semangat dan kesungguhan yang ditunjukkan mencerminkan keprihatinan semua dalam pemeliharaan dan pemuliharaan khazanah hutan negara.

Hadirin yang dihormati sekalian,

Hutan memainkan peranan yang amat penting dalam pembangunan sosioekonomi negara sejak dahulu lagi. Pada hemat saya, tema persidangan iaitu **"A Century of Forest Management: Lessons Learnt and Way Forward"** amatlah bertepatan dan relevan pada masa ini. Hutan bukan sahaja membekalkan kita semua dengan sumber kayu-kayan bahkan sumber makanan yang mewah, menyimpan dan menghasilkan herba untuk tujuan rawatan dan perubatan.

Hutan juga menjadi tonggak utama dalam penstabilan ekosistem terutamanya dalam menangani isu perubahan iklim. Di dalam persidangan khas "Climate Summit 2014" di United Nations, New York yang disertai oleh lebih 125 ketua negara, ketua kerajaan, *business leaders* dan NGOs, peranan hutan di dalam menangani isu perubahan iklim telah diiktiraf dan dihargai. Di antara lain, kenyataan bersama *Summit* telah mensasarkan aktiviti restorasi bagi 150 juta hektar hutan yang terosot menjelang 2020 dan tambahan 200 juta hektar menjelang 2030. Kepentingan hutan sebagai sumber semulajadi yang berkekalan memerlukan pengurusan yang efisien agar keaslian hutan dan peranannya sebagai salah satu sumber pendapatan negara dapat diseimbangkan dan berkekalan bersesuaian dengan kehendak semasa masyarakat dan ekonomi negara.

Dalam mengekalkan biodiversiti hutan, program restorasi, pemeliharaan dan perlindungan adalah amat penting. Saya amat berbangga dan mengucapkan setinggi-tinggi tahniah kepada semua atas usaha dan program yang telah dijalankan. Jika di Semenanjung Malaysia terdapat projek *Central Forest Spine*, di Sabah dan Sarawak pula terdapat inisiatif *Heart of Borneo*, sebagaimana yang dinyatakan oleh YAB Ketua Menteri Sabah dalam ucapan perasmian persidangan ini, inisiatif *Heart of Borneo* merupakan program konservasi biodiversiti yang bertujuan untuk menggunakan secara berkekalan kawasan hutan dan mewujudkan jaringan ekologi hutan dan melibatkan tiga negara di Borneo iaitu Malaysia, Indonesia dan Brunei Darussalam.

Hadirin yang dihormati sekalian,

Perladangan hutan memainkan peranan yang besar dalam mengurangkan kebergantungan kita kepada sumber kayu kayan dari hutan asli. Dalam persidangan kali ini terdapat isu-isu perladangan hutan yang menjurus kepada penghasilan kayu secara mampan dan industri berasas kayu dari ladang hutan bagi menangani masalah kekurangan sumber kayu kayan, khususnya dalam sektor pembuatan perabot dan perumahan. Justeru, penglibatan aktif pihak swasta untuk turut serta dalam penubuhan ladang hutan secara komersil adalah wajar bagi memastikan hasil kayu kayan dari ladang hutan dapat dihasilkan secara berterusan.

Saya juga difahamkan bahawa persidangan pada kali ini turut membincangkan isu berkaitan perhutanan masyarakat dan pihak berkepentingan yang menyentuh penglibatan dan kesedaran mereka. Saya berpandangan bahawa isu ini merupakan isu yang sensitif dan perlu ditangani secara profesional dan holistik, dengan mengambil kira hubungan masyarakat tempatan dan pihak berkepentingan sebagai satu entiti yang mantap dan turut menyumbang kepada usaha-usaha pemeliharaan dan pemuliharaan hutan.

Hadirin yang dihormati sekalian,

Malaysia akan terus komited dan melaksanakan amalan Pengurusan Hutan Secara Berkekalan (PHSB) atau *Sustainable Forest Management* (SFM). Saya percaya sistem pengurusan hutan dan objektif yang sama dalam mentadbir dan mengurus hutan diamalkan. Justeru, saya menyeru kepada semua khususnya warga jabatan perhutanan di seluruh negara agar dapat mentadbir dan mengurus hutan secara profesional dan sistematik melalui pewujudan dan amalan persijilan hutan, aktiviti penguatkuasaan secara berterusan dan pelaksanaan polisi dan undang-undang sedia ada dengan berkesan.

Malaysia komited dalam melaksanakan Pelan Strategik Biodiversiti 2011-2020 di bawah Konvensyen Kepelbagaian Biologi (*Convention on Biological Diversity*-CBD) dan juga *Non-legally Binding Instrument* untuk semua jenis hutan di bawah Forum Perhutanan Pertubuhan Bangsa-Bangsa Bersatu (*United Nations Forum on Forests*-UNFF).

Pada tahun ini, Kementerian Sumber Asli dan Alam Sekitar telah memulakan proses mengkaji semula Dasar Kepelbagaian Biologi 1998 dan Dasar Perhutanan Negara 1992. Dalam hal ini, Kementerian amat bersukacita agar Sabah dan Sarawak dapat menyokong dan sama-sama mengambil bahagian secara aktif dalam proses pengemaskinian dasar-dasar ini.

Sidang hadirin yang saya hormati sekalian,

Persidangan selama dua hari ini menghasilkan beberapa resolusi yang telah dibentang dan diterima oleh semua peserta persidangan. Saya yakin dan percaya kesemua resolusi tersebut telah mengambil kira semua usul dan cadangan yang telah dibangkitkan semasa perbincangan. Saya juga penuh yakin bahawa YBhg. Dato'-dato'/Tuan-tuan/Puan-puan akan dapat menangani kesemua butiran resolusi yang dicadangkan.

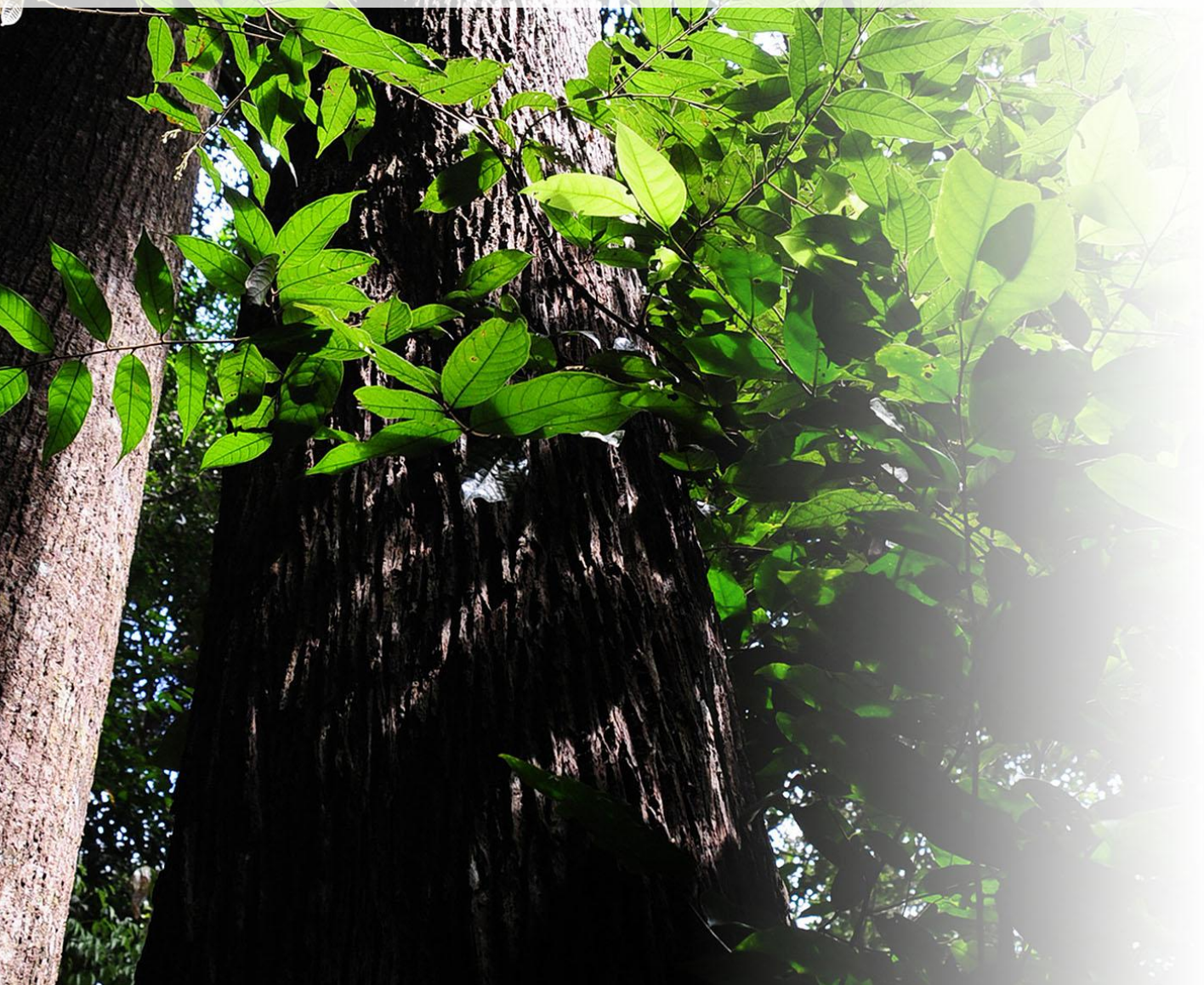
Saya ingin mengucapkan syabas kepada YBhg. Datuk Sam Mannan, Pengarah Perhutanan Sabah dan warga Jabatan Perhutanan Sabah kerana telah berjaya mengendalikan persidangan kali ini dengan begitu baik dan berkesan. Sekalung penghargaan juga kepada pegawai-pegawai persidangan yang dilantik (seperti Pengerusi-Pengerusi Sesi dan para "rapporteurs"), yang turut memastikan persidangan ini berjalan lancar. Adalah diharapkan agar semangat, kerjasama erat dan komitmen padu ini dapat diteruskan di masa-masa akan datang.

Akhir sekali, dengan lafaz Bismillahirrahmanirrahim, saya dengan sukacitanya menutup **Persidangan Perhutanan Malaysia Kali Ke-17**.

Sekian, *Wabillahitaufiq Walhidayah Wassalamualaikum Warahamtullah Wabarakatuh.*

Sekian, terima kasih.

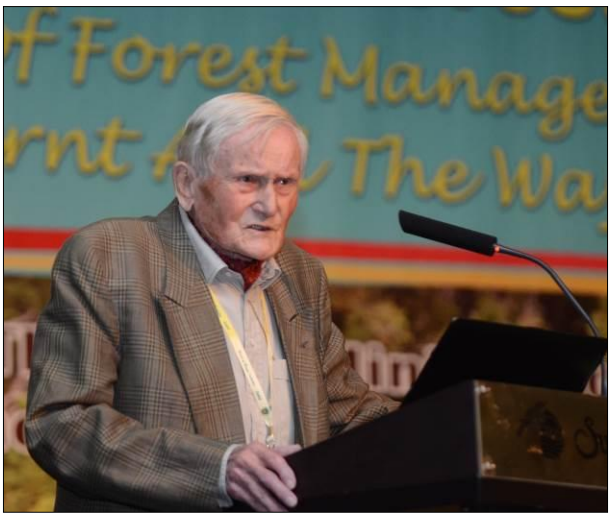
PHOTO GALLERY



OPENING CEREMONY


SARAWAK
FORESTRY

CLOSED SESSION




Spirit of Borneo


alaysian Forestry Conference

PLENARY SESSION

WORKSHOP SESSION


Meeting Room
3
FOREST BIODIVERSITY:
Restoration, Conservation and Protection


Meeting Room
4
PLANTATION FORESTRY:
Sustainable Wood Production and Wood Based Industry


MEETING ROOM
5
FOREST ECOSYSTEM SERVICES:
Food, Water, Energy, Climate and Recreation
Venue: Meeting Room 5, Level 1, TMS
Time: 3.00pm – 5.30pm

GROUPS' RECOMMENDATIONS ON CONFERENCE RESOLUTIONS









CLOSING CEREMONY




















Malaysia


MFC DINNER


Dinner Reception

SPORTS - BOWLING

PERSIDANGAN PERHUTANAN MALAYSIA

XVII

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