MALIAU BASIN CONSERVATION AREA
SABAH, MALAYSIA

STRATEGIC MANAGEMENT PLAN
2014 – 2023

DINAMIK • BERJIWA RAKYAT • KOMITED • PRIHATIN

MALIAU BASIN CONSERVATION AREA
SABAH, MALAYSIA

STRATEGIC MANAGEMENT PLAN
2014 - 2023

May 2014

Citation :

Yayasan Sabah (2014). *Maliau Basin Conservation Area: Strategic Management Plan 2014-2023.* Kota Kinabalu, Sabah: Yayasan Sabah Group.

ISBN 978-983-3987-49-8

Published by : Conservation and Environmental Management Division (CEMD),
Yayasan Sabah Group,
12th Floor, Menara Tun Mustapha,
P.O.Box 11622, Likas Bay,
88817 Kota Kinabalu,
Sabah, Malaysia.
Tel : (6)088 - 326 321
Fax : (6)088 - 432 192
Email : cemdinfo@icsb-sabah.com.my
Webpage : http://www.maliaubasin.org

CONTENTS

PART A - Current Scenario

LIST OF TABLES

LIST OF FIGURES

LIST OF BOXES

LIST OF PICTURES

LIST OF ACRONYMS AND ABBREVIATIONS

ACB	-	ASEAN Centre for Biodiversity
ASM	-	Academy of Sciences Malaysia
asl	-	Above sea level
AWS	-	Automatic Weather Station
CBD	-	Convention of Biological Diversity
CEMD	-	Conservation and Environmental Management Division
CIFOR	-	Centre for International Forestry Research
DaMaI	-	Danum, Maliau and Imbak Rainforest Complex
DANCED	-	Danish Cooperation for the Environment and Development
DANIDA	-	Danish International Development Assistance
DVCA	-	Danum Valley Conservation Area
EIA	-	Environmental Impact Assessment
EPD	-	Environmental Protection Department
F & B	-	Food and Beverages
FMU	-	Forest Management Unit
GEF	-	Global Environmental Fund
GHG	-	GreenHouse Gas
GIS	-	Geographical Information Systems
GPS	-	Global Positioning System
ha	-	Hectare (10,000 sq. metres)
HoB	-	Heart of Borneo Initiative
ICCA	-	Imbak Canyon Conservation Area
IDS	-	Institute of Development Studies, Sabah
INFAPRO	-	Innoprise-Face Foundation Rainforest Rehabilitation Project
INIKEA	-	Innoprise-IKEA Forest Rehabilitation Project
ITTO	-	International Tropical Timber Organisation
IUCN	-	International Union for Conservation of Nature
KCoL	-	Kinabatangan Corridor of Life
Kg.	-	Kampung (village)
LULUCF	-	Land Use, Land-Use Change, and Forestry
MBCA	-	Maliau Basin Conservation Area
MBMC	-	Maliau Basin Management Committee
MBSC	-	Maliau Basin Studies Centre
MBSMP	-	Maliau Basin Strategic Management Plan
MEGTW	-	Ministry of Energy, Green Technology and Water
MESCOT	-	Model Ecologically Sustainable Community Conservation and Tourism
MoCAT	-	Ministry of Culture, Arts and Tourism, Malaysia
MoNRE	-	Ministry of Natural Resources and Environment, Malaysia
MoSTE	-	Ministry of Science, Technology and the Environment
MoSTI	-	Ministry of Science, Technology and Innovation
MoTAC	-	Ministry of Tourism and Culture, Malaysia

MoTOUR	-	Ministry of Tourism, Malaysia
MTCE	-	Ministry of Tourism, Culture and Environment, Sabah
NEPCon	-	Nature, Ecology, People Consult
OSH	-	Occupational Safety and Health
PEMANDU	-	Performance Management and Delivery Unit
PES	-	Payments for Environmental Services
REDD+	-	Reducing Emissions from Deforestation and Forest Degradation
SaBC	-	Sabah Biodiversity Centre
SAFE	-	Stability of Altered Forest Environment
SAR	-	Search and Rescue
SDC	-	Sabah Development Corridor
SFD	-	Sabah Forestry Department
SEARRP	-	South East Asia Rainforest Research Programme (a set-up under the Royal Society)
SEEN	-	Sabah Environmental Education Networks
SEEP	-	Sabah Environmental Education Policy
SFMLA	-	Sustainable Forest Management Licencee Agreement
Sg.	-	Sungai (River)
SMART	-	Spatial Monitoring and Reporting Tool
SMP	-	Strategic Management Plan
SNC	-	Sabah Nature Club
SOP	-	Standard Operating Procedure
STB	-	Sabah Tourism Board
SWD	-	Sabah Wildlife Department
TDZs	-	Tourism Development Zones
UiTM	-	Universiti Teknologi MARA
UMS	-	Universiti Malaysia Sabah
UNESCO	-	United Nations Educational, Scientific and Cultural Organisation
UNDP	-	United Nations Development Programme
UNEP	-	United Nations Environment Programme
UNFCCC	-	United Nations Framework Convention on Climate Change
YS	-	Yayasan Sabah (or Sabah Foundation)
YSG	-	Yayasan Sabah Group (in English it is Sabah Foundation Group)

LIST OF APPENDICES

Acknowledgement

Foreword by YAB Chief Minister of Sabah

Preface by Chairman, MBMC

Message by Director, Yayasan Sabah

Message from Aage V. Jensen Charity Foundation

Executive Summary

INTRODUCTION

The *Maliau Basin Conservation Area: Strategic Management Plan 2014-2023* is a revised management plan of the first version, *i.e. Maliau Basin Conservation Area, Sabah: Strategic Management Plan 2003-2012* (YS, 2003). It is presented in two parts, *i.e.* Part A is on the prevailing scenario, and Part B on the way forward. Part A will detail out what has been conducted over the last decade, since 2003, including looking at the gaps and unaccomplished programmes and activities. These gaps, where relevant, are appropriately addressed in Part B of this document. This document have been formulated from gaps identified and points raised during the internal workshops held in December 2012 and September 2013, and from thematic workshops held in July and September of 2013, and eventually from the stakeholders' validation in November 2013.

THE 1st MANAGEMENT PLAN, 2003-2012

As for the first management plan, it focused more on assessing the area and surroundings, placing basic infrastructure and facilities to support the conservation efforts in Maliau Basin Conservation Area (MBCA). The management plan provides a phased Activity Plan on activities to be implemented over the 10-year period, addressing all issues identified during the development and planning process of MBCA in 2000-2003.

Most of the programmes in the Activity Plan were designed into developing MBCA as a centre for environmental research and monitoring, and environmental awareness, with facilities that can be classified as of high standards. The programmes in the plan can be broadly classified into two, *i.e.* activities-based strategies and conservation initiatives.

- *Activities-based strategies* - There were 9 activities-based strategies formulated in the plan with at total of 59 programmes supported by 234 activities on the ground; and
- *Conservation initiatives* – several initiatives were listed in the annexes of the plan, such as communications, MoU with Harvard University Herbarium, principles of bioprospecting partnerships, and process for World Heritage Site nomination.

Over the 10-year period, the achievement was encouraging, whereby all primary infrastructure essential to conduct environmental research and monitoring, and awareness with its supporting facilities were completed. Among others, it started with the ground-breaking ceremony for the Maliau Basin Studies Centre (MBSC) by HRH Prince Henri-Marie-Jean-Andre, the Prince Consort of Denmark on 17th March, 2002, to the opening of the Shell Maliau Basin Reception & Information Building on 24th April, 2007 by the Honourable Chief Minister of Sabah, and eventually the launching of MBSC by the Honourable Prime Minister of Malaysia on 29th January, 2011.

In addition, two scientific expeditions were successfully held over the years, *i.e.* the exploration in Eucalyptus Camp in 2006 by the Academy of Science Malaysia and the

Wildlife Resource Survey in 2013 that was supported by IKEA. The numbers of new records to be added to the list of flora and fauna were further improved. From 1,806 species of flora, it was increased to 1,863 species with several lower plants recorded for the first time in Sabah, and for mammals from 70 to 92 species recorded. As for birds, it was from 238 species up to 278 species. While the progress in new records for flora and fauna were encouraging, the downside of the findings were marred by ongoing threats found at the buffer zones and the core area of MBCA. These threats are encroachment into MBCA and poaching of its wildlife.

The number of visitors to MBCA increased over the years, from 242 in 2002 to that of 2,153 in 2013. These visitors can be categorised into those who were involved in trekking, simply visiting the Maliau Basin Studies Centre (MBSC) and fact-finding trips for researchers. The numbers will continue to increase in the coming years with the soon to be completed highway upgrading between Sapulut to Kalabakan, passing through the main entry point of MBCA. With the completion of the Environmental Education Complex and Belian Camp in MBSC, there are greater opportunities to implement the environmental awareness programmes in creating awareness and increasing visitors to MBCA.

By the end of the mentioned management plan, there were several new developments that appeared with regards to landuse within and outside of MBCA. Firstly, the reclassification of a new Class I forest reserve known as Maliau Buffer Zone (46,603 ha) in 2012 was indeed a welcoming news in creating additional protection to the core area, *i.e.* Maliau Forest Reserve (58,840 ha) that was gazetted in 1998. With the new reclassification, it was certainly essential to relook at the old Buffer Zone 1 (38,837 ha), and revised it to make the newly classified Maliau Buffer Zone as Buffer Zone 1. With the new Maliau Buffer Zone (*i.e.* Buffer Zone 1), the management has also been placed under the Maliau Basin Management Committee (MBMC) and this includes the addition of a new committee member, *i.e.* Sapulut Forest Development Sdn. Bhd. The original area of Buffer Zone 2 (93,959 ha) has shrunk to 86,193 ha, thus still retaining the entire area of MBCA with its two buffer zones as 191,636 ha.

THE WAY FORWARD, 2014-2023

Moving forward, Part B of this document is on the way forward for the next decade, *i.e.* 2014 till 2023. It looks at linking existing policies established by the governments (be it at state or federal level), matters related to climate change and several others. More importantly, it takes on board the unaccomplished activities or programmes identified in the earlier management plan and strengthening the capacity of staffs in managing MBCA via capacity building (human capital).

There are 11 themes, with 10 being on programmes and outputs that are to be implemented for specific purposes, while the 11th theme (*i.e.* others) is meant as cross-cutting programme that should be incorporated into the earlier themes (where relevant). The themes will cover the basic needs for development of MBCA from infrastructure,

environmental education, research to tourism and so forth. Each theme will have a few programmes and several outputs. In total there is 27 programmes and 89 outputs formulated.

The vision and mission of MBCA were formulated with the management plan, and were approved by the Maliau Basin Management Committee (MBMC) during its 14th meeting held on 16th December, 2013 in Kota Kinabalu.

Vision
To be a renown Centre of Excellence for protected area management.

Mission
Effective and vital action taken to ensure that by 2023, MBCA is recognised as a Centre of Excellence for protected area management; and ensuring that the flora and fauna assemblages contained in MBCA are protected, valued, and managed in perpetuity for the purposes of conservation, education, research and recreation.

The **objectives of MBCA** remain the same as per legislation, and are:

a. The protection in perpetuity of as much as possible of the biological diversity expressed at genetic, individual, sub-species, habitat and ecosystem levels of organisation;
b. The promotion of research into all aspects of the composition and functioning of the Reserve's ecosystem including comparative studies of disturbance and recovery processes following logging of nearby areas;
c. The promotion of education and training in conservation, natural history, ecology, forestry and related sciences;
d. The promotion of the Reserve for appropriate recreation and nature tourism, provided such activities do not significantly compromise the management objectives stated above; and
e. The integration of the objectives for the Reserve with other planned development in surrounding areas so as to create a model forest management area that combines conservation, forestry and nature tourism activities on a sustainable long-term basis.

A revision to the existing management zones (buffer zones) is made in this document and presented with management guidelines to assist the MBMC and resource manager. Another equally important zone identified is the Tourism Development Zones (TDZs). Currently, there are 5 areas earmarked for TDZs, with 4 areas within Buffer Zone 2 and one in Buffer Zone 1.These TDZs are to be managed by the MBMC, including its concession arrangements for future developers.

As for the Environmental Education programme in MBCA, there is a need to formulate and develop new modules to accommodate the potential growth in day visitors to the area.

Current programme, with support of funding by IKEA to develop the module and to be implemented by the Education team from MBCA is for duration of at least 3 days/2 nights. The proposes new programme shall be of half day duration and to be held at the main entrance of MBCA, in anticipation with the completion of the road linking Sapulut – Kalabakan will generate higher numbers of travellers passing through the main entrance, and also providing easy access for schools from these smaller towns.

The ongoing effort by the state government in nominating MBCA as a World Heritage site, within the larger Danum-Maliau-Imbak (DaMaI) Rainforest Complex, will continue to play a significant part for MBCA and the state of Sabah in its effort to protect the area. The preliminary preparation of the nomination dossier has been completed, and it is hopeful that by 2016 the nomination will be finalised by UNESCO for listing.

Also a revision to the user fees (day visitors) and introduction of concession fees are formulated. It is hopeful with the revision and introduction of these fees will potentially increase the revenues for MBCA in the future and will complement the revenue generation for the Conservation Trust Fund.

A new electronic and reservation payment system will also be introduced with credit card facilities to ease online reservation of facilities and purchases or merchandise. Privatisation on certain facilities to responsible developers may also be introduced so MBCA management can focus on the core management objectives of MBCA.

Ringkasan Eksekutif

PENGENALAN

Kawasan Pemuliharaan Lembangan Maliau: Pelan Pengurusan Strategik 2014-2023 ialah satu pelan pengurusan yang telah disemak semula dari versi pertama, iaitu Kawasan Pemuliharaan Lembangan Maliau, Sabah: Pelan Pengurusan Strategik 2003-2012 (YS, 2003). Ianya dibahagikan kepada dua bahagian, iaitu Bahagia A yang merumuskan scenario semasa, dan Bahagian B bagi perancangan masa hadapan.

Bahagian A memperincikan program-program yang telah dilaksanakan dari tahun 2003 termasuk melihat kepada kekurangan di dalam perlaksanaan program dan aktiviti. Sementara itu, Bahagian B menghuraikan penyelesaian secara terperinci bagi kekurangan yang telah dikenalpasti dalam Bahagian A. Dokumen ini telah di bentuk berdasarkan maklumbalas daripada bengkel dalaman yang telah diadakan pada Disember 2012 dan September 2013, dan daripada bengkel mengikut tema-tema yang telah dikenalpasti pada Julai dan September 2013, dan seterusnya daripada maklumbalas dan pengesahan kumpulan yang berkepentingan pada November 2013.

PELAN PENGURUSAN PERTAMA, 2003-2012

Pelan pengurusan yang pertama Lembangan Maliau lebih tertumpu kepada penilaian kawasan sekelilingnya serta pembangunan infrastruktur dan fasiliti untuk memudahkan usaha pemuliharaan di kawasan tersebut. Beberapa isu telah dikenalpasti semasa proses penubuhan dan perancangan Lembangan Maliau 2000-2003, dan justeru itu beberapa aktiviti berkala bagi tempoh 10 tahun telah disediakan di dalam pelan tersebut.

Kebanyakkan program dalam pelan aktiviti berkala tersebut telah direka bagi membangunkan MBCA sebagai pusat penyelidikan alam sekitar dan pemantauan, dan kesedaran alam sekitar dengan prasarana yang bertaraf tinggi. Program pelan aktiviti tersebut dibahagikan kepada dua:

- Strategi berasaskan aktiviti: 9 strategi dengan 59 program dan 234 aktiviti telah di bentuk;

- Inisiatif pemuliharaan: beberapa inisiatif telah disediakan seperti yang dilampirkan di dalam laporan tersebut dan diantaranya adalah komunikasi, memorandum persefahaman (MoU) dengan Herbarium Universiti Harvard, prinsip perkongsian bio prospek, dan proses pencalonan untuk Tapak Warisan Dunia.

Kebanyakkan infrastruktur utama untuk menjalankan aktiviti penyelidikan alam sekitar, pemantauan dan program kesedaran dalam tempoh 10 tahun tersebut telah tercapai. Antara lain, ia bermula dengan program pecah tanah Pusat Kajian Maliau Basin (MBSC) oleh Putera Henri-Marie-Jean-Andre, Putera Consort Denmark pada 17 Mac 2002, diikuti dengan perasmian bangunan Shell Maliau Basin Reception & Information pada 24 April

2007 oleh YAB Ketua Menteri Sabah, dan seterusnya perasmian MBSC oleh YAB Perdana Menteri Malaysia pada 29 Januari 2011.

Sebagai tambahan, dua ekspedisi saintifik telah berjaya di laksanakan sepanjang tempoh ini, iaitu penerokaan di Kem Eucalyptus pada 2006 oleh Akademi Sains Malaysia dan Inventori Sumber Hidupan Liar pada 2013 yang di sokong oleh IKEA. Jumlah rekod terbaru flora dan fauna telah perbaiki. Daripada 1,806 spesis flora, ia telah meningkat kepada 1,863 spesis dengan beberapa rekod baru untuk tumbuhan rendah yang dijumpai serta yang pertama kali di rekodkan di Sabah, dan bagi mamalia dari 70 ke 92 spesis di rekodkan. Manakala bagi spesis burung, dari 238 ke 278 spesis di rekodkan. Walaupun rekod penemuan spesis flora dan fauna amat menggalakkan, namun penemuan tersebut juga dicemari dengan beberapa ancaman seperti aktiviti pemburuan haram dan pencerobohan hutan yang berlaku di sekitar zon penampan dan kawasan teras.

Bilangan pelawat MBCA telah bertambah daripada 242 pelawat pada 2002 kepada 2,153 pada 2013. Pelawat ke Lembangan Maliau boleh dibahagikan kepada kumpulan merentas hutan, melawat MBSC dan program penelitian awal bagi penyelidikan. Jumlah ini dijangka akan terus meningkat dalam tempoh terdekat setelah kerja menaiktaraf jalan raya antara Sapulut ke Kalabakan siap sepenuhnya yang akan melalui pintu masuk utama MBCA. Dengan siapnya Kompleks Pendidikan Alam Sekitar dan juga Kem Belian di MBSC, peluang untuk melaksanaan program kesedaran awam dan pendidikan alam sekitar dapat dilaksanakan.

Di penghujung tempoh pelan pengurusan ini terdapat beberapa perkembangan baru berkenaan dengan penggunaan tanah di dalam dan di luar MBCA. Pertamanya, reklasifikasi Hutan Simpan Kelas I yang dikenali sebagai Zon Penampan Maliau (46,603 ha) pada tahun 2012 yang sememangnya amat dialukan dalam membentuk kawasan perlindungan tambahan bagi kawasan teras Maliau (Hutan Simpan Maliau, 58,840 ha yang diwartakan pada tahun 1998). Dengan pengklasifikasian tersebut, penilaian semula terhadap zon penampan Maliau yang lama (38,837ha) perlu dilihat semula untuk membolehkan ianya diklasifikasikan sebagai zon penampan I. Dengan pengelasan zon penampan yang baru tersebut, sistem pengurusan telah diletakkan di bawah Jawatankuasa Pengurusan Lembangan Maliau Basin (MBMC) dan ianya merangkumi penambahan ahli jawatankuasa baru, Sapulut Forest Development Sdn Bhd. Manakala kawasan asal zon penampan 2 (93,959 ha) telah berkurang ke 86,193ha, akan tetapi jumlah keseluruhan kawasan MBCA dengan dua zon penampannya masih kekal pada 191,636ha.

LANGKAH KE HADAPAN, 2014-2023

Bahagian B dokumen ini memperincikan halatuju MBCA bagi dekad seterusnya iaitu 2014 – 2023. Ia melihat kepada dasar-dasar yang sediaada diperingkat negeri dan persekutuan, dan isu berkenaan perubahan iklim dan lain-lain. Lebih penting lagi, ia akan menghuraikan dengan terperinci aktiviti dan program daripada pelan pengurusan yang

terdahulu yang tidak tercapai dan memperkasakan keupayaan kakitangan dalam mengurus dan mentadbir MBCA melalui program pembangunan modal insan.

Terdapat 11 tema, yang mana 10 daripadanya terdiri daripada program-program serta hasil yang akan di realisasikan bagi tujuan tertentu, manakala tema yang ke 11 (lain-lain) bertindak sebagai sebuah program yang diserapkan kepada tema-tema tersebut. Tema ini merangkumi keperluan asas bagi pembangunan MBCA dari segi infrastruktur, pendidikan alam sekitar, penyelidikan, pelancongan dan lain-lain. Setiap tema akan mempunyai beberapa program dan hasil. Secara keseluruhannya, ianya mempunyai 27 program dan 89 hasil.

Visi dan misi MBCA telah dirangka dalam pelan pengurusan ini, dimana ianya telah diluluskan oleh Jawatankuasa Pengurusan Maliau Basin (MBMC) pada mesyuarat jawatankuasa kali ke-14 yang telah diadakan pada 16 Disember 2013.

Visi
Untuk menjadi Pusat Kecemerlangan yang terkenal bagi pengurusan kawasan terlindung.

Misi
Tindakan yang berkesan dan penting diambil untuk memastikan menjelang tahun 2023 MBCA akan diiktiraf sebagai Pusat Kecemerlangan bagi pengurusan pawasan terlindung; dan memastikan kepelbagaian flora dan fauna yang terdapat di MBCA dilindungi, dinilai, dan diurus dengan mampan untuk tujuan pemuliharaan, pendidikan, penyelidikan dan rekreasi.

Objektif MBCA kekal seperti yang termaktub di dalam perlembagaan, iaitu:

a. Perlindungan untuk selama-lamanya seberapa banyak yang mungkin kepelbagaian biologi, dijelaskan secara genetic, individu, sub-spesis, sepsis, habitat dan peringkat-peringkat okosistem organisasi;
b. Pemajuan penyelidikan kepada semua aspek komposisi dan memfungsikan ekosistem Simpanan itu termasuk pengajian perbandingan gangguan dan proses-proses pemulihan berikutan dengan pembalakan di kawasan-kawasan yang berhampiran;
c. Pemajuan pelajaran dan latihan dalam pemeliharaan, sejarah asli, ekologi, perhutanan dan sains yang berkaitan;
d. Pemajuan Simpanan itu bagi rekreasi yang sesuai dan pelancongan alam, dengan syarat aktiviti-aktiviti tersebut tidak secara maksud mengkompromi matlamat-matlamat pengurusan yang dinyatakan di atas; dan
e. Integrasi matlamat-matlamat tersebut di atas bagi Simpanan itu berserta dengan pemajuan kawasan persekitaran yang dirancang untuk mencipta contoh kawasan pengurusan hutan yang mencantumkan pemeliharaan, perhutanan dan aktiviti-aktiviti pelancongan alam atas asas jangka panjang yang berkekalan.

Semakan semula kawasan zon pengurusan sediaada (zon penampan) juga di buat dalam dokumen ini dan disertakan dengan garis panduan untuk membantu MBMC dan pengurus sumber. Satu lagi zon sama penting yang dikenal pasti ialah Zon Pembangunan Pelancongan (TDZs). Pada masa ini, terdapat 5 kawasan yang tersenarai bagi TDZs, dengan empat kawasan dalam Zon Penampan 2 dan satu di Zon Penampan 1. Zon Pembangunan Pelancongan ini akan diuruskan oleh MBMC, termasuk pengurusan konsesi untuk pemaju-pemaju.

Bagi program Pendidikan Alam Sekitar di MBCA, terdapat keperluan untuk merangka dan membangunkan modul baru untuk menampung potensi penambahan bilangan pelawat ke MBCA. Ketika ini dengan adanya tajaan daripada IKEA untuk penyediaan modul untuk dilaksanakan oleh unit pendidikan MBCA bagi tempoh 3 hari/ 2 malam. Program baru yang di cadangkan adalah untuk tempoh setengah hari yang boleh diadakan di pintu masuk utama Maliau, sejajar dengan siapnya jalan yang menghubungkan Sapulut – Kalabakan pengguna jalan yang melalui pintu utama Maliau dijangka akan bertambah. lanya juga menyediakan laluan mudah untuk sekolah-sekolah dari kawasan berhampiran MBCA.

Usaha berterusan yang dilakukan oleh kerajaan negeri dalam mencalonkan MBCA sebagai tapak Warisan Dunia, merangkumi Danum-Maliau-Imbak (DaMaI) Kompleks Hutan Hujan, akan terus memainkan peranan penting untuk MBCA dan negeri Sabah dalam usaha untuk melindungi kawasan tersebut. Penyediaan awal dosir pencalonan itu telah pun siap, dan diharap menjelang 2016 pencalonan akan dimuktamadkan oleh UNESCO untuk penyenaraian.

Semakan kepada yuran pengguna (Pelawat hari) dan pengenalan yuran konsesi juga telah diwujudkan. Ia berharap dengan semakan dan pengenalan yuran tersebut akan dapat meningkatkan pendapatan MBCA pada masa akan datang dan akan melengkapkan penjanaan pendapatan bagi Dana Pemuliharaan.

Sistem baru bagi pembayaran elektronik dan tempahan juga akan diperkenalkan dengan kemudahan kad kredit untuk memudahkan tempahan talian dan bagi pembelian cenderamata. Penswastaan bagi kemudahan tertentu kepada pemaju yang bertanggungjawab juga akan diperkenalkan agar pengurusan MBCA boleh memberi tumpuan kepada objektif teras pengurusan MBCA.

PART A – CURRENT SCENARIO

CHAPTER 1 GENERAL INTRODUCTION

1.1. Introduction

This report presents the revised management plan of Maliau Basin Conservation Area (MBCA). Presented in two parts, i.e. Part A is on the existing scenario, and Part B on the way forward.

Briefly, **Part A** describes what has been conducted over the last decade, since 2003, including looking at the programmes and activities. Several gaps and unaccomplished programmes were identified during a 2-day workshop held in 2012, and these gaps and unaccomplished programmes are to be addressed in Part B.

Part B of this document is on the way forward for the next decade, i.e. 2014 till 2023. It looks at linking existing policies established by the governments (be it at state or federal level), matters related to climate change and several others. More important, it takes on board the unaccomplished activities or programme identified in the earlier management plan.

1.2. Background

Maliau Basin derived its name from the Murut word *Maliau* for murky or milky, a direct reference to the Maliau River while having other definition of the same word for bowl or basin. The basin is also called "Land of the Giant Staircases" by the Murut people, believed to be derived from the basin's land formation for being step-like and also its many waterfalls.

The 58,840 ha Maliau Basin Conservation Area (MBCA) is located in South Central-interior of Sabah at about 4° 50' North and 116° 55' East (**Figure 1.1**), within the Forestry District of Tibow. The conservation area includes the basin itself and the outer slopes of most of its circumference.

The Maliau Basin's spectacular crater-like landform is bounded by formidable escarpments that are near vertical in places, reaching a height of over 1,675 m asl, and a depth of close to 1.0 km from the highest ridge to the lowest point of the basin. This altitudinal range from under 300 m to almost 1,700 m provides a gradation of intact forest formations from lowland dipterocarp to upper montane, most of which is completely pristine. The basin's interior is low and accessible only through the rugged Maliau Gorge in the southeast.

The basin's diameter which span up to 25.0 km is bounded by a mountainous rim at 1,500-1,700 m above sea level acting as a natural barrier, which isolates and preserve the inner rim's immense flora and fauna biodiversity from the outside world – a self-contained ecosystem. The basin's interior is connected with the outside world only via the Maliau

Gorge which is the lowest altitude located at the South-East part of the basin, hence the name "Sabah's Lost World".

The *Maliau Basin Conservation Area: Strategic Management Plan 2003-2012* (YS, 2003) was one of the major outputs under the 4-year project known as the "Management of Maliau Basin Conservation Area". In October 1998, it was agreed upon as a Malaysian – Danish government-to-government co-operation project in the field of environment (biodiversity), and implemented by Yayasan Sabah Group (YSG) with financial and technical assistance from the Danish Cooperation for the Environment and Development (DANCED) and Danish International Development Assistance (DANIDA).

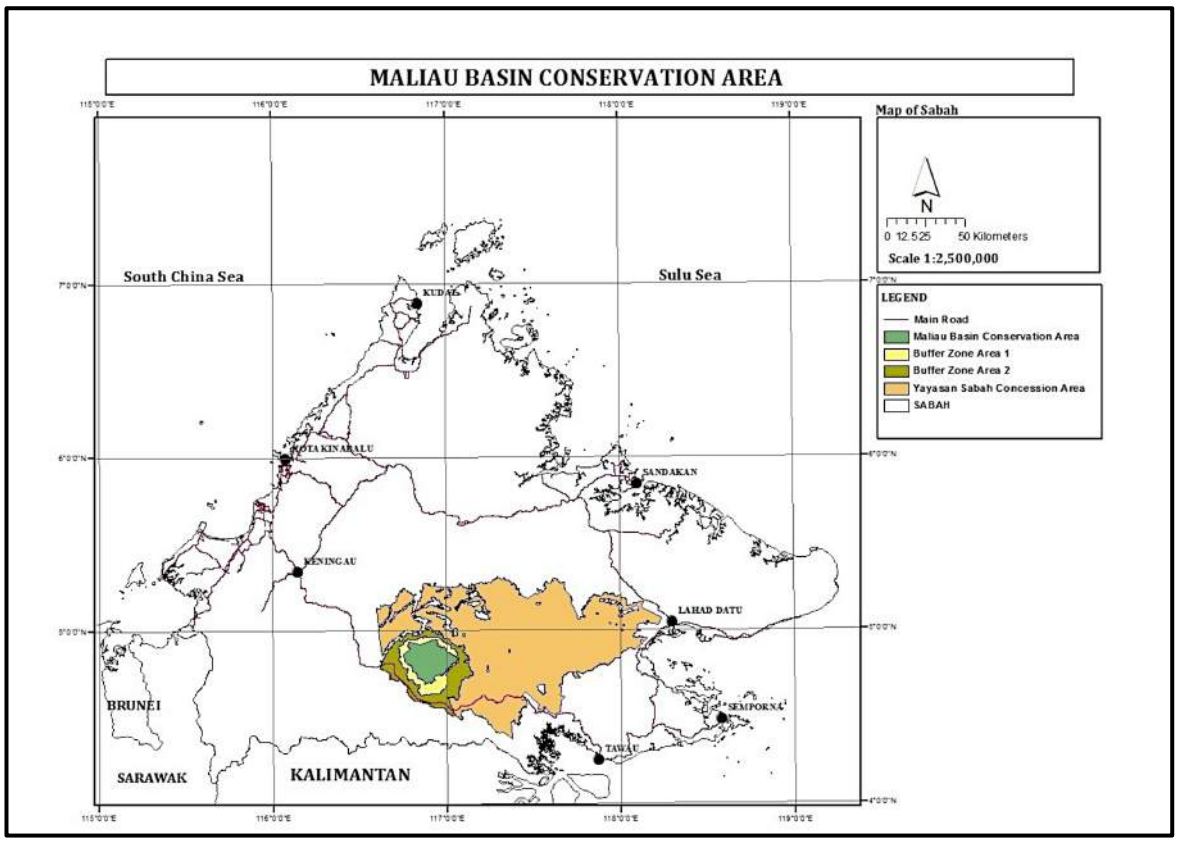


Figure 1.1: Location of Maliau Basin Conservation Area (MBCA)

The 10-year document provides the framework of activities to be implemented, addressing all issues that were identified by stakeholders. As the lifespan of the management plan ended in 2012, there is a need to provide continuity in managing MBCA for the next decade.

1.2.1. Accessibility

Accessibility to MBCA is either by road from Kota Kinabalu via Keningau or from Tawau via Kalabakan. It is about 200 km from Tawau, and 175 km from Keningau (refer to **Figure 1.1**).

Tawau, the third largest town in Sabah, is strategically located as the main gateway to MBCA. With the completion of the new airport in Balung, bigger aircrafts are now able to land, assisted with complete night navigation system.

The road between Sapulut and Kalabakan is being upgraded and this will improve accessibility to the area, upto the Security Gate. Currently, the overland travelling time from Kota Kinabalu to the Security Gate is about 5 hours, whilst from Tawau is about 3.5 hours. With the completion of the surfaced road between Sapulut and Kalabakan in 2014, the total travelling time would be reduced.

1.3. Historical Development of Maliau Basin Conservation Area (MBCA)

The first printed record for Maliau Basin was in 1947 in the Borneo Bulletin, whereby it was reported that a pilot had narrowly avoided crashing into (what turned out to be) the cliffs of the basin's northern rim. Following that unexpected discovery, much attention has been given to Maliau since then (refer to **Box 1.1**).

In 1970, an initial area of 39,000 ha (known as Maliau Basin) was incorporated into part of the 1.0

Box 1.1: Chronology of MBCA

1947	First discovered by a pilot;
1970	Maliau Basin as part of Gunung Rara Class II (Commercial Forest) was incorporated into Yayasan Sabah Concession Area;
1972	Forestry Department team reached Lake Linumunsut at the foothill of Mt. Lotung;
1981	Designated as Conservation Area;
1988	First major scientific expedition to the Basin by Yayasan Sabah Group (YSG) and WWF-Malaysia;
1993	Camel Trophy Camp completed;
1996	Second major scientific expedition by Universiti Malaysia Sabah (UMS) and YSG;
1997	Gazetted as Class I (Protection Forest);
1998	Gazettement of the *Forest (Maliau Basin Conservation Area) Rules 1998*, establishing the Maliau Basin Management Committee (MBMC);
1999	Work started by YSG and DANCED on a 4-year project "Maliau Basin Conservation Area, Sabah";
	Gazetted as cultural heritage site under the *Cultural Heritage (Conservation) Enactment, 1997*;
2001	Major expedition to Lake Linumunsut;
	Ground breaking ceremony for the Maliau Basin Studies Centre on 17th March by HRH the Prince Consort of Denmark, Prince Henrik-Marie Jean Andre (aka Prince Henrik);
2003	Completion of YS-DANCED project;
	Honourable Prime Minister mentioned on efforts to nominate MBCA as a World Heritage Site during the motion to table the Mid-term Review of the Eight Malaysia Plan (8MP) on 30th October.
2006	Third major scientific expedition to Eucalyptus Camp (15-24 June 2006), jointly organised by the Academy of Sciences Malaysia (ASM) and YSG.
2007	Honourable Chief Minister of Sabah officially opened the Shell's Maliau Basin Reception & Information Centre on 24th April.
	It was announced that the state government is making effort to make MBCA a World Heritage Site.
2011	Official launching of Maliau Basin Studies Centre by the Honourable Prime Minister of Malaysia on 29th January.
	In addition, it was also announced that the Malaysian government seek the recognition from UNESCO for MBCA to be listed as a World Heritage Site.
2012	Protection of additional area adjacent to MBCA, totalling 46,603 ha, reclassifying of Class II (Commercial forest) to Class I (Protection forest) adjacent to MBCA;
	Official agreement between YSG and NEPCon to prepare a revision on the management plan of MBCA, was sealed in December.
2013	Fourth major scientific expedition to assess the wildlife resources in the core area and buffer zones (10th June-24th June 2013) organised in collaboration with Sabah Wildlife Department

million ha timber concession within Yayasan Sabah Concession Area (refer to **Figure 1.1**), and within the Gunung Rara Class II (Commercial forest) (Hazebroek *et al.*, 2004). Yayasan Sabah Group (YSG) (initially known as Yayasan Sabah) is an organisation formed in 1966 through the *Sabah Foundation Enactment 1966* by the State Legislative Assembly, with the objective towards the "advancement of education and the relief of poverty and other charitable purposes for the benefit of the peoples of Sabah…".

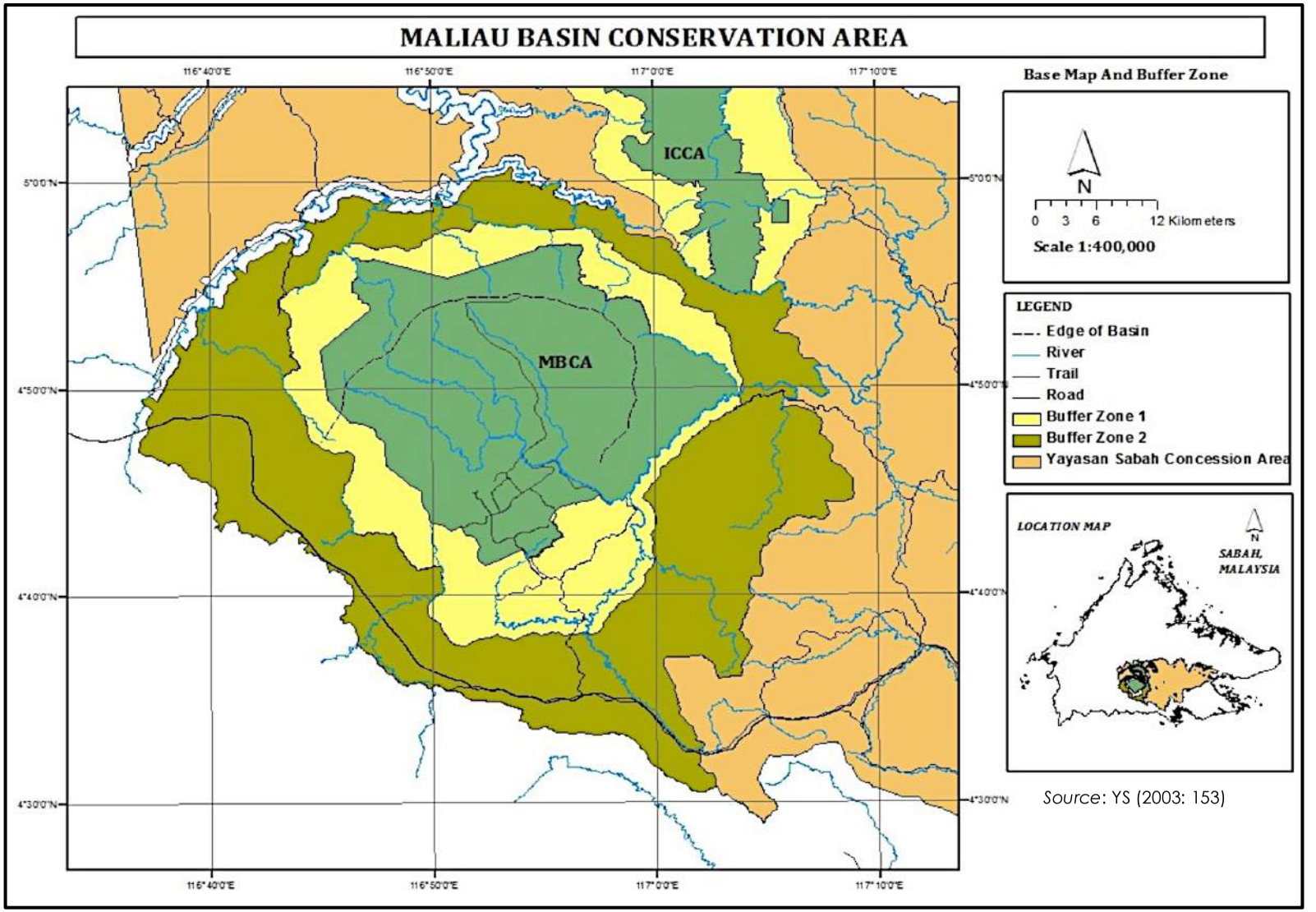
In 1981, Yayasan Sabah voluntarily designated Maliau Basin as a conservation area for the purposes of research, education and training and the State Cabinet approved the conservation area status for Maliau in 1984, and following that in 1997 the State Legislative Assembly gazetted the whole area as a Class I (Protection forest) and increasing the total area size to 58,840 ha to include the outer slopes and Lake Linumunsut (GoS, 1998), and excising it from the Yayasan Sabah timber concession area. Eventually, an area of 191,634.0 ha was established under MBCA, i.e. comprising of the core area with 58,840 ha and another 132,794.0 ha for its buffer (Greer, 2002) (refer to **Table 1.1** and **Figure 1.2**). Under the earlier management plan (YS, 2003), the buffer zones were mentioned as 39,000 ha (Buffer Zone 1) and 94,000 ha (Buffer Zone 2). The exact figures were derived from detailed GIS outputs (Greer, 2002), and will now be used in the report.

In 1998, with the gazettement of the *Forest (Maliau Basin Conservation Area) Rules 1998*, it officially established the Maliau Basin Management Committee (MBMC) (refer to **Appendix A**), whose main role is to supervise the protection and development of the area, with Yayasan Sabah appointed as the day-to-day manager of the conservation area. The primary purpose of Buffer Zone 1 is "to extend and prioritise conservation objectives" (Greer, 2002: 14), and Buffer Zone 2 is to allow development activities to take place that are compatible with the overall conservation objectives of MBCA. The functions of Buffer Zones 1 & 2 are well described by Greer (2002)

Table 1.1: The overall area of Maliau Basin Conservation Area (MBCA)

Description	**Area (ha)**	**Total (ha)**
Maliau Basin Forest Reserve (Core Area)	58,840.0	58,840.0
Buffer Zone 1	38,837.0	132,794.0
Buffer Zone 2	93,957.0	
Grand Total (ha)		**191,634.0**

The highlight of MBCA was the official launching of the Maliau Basin Studies Centre (MBSC) by the Honourable Prime Minister of Malaysia on 29th January, 2011 (refer to **Picture 1.1**).



Source: YS (2003: 153)

Figure 1.2: MBCA – core area and its buffer zones

Picture 1.1: Opening ceremony of MBSC by the Honourable Prime Minister on January 29, 2011

In 2012, an area of 46,603 ha was reclassified to Class I (Protection) Forest Reserve for the purpose of water catchment protection as well as its high conservation value (GoS, 2012). A detailed elaboration of this reclassification from Class II to Class I, known as the Maliau Basin Buffer is presented in **section 4.2**.

Prior to the development of the first Management Plan in 2003, several scientific expeditions were organised by Yayasan Sabah Group (YSG); in 1988 jointly with WWF-Malaysia (Marsh, 1989). With the success of the first expedition, two subsequent expeditions were held in 1996 with Universiti Malaysia Sabah (UMS) (Mohamed *et al*., 1998) and the Lake Linumunsut expedition in 2001. After the completion of the first Management Plan, the third scientific expedition was held at Eucalyptus Camp jointly organised by YSG and ASM in 2006 (Ibrahim Komoo *et al*., 2010), and subsequently in June 2013, a major wildlife resource survey was conducted jointly between YSG and Sabah Wildlife Department to assess the biodiversity of Maliau for the formulation of the new management plan (2014 - 2023). It was funded by IKEA from Sweden.

1.4. Forestry in Sabah

With regards to forested areas in Sabah as of 2012, a total of 4.13 million ha are managed by the relevant agencies as forest reserves, parks and sanctuary (refer to **Table 1.2** and **Appendix B**) (SFD, 2013a). These forested areas represent 56.1% of the total land area of

Sabah (whose total land area is 7,363,300 ha or 73,633 sq. km) (NRO, 2010b). Over the years, there has been an increased on forest reserves over the decade, from 3,594,072.0 ha in 1999 to that of 3,609,249.0 ha in 2012. Significant reduction in Class II (Commercial) forest reserve is observed (from 2.6 million ha in 1999 to that of 2.2 million ha in 2012), with increasing efforts increating more Class I (Protection) forest reserve to double of that in 1999, i.e. from 0.34 million ha to that of 0.77 million ha in 2012.

Table 1.2: Forested areas in Sabah

Description	1999[1]	2012[2]	
	Area (ha)	Area (ha)	Total (ha)
1. Forest Reserves			
Class I – Protection Forest Reserve	342,216.0	773,705.74	3,609,249.55
Class II – Commercial Forest Reserve	2,685,119.0	2,241,501.00	
Class III – Domestic Forest Reserve	7,355.0	6,919.00	
Class IV – Amenity Forest Reserve	20,940.0	15,725.45	
Class V – Mangrove Forest Reserve	316,024.0	331,620.12	
Class VI – Virgin Jungle Reserve	90,209.0	102,043.24	
Class VII – Wildlife Reserve	132,653.0	137,735.00	
2. Parks & Wildlife Sanctuary			
Parks	Not available	245,172.00	274,269.49
Wildlife Sanctuary		26,243.49	
Wildlife Conservation Area		2,854.00	
3. Timber Plantation			
Sabah Forest Industries	Not available	118,000.00	244,722.15
SAFODA		66,104.15	
SSSB		60,618.00	
Grand Total (ha)			**4,128,241.19**

Sources: [1]YS (2003: 39-40), [2]SFD (2013a: 169)

In terms of revenue, the annual revenue for SFD has been declining from RM1,258.0 million in 1999, to RM336.2 million in 2003 and eventually RM176.5 million in 2012 (SFD, 2013a). As for 2013, Sabah is expected to record low forest revenue of RM120.0 million, which will be lowest since 1973, and would continue to fall to about RM50.0 million per annum for the next 20 years before rising again.

1.5. Purpose of Review

The first management plan, i.e. *Maliau Basin Conservation Area, Sabah: Strategic Management Plan 2003-2012* (YS, 2003), was approved and adopted by the Maliau Basin Management Committee (MBMC) during the 6th MBMC meeting in January 2003.

Over the years, there have been many changes surrounding MBCA in terms of landuses, with potential new issues that need to be considered. At the state level, with the completion and approval of the Species Action Plans prepared by Sabah Wildlife Department (SWD), which were officially launched in January 2012, there was growing concern for the protection of biodiversity in Sabah. Among others, the species action

plans were meant for the long-term conservation of the Borneo Pygmy Elephant (SWD, 2011a), Sumatran Rhino (SWD, 2011b) and Orangutan (SWD, 2011c).

The reclassification of 46,603 ha of Class II forest reserve to Class I forest reserve (i.e. known as the Maliau Buffer Zone) in 2012 is to be considered under the revised management zoning of MBCA. Changes in landuse surrounding MBCA are to be taken into account, especially with the introduction of mosaic planting and agroforestry adjacent to MBCA. A 6-year project by the Government of Malaysia and UNDP-GEF is currently at its inception stage, and several models are being introduced in the multiple forest landscape project. While the analysis on climate condition in MBCA did not generate significant changes, it is necessary to increase data collection from different locations in MBC (including the buffer zones) in order to generate reliable long-term data. These data are essential to monitor potential climate change in the area, as a consequence of the changes in landuse surrounding MBCA, e.g. the forest stratum in Buffer Zones 1 & 2.

The need to address several gaps on communication, protection of the site and enforcement are to be taken into account in preparing the revised management plan. Illegal activities (e.g. encroachment, harvesting of *gaharu* and wildlife) were recorded during the Wildlife Resource Survey 2013. If these activities are not curbed, there is certainly an impact on the food chain and thus contributing to the potential loss of biodiversity.

Hence, with the expiry of the management plan, an updated plan is essential to guide resource manager to manage the area appropriately. The updated management plan for MBCA will:

- Take into account new development in the surrounding area and merging issues;
- Ensure that it will achieve regional recognition as a training centre for protected areas management;
- Strengthen the environmental education and awareness programmes;
- Increase research capacity;
- Aim to accommodate increasing community involvement, and the greater public awareness and support for the area; and
- Take into account the prospect of establishing a long-term basic climate change monitoring.

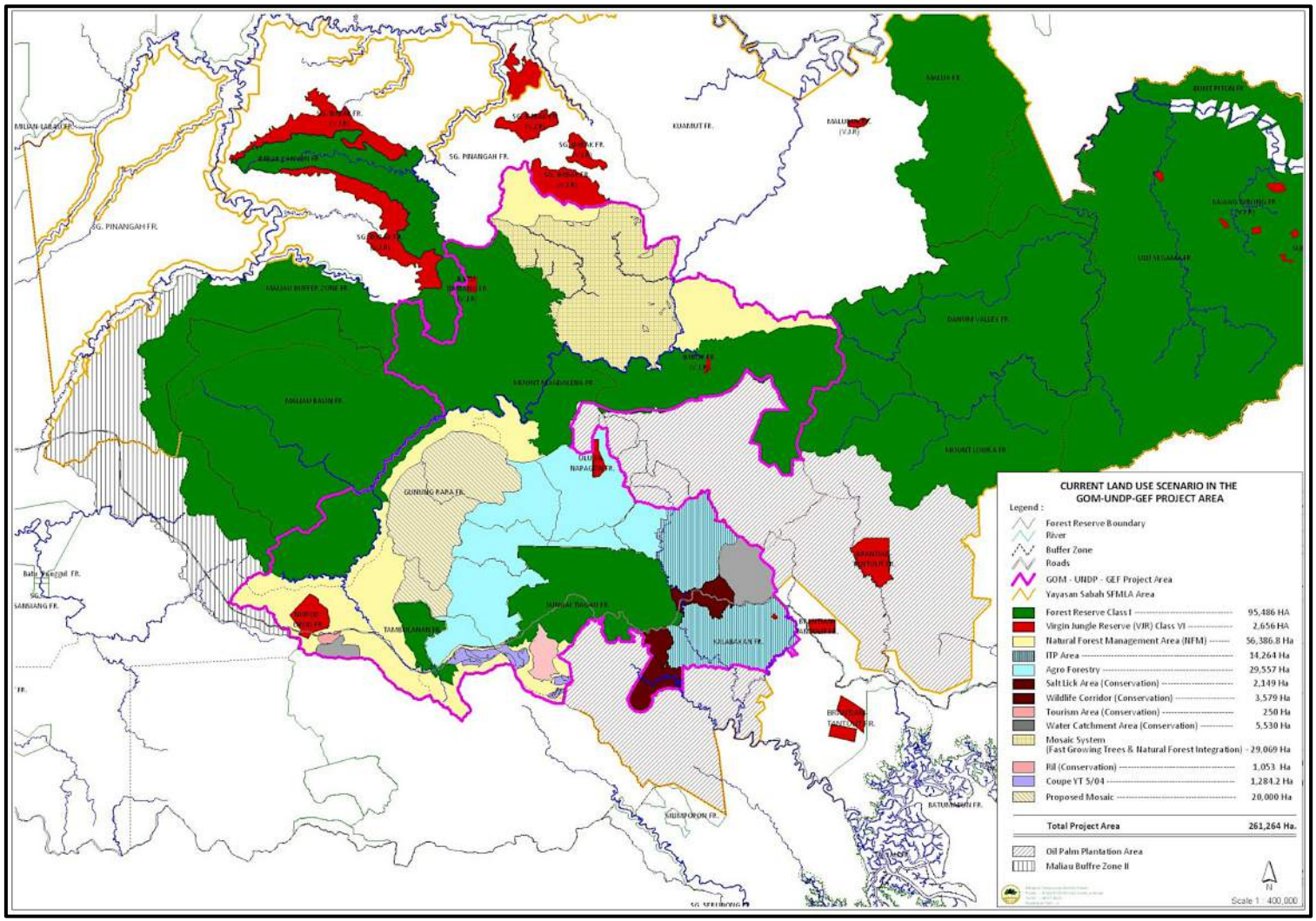


Figure 1.3: MBCA and current landuse surrounding it (January 2014)

1.6. Objectives of the Strategic Management Plan 2014-2023

The overall purpose in preparing the Strategic Management Plan 2014-2023 is to maintain and improve protection and conservation of MBCA and its buffer, while establishing clear, prioritised management strategies and actions for the area.

In addition, there are several objectives of the strategic management plan, such as to:

- Update on ongoing efforts in research, environmental education and tourism programmes of MBCA;
- Develop MBCA as a Centre of Excellence for protected areas management;
- Contribute to effective holistic management of MBCA by the Conservation & Environmental Management Division (CEMD) of the Yayasan Sabah Group (YSG);
- Facilitate the preparation of an annual workplan and budget and annual reports for the resource manager and the MBMC;
- Encourage opportunities for low impact, environmental educational programmes
- Provide opportunities, compatible with the nature conservation purposes of MBCA, for appropriate community support and participation in management programmes;
- Strengthening the sustainable management of the MBCA buffer zones and the ecological coherence or connectivity with the other conservation areas (Imbak, Danum, possibly Silam) in order to promote a biological corridor, *cf*. the World Heritage; and
- Promote the values of MBCA for the purpose of long-term sustainable finance.

Box 1.2: Purpose of a Management Plan

In brief, it is simply a document that:

- Provide a framework primarily aimed to guide the resource manager;
- Provide objectives of the site management;
- Identify issues that affects the integrity of MBCA, and its ecological character;
- Resolving identified and potential issues or conflicts;
- Provide monitoring requirements;
- Identify and described the management required to achieve the objectives;
- Maintain continuity of effective management;
- Enable communication within or between sites, organisations and stakeholders; and
- Ensure compliance with state, national and international policies.

This management plan should therefore be viewed as a mechanism to both maintains the values and attributes of MBCA, and to meet the potential obligations under the World Heritage Site listing. Since the plan is a dynamic document, it is essential to review the progress within 5 years of commencement.

1.7. Methodology

Different methods of data collection were utilised, including gathering secondary data from available publications and records. Notes from discussions, be it from minutes of meeting, consultation or workshop are all taken into account.

1.7.1. Processes

Preliminary discussion was held between Conservation and Environmental Management Division (CEMD) of Yayasan Sabah Group with NEPCon – a Danish-registered non-profit organisation in 2012 to potentially form a partnership in reviewing the old management plan, and to facilitate in raising funds towards its preparation (refer to **Figure 1.2**). In December 2012, an agreement was sealed for NEPCon (http://www.nepcon.net/117/English/About/) to participate in the review and update of the old management plan, with a substantial funding of RM1.2 million (Euro294,875) from the Aage V. Jensen Charity Foundation of Denmark (http://www.avjcf.org/). The MOU was officially signed on 8th July, 2013.

A Strategic Management Plan internal workshop to review the old management plan was conducted internally on 13th & 14th December, 2012 in Kota Kinabalu. About 50 staffs from CEMD, and in particular those having links with MBCA, attended the 2-day workshop, with facilitation by NEPCon. **Figure 1.2** illustrates the planning process undertaken in the preparation of the management plan.

Subsequent to the internal workshop, further discussions were held including the thematic workshops with key stakeholders in July and September of 2013. The themes were research, tourism, fundraising, web-strategy and biodiversity with carbon. Inputs from experts were collated during the workshop. It was later followed by another internal discussion on 6th November, 2013 to formulate the action plan, capturing into different themes, programmes and potential outputs.

The proposed themes, programmes and outputs were presented for validation with stakeholders on 14th November, 2013. The stakeholders comprised of public agencies, the private sectors and head of communities from the surrounding of MBCA.

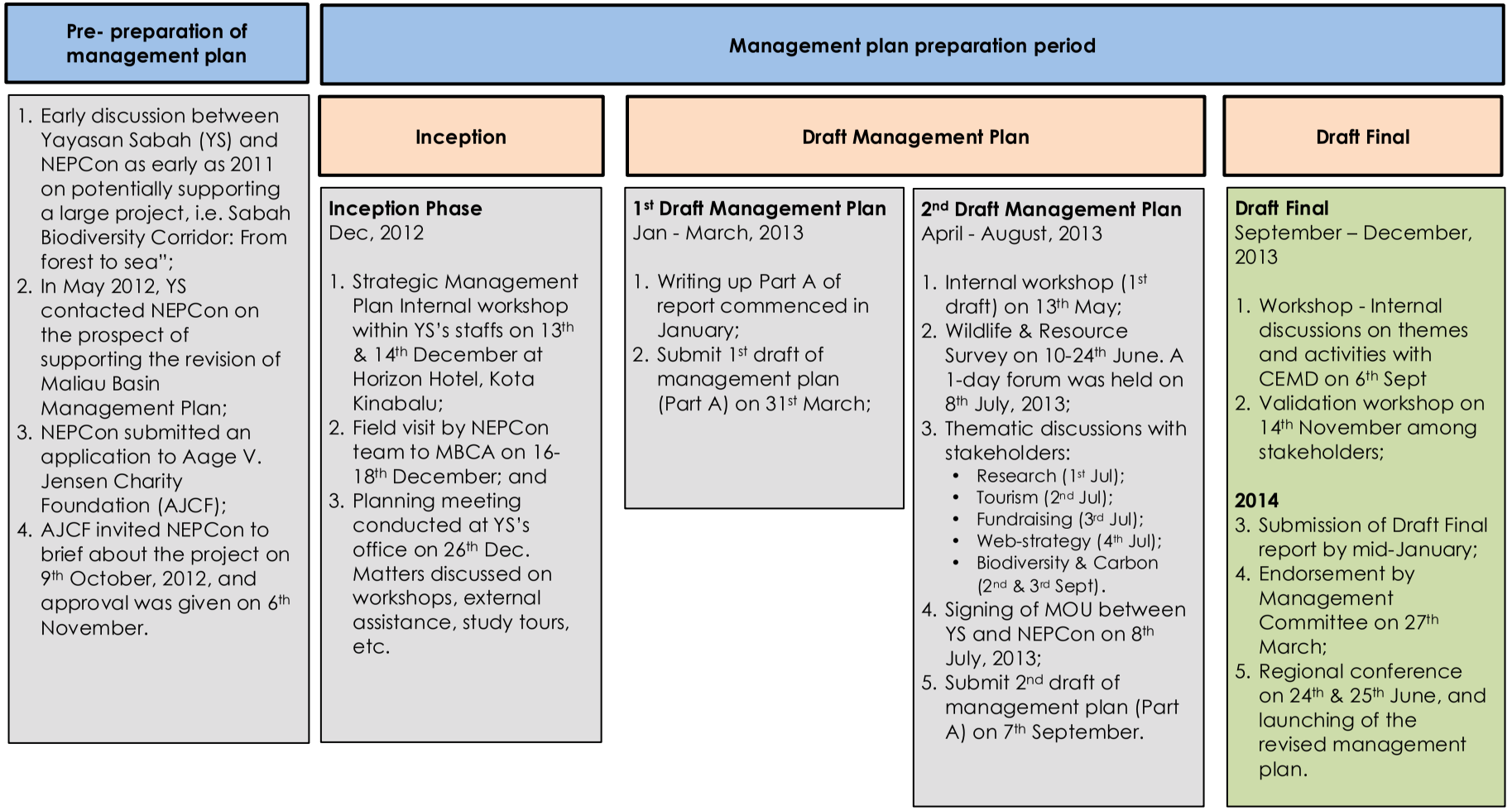


Figure 1.4: The planning process in the preparation of the management plan

1.7.2. Scope of Work

In addition to reviewing of the old management plan, there are also the needs to take into account on several new factors that are in progress in/around the area (refer to **Figure 1.4**):

- The ongoing nomination of Danum-Maliau-Imbak (DaMaI) as a World Heritage site. A taskforce was established under the Ministry of Tourism, Culture & Environment (MTCE) to prepare the nomination dossier, and followed-up with a workshop on 13th March, 2011. A paper was then submitted to the state cabinet, and the nomination of DaMaI was endorsed through the state cabinet decision on 22nd June, 2011. The preliminary tentative list for DaMaI, under criteria (ix) & (x), was submitted to National Heritage Department on 28th June, 2011 by MTCE with a high level follow-up meeting on 13th October, 2011. A second workshop was held on 4th December, 2012. The final dossier is to be completed by end of 2013;
- The UNDP-GEF project which is a 61,264 ha project landscape forms an important connecting landmass to three renowned protected areas in Sabah; the Maliau Basin Conservation Area (58,840 ha) to the West, the Danum Valley Conservation Areas (43,800 ha) to the East, and the Imbak Canyon Conservation Areas (16,750 ha) to the North. The project landscape constitutes a connecting landscape that is utilised for timber production (69.0% of total area), industrial tree plantation (16.0%), rehabilitated forests by enrichment planting (6.0%) and conservation purposes (6.0%); with the remaining amount earmarked for riparian reserve. This landuse mix is an emerging trend in the forest reserves of Sabah driven by: (i) the comparative disadvantage in crop gestation periods between growing trees and agriculture crops; (ii) low rent capture; and (iii) incoherent enforcement associated with the lack of expertise in multiple-use forest landscapes. Under a business-as-usual scenario, the above protected areas will become increasingly vulnerable to fire during prolonged droughts potentially from the surrounding degraded forests. The objective of the project is to bring the landuses in the connecting landscape and protected areas under a common and integrated management umbrella strategy in order to mainstream biodiversity, ecosystem functions and resilience, while enabling ongoing sustainable uses; and
- The Stability of Altered Forest Environment (SAFE) project is a long-term research project collaboration between Sime Darby Foundation and South East Asia Rainforest Research Programme (SEARRP), an overseas research programme of the Royal Society (The UK and Commonwealth Academy of Science). SAFE is slated to be the world's largest ecological experiment both in terms of size and breadth of ecological processes. The project will allow insights into the minimisation of biodiversity impacts while maximising ecosystem services (http://www.safeproject.net/).

In preparing this report, several materials were used as reference on scientific names for flora and fauna, and with reference to appendices in order to standardise the scientific names of species. Among others:

- Payne, J., Francis, C.M. & Phillipps, K. (1985). *A Field Guide to the Mammals of Borneo*. Kota Kinabalu: Sabah Society.
- Phillipps, Q. & Phillipps, K. (2011). *Field Guide to the Birds of Borneo*. 2nd edition. Oxford: Beaufoy Books.
- Lee, Y.F. (2003). *Preferred Checklist of Sabah Trees*, 3rd edition. Kota Kinabalu: Natural History Publications (Borneo).
- Das, I. (2012). *Snakes of South-East Asia*. Oxford: John Beaufoy Publishing.
- Inger, R.F. and Stuebing, R.B. (2005). *Frogs of Borneo*, 2nd edition. Kota Kinabalu: Natural History Publications (Borneo).

1.7.3. MBCA Study Area

Figure 1.2 shows the study area, covering the core conservation area (58,840 ha), and its buffer zones. The study area has not changed compared to the former management plan, but the prospect of looking into the link with Imbak Canyon Conservation Area (ICCA) and the new addition of Class I (Protection forest), i.e. Maliau Buffer Zone in part of Buffer Zone 1 and 2 needed to be given greater attention.

1.7.4. Outputs

This document, which is entitled "Maliau Basin Conservation Area, Sabah, Malaysia: Strategic Management Plan 2014-2023", is the output from the study, and it will detail out the strategies.

1.8. Organisation of the Plan

This report is organised into two parts, i.e. **Part A** for current status of MBCA and the implementation of programmes during its lifespan, and **Part B** on the way forward in implementing programmes and activities till 2023.

1.8.1. Part A – Current Scenario

This part of the report provides the background of MBCA, together with existing scenarios with regards to ongoing activities and development, within and outside of the area. It encompasses several chapters. Chapter 1 provides a background of MBCA and the objectives of the plan. Chapter 2 looks at the former management plan that ended in 2012, and review all the programmes and activities, especially on accomplishments and uncompleted activities. It heightened some of the issues encountered during the implementation stage, and these issues will be addressed appropriately in Part B. The existence of MBCA does complement efforts addressed by international agenda, and those of national and state governments. These are discussed in Chapter 3, and will look at how MBCA can accommodate these new

agendas or advocacies that has been put forward, whereby Malaysia ratified to some of these conventions or declarations. Chapter 4 presents the existing legal framework that administer and govern MBCA, and more important how the plan will assist in planning framework at surrounding areas, adjacent to MBCA. Chapters 5 detailed out the natural resources of MBCA extracted from several publications, and it merely highlight some of the crucial points that need further attention and considered in the new plan. Local community and economic activities are addressed in Chapter 6, providing an insight on existing socio-economic activities within or adjacent to MBCA, inclusive of its buffer zones. Chapter 7 elaborates on conservation values of the available resources, including that of biodiversity and tourism in the area. The importance of MBCA for educational values is addressed appropriately in the same chapter. Eventually, Chapter 8 put forward the issues and gaps that need to be addressed, including taking into account current development surrounding MBCA and those related to biodiversity and climate changes on a wider scale.

1.8.2. Part B – The Way Forward

Part B of this document provides the approaches undertaken towards strengthening the conservation efforts in MBCA, and ways to manage it in a sustainable manner, including the prospect of linking forest corridors. Chapter 9 presents the vision and mission of MBCA, inline with the management objectives. The chapter also highlights the proposed management framework that will guide the way forward.

Chapter 10 put forward the detailed management zones and its revision, taking into account the newly reclassified Maliau Buffer Zone (i.e. into Class I forest reserve), which is now proposed to be the Buffer Zone 1. In addition, several "activity-oriented" zones within the core area has been removed and replaced with the "wilderness" zone. Chapter 11 put forward the details of themes, programmes and outputs that will be implemented in the life span of this management plan.

CHAPTER 2 THE STRATEGIC MANAGEMENT PLAN 2003-2012

2.1. Introduction

This chapter look at the first Maliau Basin Conservation Area (MBCA) Strategic Management Plan 2003-2012 (YS, 2003), which was formulated and funded by Yayasan Sabah -Danish Cooperation for the Environment and Development (YS-DANCED). The plan was formulated with the support of two Danish consulting firms, i.e. Ornis Consult and NEPCon. It was through a government-to-government environmental cooperation in 1999 that led to the development of the inception plan of MBCA Strategic Management Plan (YS, 2003).

On the 13th & 14th December 2012, the staff conducted a review of activities, and the summary is presented in **Appendix C**.

2.2. The Document

The 2003-2012 Management Plan provides activities and strategies to be implemented over the 10 years period, and trying to address all issues and threats identified during the development and planning process of the plan (YS, 2003). The plan was a result of consultations from a broad spectrum of relevant stakeholders that were brought together, fostering participation, ensuring inputs, strengthening partnerships and enhancing synergy. It also stresses the importance of maintaining good natural forest cover and connectivity with the other protected areas in the vicinity, such as Imbak Canyon and Danum Valley Conservation Area (DVCA).

2.3. Programme

The plan had identified several programmes and activities to be implemented during the lifespan of the document. Most of the programmes were designed into developing MBCA as a centre for environmental research and monitoring, and environmental awareness, with facilities that can be classified as of high standards.

The programmes in the plan can be broadly classified into two, i.e. activities-based strategies and conservation initiatives.

- *Activities-based strategies* - There were 9 activities-based strategies formulated in the plan with at total of 59 programmes supported by 234 activities on the ground, as shown in **Table 2.1**.
- *Conservation initiatives* – several initiatives were listed in the annexes of the plan, and among others:
    - Annex 4 - Satellite communication;
    - Annex 5 – MoU with Harvard University Herbarium;
    - Annex 7 – Principles of bioprospecting partnerships; and

- Annex 8 – Notes on the World Heritage Site nomination.

The activities-based strategies are further discussed in the following section, and additional points are discussed in **section 2.5** of this document.

Table 2.1: Activities-based strategies from the plan

Description	Programme	Activities
1. Development & Infrastructures	9	47
2. Human resource development & training	6	39
3. Public awareness & environmental education	6	23
4. Research & environmental monitoring	8	39
5. Buffer zone management planning	4	30
6. Tourism within conservation area	14	14
7. Sustainable financing	7	7
8. Planning & reporting	3	3
9. Miscellaneous	2	2
Total	**59**	**234**

2.4. Activities

An extensive list of activity plan has been identified in the 2003-2012 Strategic Management Plan (YS, 2003: pp. 138-143) to guide the development and planning of MBCA. But due to limited resources during that time, selection of activities considered as the most critical activity has been done based on:

- How well it can protect key ecosystems;
- How well it can maintain facilities, equipment, trails and roads;
- How well it can provide training to staff in key skills;
- How well it can provide revenue and gain experience from tourism;
- How well it can facilitate dialogue and agree procedures amongst stakeholders;
- How it can start and maintain an environmental monitoring programme;
- How well it can maintain and further increase public support; and
- How it can undertake certain cost-effective strategic actions.

The activities identified in the plan were to have been implemented by Yayasan Sabah and various other bodies such as Sabah Wildlife Department (SWD), Sabah Forestry Department (SFD), etc. These activities were presented as Annex 2 in the plan (YS, 2003), and this will be further discussed in **section 2.5** of this document.

2.4.1. Development and Infrastructure

Almost all the proposed development and infrastructure plans have been implemented in Maliau. The only development plan that was not implemented is the set up of a solar power for power generation. This has been identified as not

feasible from the workshop in December 2012 and other alternative options for power supply from micro hydro will be explored. Feasibility study to identify the suitable location for the micro hydro will be conducted once the potential consultant is taken on board. However, with new development of solar, e.g. from using sunlight to heat a high-temperature material whose infrared radiation would then be collected by a conventional photovoltaic cell; to that of Solar Frontier CIS thin film modules, proven to offer higher electricity yield than crystalline silicon modules and boasting anti-glare properties. These advance technologies could also make it easier to store the energy for later use.

Currently, there are 8 field stations (formerly known as satellite camps) in Maliau Basin with an observation platform, skybridge/canopy walkway and Maliau basin studies centre (MBSC) (refer to **Figure 2.1** and **Figure 2.2**). The MBSC also provides housing for staff as well as offering various forms of accommodation equipped with water and electricity, such as VIP chalets, scientists' quarters, a rest house with its own kitchen and dining hall and two hostel blocks with 16 rooms which can accommodate 64 people at any one time. Adjoining the hostel is a kitchen and dining hall.

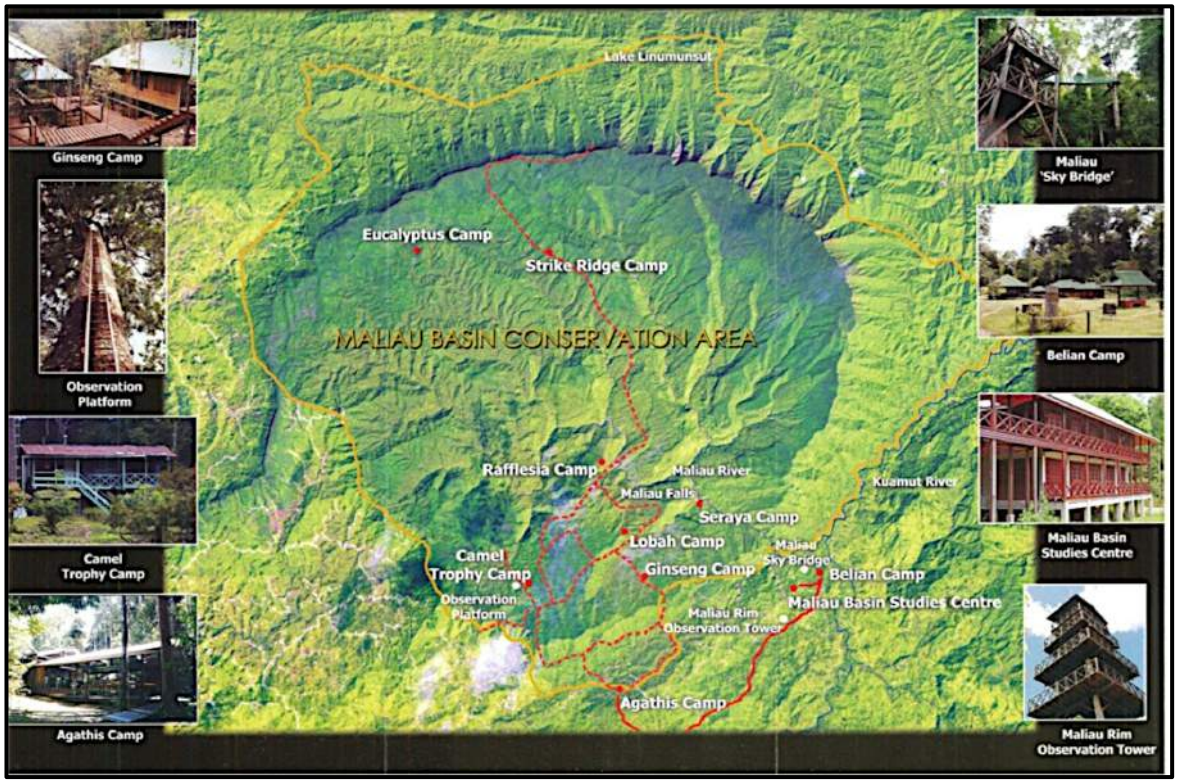


Figure 2.1: Overview of facilities found in MBCA

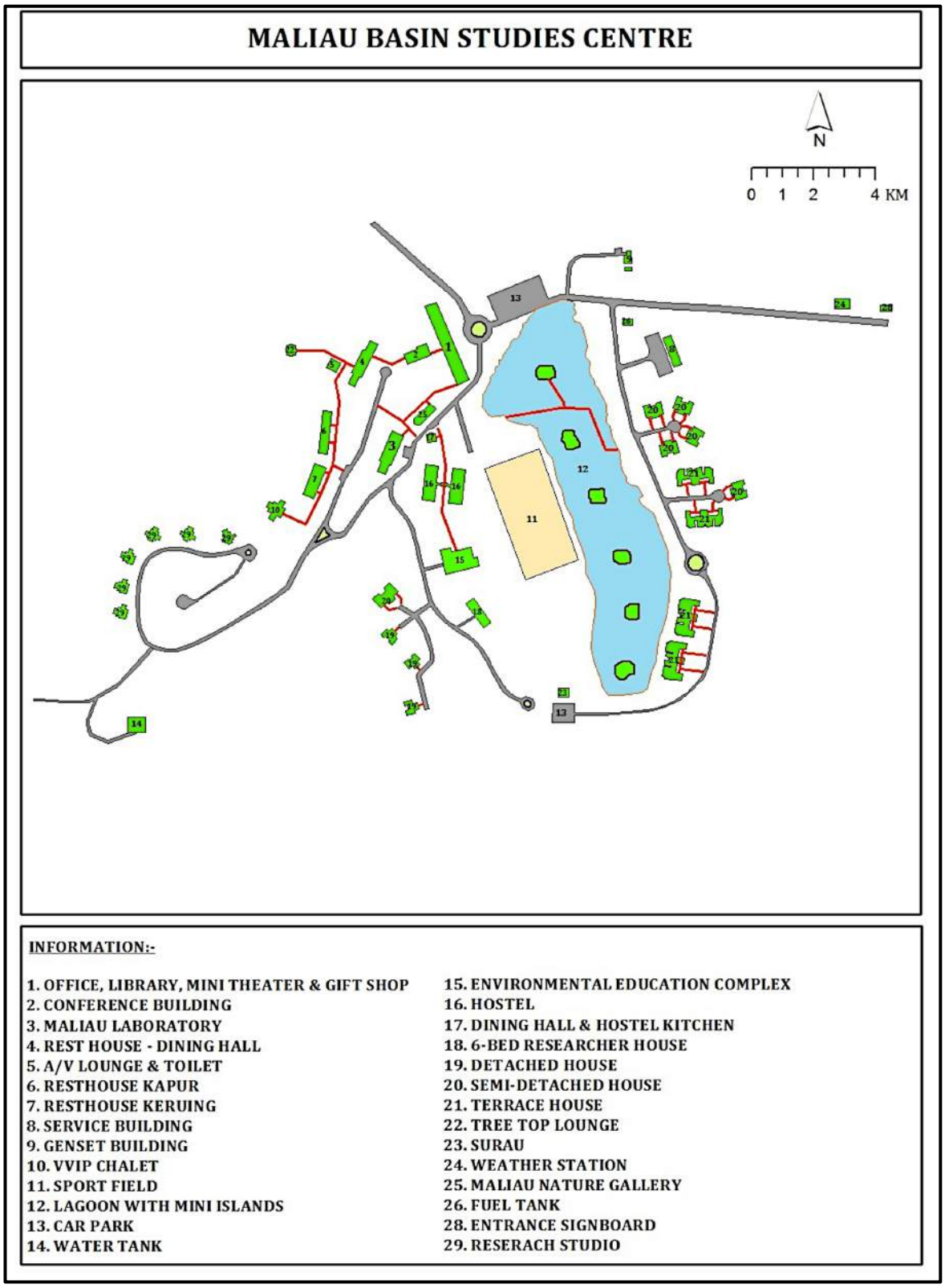


Figure 2.2: Facilities found at MBSC (2013)

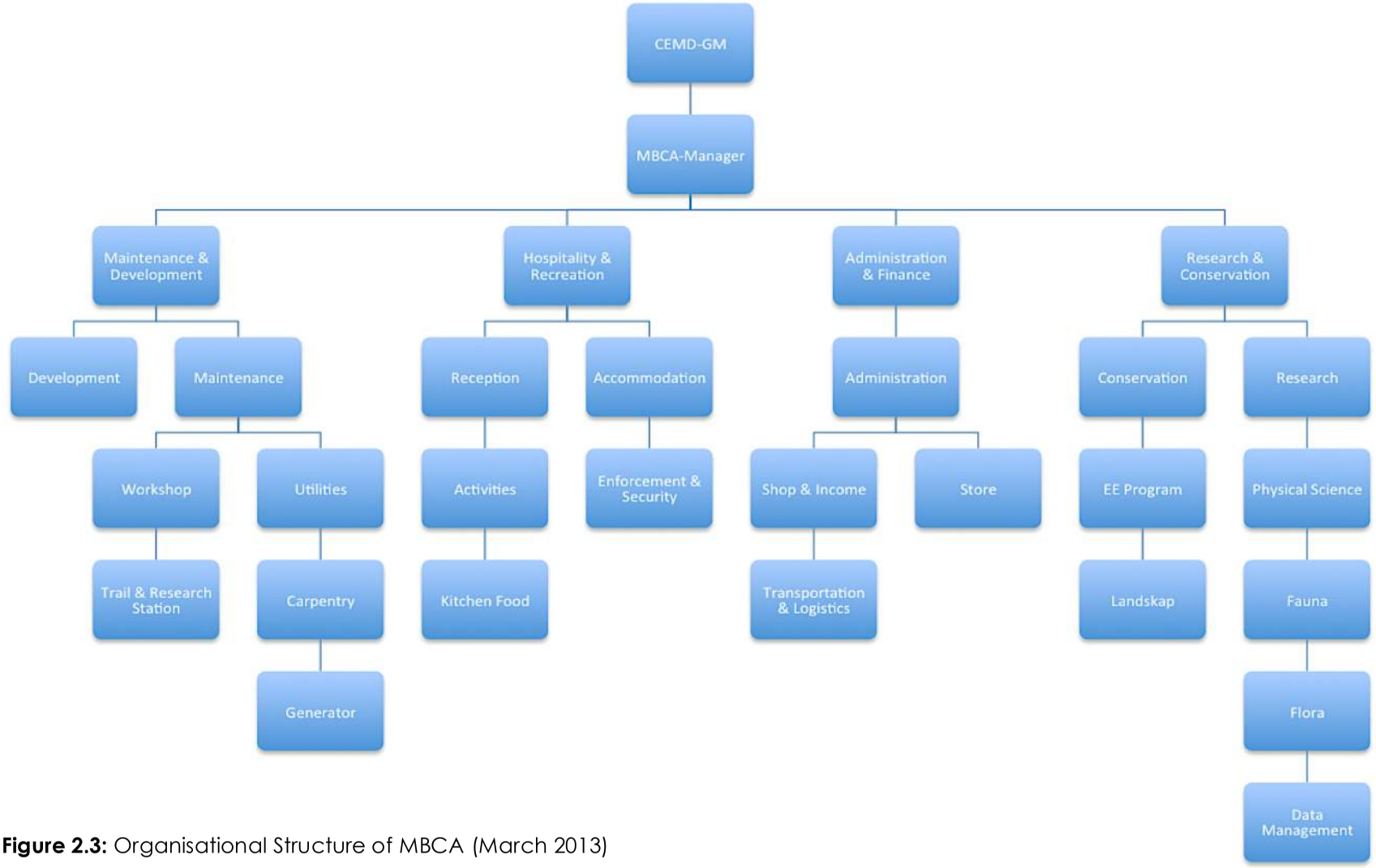


Figure 2.3: Organisational Structure of MBCA (March 2013)

2.4.2. Human Resource Development and Training

The management structure for MBCA can be divided into 4. They are:

i. Conservation and Research;
ii. Hospitality and Recreation;
iii. Development and Maintenance; and
iv. Administration and Finance

The human resources in MBCA are also divided based on the 4 structures above. Currently, Maliau is made up of 64 staff ranging from senior to junior level. Almost half of the staffs are forest rangers (refer to **Figure 2.3** for organisational structure). They are the frontliners who will be dealing with the ground management and day-to-day monitoring/enforcement of Maliau and it should be the utmost priority in Maliau for them to be given the proper training and capacity development. 39 main training and capacity development activities has been identified in the old management plan and out of that 14 have been implemented via various mechanisms and by different training institutions/bodies and the rest (26) was not done due to funding issue.

2.4.3. Public Awareness and Environmental Education

Public awareness is an essential part of MBCA livelihood. The objective is to provide knowledge to the masses such as the location, status, and the existence of MBCA. One of the first steps that could be done was to maintain and further develop the MBCA website, publishing more books and reports, cheap and affordable booklets or pamphlets for the public; digitisation of books, journals and reports so it could be easily viewed or purchased online by public and researchers globally.

Out of the 23 identified activities in the previous management plan, 17 activities have been completed, 5 have not been implemented and 1 is still ongoing. The on-going activity is the submission of World Heritage (WH) Site application. A taskforce under the purview of the Ministry of Tourism, Culture & Environment (MTCE) has been specially established to work on the nomination processes (refer to **section 1.6.2** on the processes undertaken so far by MTCE). The dossier for the Tentative List has been completed and is to be submitted by the national focal agency, i.e. Department of National Heritage. Thus, it is not appropriate to put this activity under this management plan as the overall planning works toward WH listing is now handled by MTCE.

Most of the public awareness and environmental education programs conducted in Maliau Basin is through the Sabah Nature Club (SNC) (**Picture 1.1**). Sabah Nature Club is a Sabah Foundation Educational Scheme, which is established with the cooperation of Sabah Education Department. Currently, there are about 180 schools that had formed their own clubs with 41,000 members throughout the State.

Picture 2.1: EE Programme under Sabah Nature Club

Raising the awareness among the public is a current challenge for MBCA in term of requiring a number of properly trained staff in a specific area to carry out the mission for public awareness. The current concerns are: the current workforce is not adequate to reach to the masses, who will be carrying out the job, and how to increase public awareness more effectively. Other issue includes as mentioned the inactive MBCA website – www.maliaubasin.org hence the website development for Maliau is to be upgraded and updated to increase the area profile and to include an on-line reservation and bookings to ease reservation processes; it will also include system for online payments. However, the upgrading of the MBCA-website could possibly be done together with the further development of the websites for the other YS conservation areas, i.e. Danum Valley and Imbak Canyon.

2.4.4. Research and Environmental Monitoring

A research management plan was prepared to assist YS in implementing research activities in MBCA (YS, 2006a). It provides the resource manager (i.e. MBCA Management Committee) with a document that enables research to be managed effectively. Among others, it contains strategies and guidelines to be undertaken by the resource manager, based on the overall objectives of MBCA. It also forms as a guiding document for the management to enforce and monitor/check on the proposed research activities. The results of the research programmes and projects initiated and instituted would hopefully provide information that can act as a feedback mechanism for the improvement of managing MBCA. The result could also be readily used for servicing the educational and eco-tourism sectors. To date, there are 115 research activities that have been conducted in MBCA since 2000 (refer to **Appendix D**). As of December 2013, there were 115 researchers since 2000, with 69 having completed their activities (PhD = 9, MSc = 25, BSc = 13, Post-doctoral = 16 and others = 6). There were 43 in progress and another 3 to commence.

To pursue continuity for research works in MBCA, several MoUs were signed with local and international partners since 2002 to 2013. Among the most notable ones were those with:

- Harvard University Herbaria (HUH), USA for the Collection, Study & Conservation of the Maliau Flora (MoU4Harvard); and
- Sabah State Government and Rainforest Research Sdn Bhd for the Stability of Altered Forest Ecosystem (SAFE) Project (briefly described in **section 1.6.2**)

In addition, several working MOUs were also established over the period, including:

- Sabah Shell Petroleum Company Limited (SSPC) to build the Shell Maliau Basin Visitor Reception and Information Building;
- WWF-Malaysia on protected areas and capacity building; and
- NEPCon on management planning for the Maliau Basin and surrounding forest areas in Sabah, including the review and preparation of a revised strategic Management Plan for MBCA for 2014-2023.

The main problems for researchers are the high cost of conducting research and the laboratory is not fully equipped with research apparatus, which resulted in the researchers having to bring their own equipment. Other issue is there are a low number of researchers and students from local academic institution doing their research in MBCA because the cost of living in MBCA is expensive with limited internet availability, bad road condition, and lack of recreational room for entertainment.

MBCA is in need for a research coordinator to lead and conduct research in the area. The lack of a partner to assist MBMC in coordinating research activities need to be addressed appropriately. Examples of successful partnership can be observed in Danum Valley (DVCA) with Royal Society (RS), and in Imbak Canyon (ICCA) with the Academy of Sciences Malaysia (ASM).

2.4.5. Buffer Zone Management Planning

The buffer zone area will have a critical role in the protection of MBCA. The way in which the buffer zones is managed would also largely determine its potential risk for fire prevention, illegal intrusion (by poachers and *Gaharu* collectors), the scale and nature of tourism development, the extent of local involvement in tourism, and the possibility of deriving revenue and other benefits from carbon storage mechanism. The buffer zone will also be the place where the most immediate threats to MBCA are addressed in a tactical manner.

Initially, the conservation area of 58,840 ha is protected and cushioned by Buffer Zone I (an area of 38,837 ha) and Buffer Zone II (an area of 93,957 ha), totalling to 132,794 ha of buffer zones (refer to **Figure 1.2**) (Greer, 2002). Under the earlier management plan, the Committee (MBMC) has authority inside the conservation

area (MBCA) and this will have to be reviewed due to the fact that an additional area known as the Maliau Buffer Zone (total area of 46,603 ha) is legally described under FD Plan No 102/94, and classified as a Class I FR. In 2012, the *Forest (Maliau Basin Conservation Area) (Amendment) Rules 2012* came into effect, whereby the "Maliau Buffer Zone" was included for the purposes of privileges and conditions declared under the Rules, thus the buffer zone mentioned is now under the purview of MBMC.

The management of the buffer zone in MBCA also contributes and is in line with the CBD Aichi Target as listed in **Table 2.2**.

Table 2.2: Buffer Zone management in MBCA and relevancy to Aichi Target

Goal	Target	Relevancy to Maliau
Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	**T5:** By 2020 the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	Creation of buffer zones, gazettement of new corridors connecting Maliau to Imbak & Danum
Goal D: Enhance the benefits to all from biodiversity and ecosystem services	**T14:** By 2020, ecosystem that provide essential services, including services related to water, and contribute to health, livelihoods and wellbeing, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and the vulnerable.	Buffer zone establishment to strengthen the core area capacity to regulate water. Local communities rights to use the forest area for subsistence is to be recognised (where applicable) and applied in the management of the buffer zone area.
	T15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystem, thereby contributing to climate change mitigation and adaptation and to combating desertification.	Buffer zones area, which has been affected by previous logging activities, is to be restored. Priority will be on Buffer Zone I.

2.4.6. Tourism within Conservation Area

The objectives to develop tourism activities in MBCA are for the conservation of biodiversity, addressing the issue of poverty through economic activities for local communities and creating business opportunity for income generation.

Hansen (2000) in his report summarises that MBCA needs a slow and careful approach to develop its eco-tourism plan. Any tourism development should not be encouraged and promoted before all the facilities have been upgraded, trails

have been secured and procedures established. With that, a tourism development plan was formulated (YS, 2006b) with several of the recommendations implemented.

Other than the insufficient or not yet constructed facilities, the most inhibiting factor for the tourism development is lack of qualified staff and guides. Knowledge, language and interpretation skills are of paramount importance for the success of a high profile tourism development and the staffs need to be equipped with such skills to implement the tourism activities.

The current tourism related activities conducted in MBCA based on the previous MP identified 14 activities in which 10 have been fully implemented, 3 pending and 1 ongoing. Moving forward, MBCA needs to identify how to increase the visitor receipt and their satisfaction, maintain, improve and upgrade the existing facilities and to use eco-friendly/green technologies for any new development activities, and to identify other new potential eco-tourism products.

2.4.7. Sustainable Financing

The immense biodiversity and natural resources in MBCA is now attracting international demand for its direct benefit use, but has yet to be translated to actions on the ground. With the appropriate marketing and promotions mechanism, there is scope for MBCA to yield significant revenues. Environmental benefits offered in MBCA can in turn be an income source for MBCA. Listed here are some of the known environmental benefits MBCA can provide:

- Ecotourism;
- Biocredits;
- Bioprospecting;
- Carbon Sequestration (in buffer zone areas);
- Watershed protection; and
- Existence value of biodiversity.

In the previous MP 2003-2012 there were also a few opportunities identified that can generate revenue to MBCA and can be further explored in the new SMP (refer to **Table 2.3**). These benefits will be looked into in the coming management plan.

Table 2.3: Identified opportunities for revenue generation in MBCA

Opportunities	Description	Remarks
Ecotourism	Involving charging locals and foreign visitors. For access and services within MBCA and managing the resulting impacts to minimise conflicts with conservation priorities.	Implemented Should be continued in the new SMP while addressing the followings: • Added attractions appealing to ecotourism market; • Relationship with tour companies (establishment of porter & guide association, etc…); • Personnel and other support resources (e.g. employing resident naturalists); • Mechanisms for capturing portion of the revenue; and • Improve facilities – harden and ease trail systems.
Educational services	Sales and subscription to web-cast or satellite broadcast lectures about the rain forest, aimed at the international schools and universities	Not implemented due to the following challenges: • Need international Marketing Manager; • Need specific hardware & software; • Need global marketing efforts; and • Good internet. Work to decide of this is feasible to be implemented in the new SMP. However, information dissemination about the rainforest through the Sabah Nature Club activities is being carried out in MBCA, targeting school children, teachers, community leaders and relevant groups.
Educational merchandising	Selling products such as books, booklets, postcards, posters, etc. through international catalogue orders	Implemented through sales from souvenir shops at the gate and Studies Centre as well as other outlets in MB, but not through international catalogue orders. **Challenges**: Need international Marketing Manager (plus support team). To decide during discussion if it is still a viable option under the revised MP, based on its cost-benefit analysis.
Bioprospecting	Develop long-term equitable partnerships with groups that undertake commercial research on biodiversity	Not implemented under the old SMP as there is a lack in understanding and a dedicated Bioprospecting Development manager or consultant to carry it out. May require large investment, but potential revenue from bioprospecting can be considered. The search for biochemical and genetic materials from nature that can be applied commercially to pharmaceutical, agricultural, cosmetic and other applications are vast. May need to engage an expert to prepare the plan.
Biodiversity future trading	Selling rights to use the conservation area's biodiversity resources sustainably in the distant future, to investors who expect the values of those rights to rise in the near future, with price increments being taxed.	Not implemented under the old SMP. Need specific hardware and software, and international advertising. Workshop to decide if this is feasible to be carried out under the new SMP, considering the amounts of money investors are willing to invest and the current world economic status.
Carbon storage	Obtaining international grants or carbon emission credits for replanting native trees in the buffer zone, or for putting the Maliau coal deposits and forests "beyond use" under legal protection.	Not implemented under the old SMP. Need global marketing efforts. Could be considered under the new SMP. Will need to engage an international consultant/expert on carbon storage credits.

Opportunities	Description	Remarks
Grants, sponsorships and partnerships	Systematic quest for international and national grant financing and the recruitment of corporate sponsors and partners for investments, long-term relationship building and for senior staff secondments.	Implemented short-term partnerships/sponsors, but not much otherwise. The possibly has been discussed and an opportunity that should be included under the new SMP, especially on research prospects and the need to employ resident naturalist together with a full time professional donor liaison capacity within the CEMD
Trust funds	Involving managing endowments to finance all aspects of the long-term management of MBCA.	Not implemented yet, but discussed on the possibility to introduce to MBCA. May be included under the new SMP.

Source: Presentation on Finance at MBCA MP workshop on 13th December, 2012.

2.4.8. Planning and Reporting

Based from the previous MP only 3 activities were identified under this strategy and all have been implemented with 1 activity still on-going (review 10-year strategic plan).

2.4.9. Miscellaneous

There were only 2 activities identified in the old management plan under miscellaneous, i.e. scientific seminar and Lake Linumunsut report. However, there were a number of scientific seminars conducted by the MBCA management committee since 2003-2012 periods with regards to those related to scientific expeditions in MBCA, with the addition of other seminars held in.

As for the Lake Linumunsut report, this has not been undertaken within the stipulated 2003-2012 management plan, but it is now in its final stage of preparation and will be released soon. Planning is underway in CEMD to propose a new development for controlled tourism activities at Lake Linumunsut. This plan must be read together with the recommendations and guidelines that are presented in **section 11.3.1** of this report.

2.5. Gaps and Current Activities

During the 2-days workshop conducted in December 2012, presentations were made to show the delivery of activities designed for the lifespan of the document. A breakdown of the outcomes was tabulated and analysed. The following sub-sections briefly provide the result and gaps identified as issues.

2.5.1. Overall Performance

The overall performances in implementing the activities are tabulated in **Appendix C** in this document. **Table 2.4** summarises the overall performance in the implementation of activities in MBCA till December 2012, with 106 activities implemented and 95 to be conducted.

The bulk of activities have been implemented, and there are still activities that need to be implemented in the coming management plan. These uncompleted or ongoing programme/activities will be further re-evaluated, and a look at its relevancy in the coming years.

Table 2.4: Summary of Performance

Description	Activities	Yes	No	Ongoing
1. Development & Infrastructures	47	32	15	-
2. Human resource development & training	39	14	25	-
3. Public awareness & environmental education	23	17	5	1
4. Research & environmental monitoring	39	23	16	-
5. Buffer zone management planning	30	7	23	-
6. Tourism within conservation area	14	10	3	1
7. Sustainable financing	7	-	7	-
8. Planning & reporting	3	2	-	1
9. Miscellaneous	2	1	1	-
Total	**234**	**106**	**95**	**3**

2.5.2. Gaps that need to be addressed

During the 2-days workshop held in December 2012, there were several issues raised, including those that hindered the successful implementation of the activities, and those that emerged along the years of implementation. These issues are summarised and listed in **Appendix E**.

In brief, it can be broadly classified into the following:

a. *Manpower* – inadequate staffing to manage the area, especially in terms of conducting boundary patrolling. However, this duty of enforcement need to be assessed, as the potential role of *Polis Bantuan* (Auxiliary Police) need to be considered in undertaking patrolling and providing security to MBCA. The process of replacing staff that left was not conducted immediately, thus making those available has to do extra workload.

b. *Capacity* – existing staff are found not to have the opportunity to undergo trainings, e.g. group dynamic, paramedic, communication, skill, research methodology, etc.

c. *Funding* – need to be upscaled to support planned and approved development, maintenance of facilities, EE programme, research and capacity building. While it is acknowledged that the number of researchers were encouraging, the numbers of researcher at the local institutions were only 40 of 115 (refer to **Appendix D**). The lack of financial support for researchers from the local institutions needs to be addressed by the relevant institutions or agencies.

2.6. Conclusion

In brief, while there were many factors (be it endogenous or exogenous) influencing the successful deliveries of the planned activities, it can still be summarised that the performance of YS has been satisfactory, especially in delivering the hardware to MBCA. With most of the hardware (from buildings for staff and visitors, to research facilities) successfully developed, it is time that YS moves on to develop the software (manpower and capacity, including competency) and managed the security of the area. This is crucial as MBCA is being nominated for listing as a World Heritage Site, the long-term security and enhancement of its biodiversity are essentials.

CHAPTER 3 MANAGEMENT FRAMEWORK

3.1. Introduction

This chapter presents the related state, national and international initiatives, policies and treaties that are relevant to Maliau Basin Conservation Area (MBCA) and its management. In addition, MBCA supports many of the Sabah State and international treaties. Outlined below are the most significant treaties and policies relevant to MBCA.

3.2. International

The needs for MBCA to align with the international governance or treaties are crucial in order to contribute to the objectives of such governance or treaties, and on its potential implications in managing MBCA. Among the most crucial are the Convention of Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC). In addition, there are other ongoing programmes that are relevant to MBCA, and continuous efforts are being made to streamline these activities on the ground with the governance or treaties.

3.2.1. Convention on Biological Diversity (CBD)

The CBD is a global agreement addressing all aspects of biological diversity: genetic resources, species, and ecosystems. Malaysia signed the treaty at the Earth Summit in Rio de Janeiro in June 1992, and ratified the treaty on 24th June 1994, the 65th country to do so (MOSTE, 1998a). Under the term of the ratification, yearly reporting to CBD is required on the status of biodiversity of the country.

The Conference of Parties 10 (COP10) to the Convention of Biological Diversity (CBD) adopted the Strategic Plan for Biodiversity 2011-2020, via decision UNEP/CBD/COP/DEC/X/2, dated 29th December 2010 in Nagoya, Japan. It consists of shared vision, mission (refer to **Box 3.1**), 5 strategic goals and 20 ambitious yet achievable targets, collectively known as the Aichi Targets. With reference to the 20 targets, **Appendix F** shows the relationship of these targets with MBCA.

Box 3.1: The Aichi Declaration

The *Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets* clearly spell out the following:

The Vision

''By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people''

The Mission

- Take effective and urgent action to halt the loss of biodiversity by 2020;
- Contributing to human well-being, and poverty eradication;
- Pressures on biodiversity are reduced, ecosystem are restored, biological resources are sustainably used and benefits arising out of utilisation of genetic resources are shared and equitably manner;
- Adequate financial resources are provided, capacities are enhanced, biodiversity issues and values mainstreamed, appropriate policies are effectively implemented; and
- Decision making is based on sound science and the precautionary approach.

3.2.2. United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC sets the overall framework for intergovernmental efforts to tackle the challenge posed by climate change. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialised countries and the European community for reducing greenhouse gas (GHG) emissions.

The major difference between the Protocol and the Convention is that the Convention encouraged industrialised countries to stabilise GHG emissions; the Protocol commits them to do so.

Malaysia ratified the Climate Change Convention on the 13th July 1994 and ratified the Kyoto Protocol on the 4th September 2002. To meet the obligation as a signatory party of the UNFCCC, Malaysia's have agreed to periodically prepare a report on national greenhouse gas (GHG) emissions and measures taken to address climate change in the country. In 2009, the National Policy on Climate Change (NPCC) was formulated and launched (MoNRE, 2010).

According to a report by MoNRE (2011), it was stated that the top three sectors in Malaysia that contribute to GHG emission are the energy sectors (energy industries, transport, and manufacturing industries and construction), waste sectors (landfills), and LULUCF (Land Use, Land Use Change & Forestry) sector of forest conversion. The LULUCF ranked the 3rd source in Malaysia that contributes to GHG emission of CO_2, CH_4 and N_2O. However, the LULUCF sector also act as the carbon removal where permanent forest reserve (PFR) is the main contributor for carbon sink followed by oil palm plantation and stateland forest.

The projections studied in the report shows that reducing the rate of forest conversion by 1% (13,000 ha) have the potential to reduce emission by as much as 3.34 Mt, and by 5% (65,000 ha) as much as 16.68 Mt of CO_2 eq is reduced. The emission of CO_2 in forest and landuse is 23.44 Mt CO_2 (14% from total 167.44 Mt CO_2). Meanwhile carbon sink for PFR is approximately 139.0 Mt CO_2, oil palm plantation approximately 82.0 Mt CO_2 and stateland forest approximately sink 72 Mt CO_2 eq.

The national average sequestration rates of CO_2 by forests in Malaysia ranged between 240.5 Mt CO_2 in 2005 and to 249.8 Mt CO_2 in 2000. Though the oil palm plantations can act as a carbon sinks, fertilised oil palm plantations emit higher number of N_2O compared to the other parameter that are included in LULUCF. The comparison is 1 tonnes of N_2O equals to 310 tonnes CO_2 and 1 tonnes of CH_4 equals to 21 tonnes of CO_2. Primary forest emits CH_4 more rather than N_2O.

Malaysia aims to reduce GHG emissions intensity of GDP by up to 40% of 2005 levels by 2020. The emissions intensity for 2005 was 0.62 tonnes CO_2 eq/thousand RM and by 2020 it is targeted to reduce its emissions intensity of 0.37 tonnes CO_2 eq/thousand RM. This means, it is targeting into emitting only about 60 percent of the 2005 GHG emissions in the production of each unit of GDP. The GDP in 2005 is based on estimated emissions. On the assumption that Malaysia successfully progresses on the path of projected development, GDP in 2020 is expected to be RM906.64 billion and total emissions would have to be limited to about 335 million tonnes CO_2 eq.

Studies conducted in the report (MoNRE, 2011) stated that, the energy sectors and the waste sectors contribute to about 303 million tonnes CO_2 eq. (90% of the maximum total based on the projected GDP in 2020). The existence of the forest management and conservation provides significant benefits in terms of avoided emissions and enhanced sequestration (MoNRE, 2010).

3.2.3. World Heritage

The World Heritage (WH) describes the kind of natural or cultural sites, which can be considered for inscription on the World Heritage List. Duties of each States Parties are to identify potential sites and protecting and preserving them is sets outs by the Convention.

Malaysia ratified the convention on 7th December 1988 and by signing and ratifying the Convention, Malaysia pledges to conserve not only the World Heritage sites situated on its territory, but also to protect its national heritage.

The idea to nominate MBCA as a World Heritage site has been around since 2000 during the development of the first management plan, where it was initiated. And recently in 2011, the Malaysian Government adopted the application to have Maliau Basin, Danum Valley and Imbak Canyon conservation areas and in-between forest areas to be nominated in the UNESCO World Heritage Site as a cluster WH and the area to be known as Danum-Maliau-Imbak World Heritage Site (or simply as DaMaI) (refer to **section 1.6.2** for the processes involved so far).

Box 3.2: World Heritage Sites in Malaysia

Listed below are the sites in Malaysia.

Natural (2)
Kinabalu Park, 75,370 ha (2000)
Criteria: (ix) & (x)

Gunung Mulu National Park, 52,864 ha (2000)
Criteria: (vii) (viii) (ix) & (x)

Cultural (2)
Melaka & George Town, Historic Cities of the Straits of Malacca, 219 ha (2008)
Criteria: (ii) (iii) & (iv)

Archaeological Heritage of the Lenggong Valley, 399 ha (2012)
Criteria: (iii) & (iv)

Tentative List (2)
The Taman Negara National Park of Peninsular Malaysia (2004)
Criteria: (vii) & (x)

Lanjak Entimau Wildlife Sanctuary (LEWS) and Batang Ai National Park (BANP) (2004)
Criteria: (viii), (ix) & (x)

On the 29th January 2011, during the launching of Maliau Basin Studies Centre (MBSC), the Honourable Prime Minister of Malaysia, Datuk Seri Najib Tun Razak announced that the government would support the State with the nomination process. A task force headed by the Ministry of Tourism, Culture and Environment of Sabah (MTCE), and chaired by the Permanent Secretary of MTCE was formed to coordinate the dossier write up. The preliminary Tentative List has been completed and submitted to the national focal agency, i.e. Department of National Heritage. Nevertheless, the review and endorsement by the World Heritage Committee is put on hold, as Malaysia is a member of the Committee for the term 2011-15. **Box 3.2** shows the sites in Malaysia listed under World Heritage.

3.2.4. International Union for Conservation of Nature (IUCN)

The IUCN was founded in October 1948 as the International Union for the Protection of Nature (or IUPN) following an international conference in Fontainebleau, France. The organisation changed its name to the International Union for Conservation of Nature and Natural Resources in 1956.

In Malaysia, as of 2012, there are only 4 government departments (**Figure 3.1**), 3 national NGOs and 1 National government department that have joined as a member of IUCN. The 3 state members are from Sabah Wildlife Department and The Sabah Parks Board of Trustees and 1 from Sarawak Forestry Corporation, the 1 national member is the Department of Wildlife and National Parks-Peninsular Malaysia and the 3 national NGOs are the Malaysia Nature Society, Marine Research Foundation and World Wide Fund for Nature (WWF-Malaysia).

Yayasan Sabah as the custodian of Maliau Basin should also consider becoming a member of IUCN. YS can use the organisation scientific credibility, its unsurpassed knowledge base and convening power, extensive networking opportunities and access to high-level political, economic and social decision making for future work in Maliau. Staffs can also participate in programmes organised by one of the 6 commissions in IUCN, i.e. the World Commission on Protected Areas (WCPA).

Country: Malaysia
Total: 7

a. Government agency
- PERHILITAN;
- Sabah Wildlife Department;
- The Sabah Parks Board of Trustees;
- Sarawak Forestry Corporation;

b. National NGO
- Malaysian Nature Society;
- Malaysia Marine Research Foundation;
- World Wildlife Fund for Nature.

Figure 3.1: Membership to IUCN from Malaysia

3.3. National

The purpose of this section is to analyse the existing policies that are impacting the management of Maliau Basin, and to evaluate its effectiveness. It is therefore, imperative that the policy gaps that exist are identified to further develop recommendations for the improvement of management of biodiversity, and exploring the potential of global environmental climate change adaptation in protected areas such as Maliau Basin. It is of the stakeholder concern that by identifying the gaps and with the development of the recommendations, it will help decision makers in managing the area even better to enhance the carbon, water and biodiversity values of the forest.

Apparently, there have been a lot of policies that were formulated after 2003 and many of these policies were not taken into consideration in terms of input to the MBCA Strategic Management Plan 2003-2012. Therefore, this warrants further review on the new policies, such as the National Policy on Climate Change (MoNRE, 2010), National Green Technology Policy (MEGTW, 2009) and the National Biotechnology Policy (MoSTI, 2005). On top of that, there are numbers of policy that are currently being revised, and these need to be referred to. As such, particular attention will be given unto policies that were formulated after 2003 as well as policies that were undergoing revision to better reflect the enabler of how best these policies can benefit protected area in terms of management planning decision.

The policy for climate change in Malaysia (MoNRE, 2010), for example, has only been able to address "environmental change treat" rather than "climate change specific threat", which is likely to impact our marine and terrestrial area in the long term. Currently, focus of change is put on the region's major river basins respective of flood and drought intensities, haze pollution, slope failures and the emergence of certain diseases. Changes in temperature as well as changes in rainfall pattern could be the early detection although there are many uncertainties in determining as to whether we are facing the impact of climate change. With the national policy on climate change in place and backed by stringent economic policies, MBCA will need to incorporate climate change in considering future management actions.

The year 2009 marks the year Malaysia formulated a series of green policies to support sustainable development in the country. The Renewable Energy Policy (MEGTW, 2008) was formulated in 2009 with the recognition of renewable energy as an option to reduce the dependencies of fossil fuel such as diesel generators. Since the policy was formulated after 2003, this was not taken into consideration and integration into existing planning decisions, except for a study by Ibrahim (2002) on the provision of an environmentally friendly energy supply for MBSC. Therefore, with the policy in place, this creates a strong justification for a protected area like MBCA to source its energy from renewable sources. An array of options from solar energy to micro/ mini-hydro could be explored and assessed against the cost effectiveness of utilising energy sources that are clean.

The formulation of National Green Technology Policy in 2009 also enables one to invest and utilising green technology potential such as micro-hydro and solar panels by getting incentives, as a result of pursuing green technology. Nevertheless, the analysis will not dealt with incentive matter thoroughly. The policy is defined as the development and application of products, equipment and systems used to conserve the natural environment and resources, which minimises and reduces the negative impact of human activities.

3.3.1. National Biodiversity Policy (1998)

The National Biodiversity Policy (NBP) has its statement that it is imperative that Malaysia conserves the biological diversity and sustainably utilise its component for the continued progress and socio-economic development of the nation (MoSTE, 1998a). This policy will serves as a major guide to our future action.

The rationale of this policy is that the nation's biological diversity remains to be explored fully or documented and there is an understanding that lack of data could be the stumbling block, which impede the efforts to better manage nation's biological resources. In addition the policy also looking at documenting the biological diversity which is greatly affected as a result of continuing habitat destruction and also loss of species that has potential to be engineered into a useful product.

Therefore, due to its economic benefits, long-term food security, increase environment stability, preservation of national biological heritage, ethical values, importance of biosafety, scientific, educational and recreational values of the biological diversity, each and every aspect are being looked into for the benefit of present and future generation. Nevertheless, this policy is currently being looked into for a review.

Principles of NBP relevant to MBCA are:

- Biological diversity is a national heritage and it must be sustainably managed and wisely utilised today and conserved for future generations;
- Biological resources are natural capital and their conservation is an investment that will yield benefits locally, nationally and globally for the present and future; and
- Public awareness and education is essential for ensuring the conservation of biological diversity and the sustainable utilisation of its components.

In addition, the objectives of NBP relevant to MBCA are:

- To maintain and improve environmental stability for proper functioning of ecological systems;
- To ensure preservation of the unique biological heritage of the nation for the benefit of present and future generations; and

- To enhance scientific and technological knowledge, and educational, social, cultural and aesthetic values of biological diversity.

3.3.2. National Environmental Policy (2002)

The National Environment Policy (MoSTE, 2002) aims at ensuring productive environment for continuous economic, social and cultural progress while enhancing the quality of life via environmentally sound and sustainable development, which shall contribute economically and ecologically. This will be done through the sets of strategies and action plan that were developed, which integrates four (4) important elements, i.e. social, economic, cultural development and environmental conservation.

In order for harmonisation of economic development goal and environmental imperatives to take place, the policy sets out 8 major principles that are inter-related and mutually supporting namely, stewardship of environment, conservation of nature's vitality and diversity, continuous improvement in the quality of environment, sustainable use of natural resources, integrated decision-making, role of private sector, commitment and accountability and also active participation in the international community. In addition, specific green strategies are also formulated and embedded in the National Environment Policy (NEP) encompassing multiple key areas of importance.

There are several objectives of NEP that are relevant to MBCA:

- A clean, safe, healthy and productive environment for present and future generations; and
- Conservation of the country's unique and diverse cultural and natural heritage with effective participation by all sectors of society.

3.3.3. National Biotechnology Policy (2005)

Research priorities and innovation in Malaysia are positioned within and driven by a wide number of the national policy areas, with biotechnology as the driving technology and potential area to be explored. With that, the National Biotechnology Policy is envisaged to be the new economic engine that will accelerate the nation's prosperity. Due to the interdisciplinary nature of the biotechnology, the Policy is aimed at creating environment that is favourable for research and development to expand, to optimise and sustainably utilise the nation's rich natural resources (MoSTI, 2005).

The Policy, which is guided by the Biodiversity Master Plan has laid down a sound set of strategies to spur the industry. The following are the nine (9) policy thrusts that have been developed:

- Thrust 1: Agriculture Biotechnology Development
- Thrust 2: Healthcare Biotechnology Development

- Thrust 3: Industrial Biotechnology Development
- Thrust 4: R&D and Technology Acquisition
- Thrust 5: Human Capital Development
- Thrust 6: Financial Infrastructure Development
- Thrust 7: Legislative and Regulatory Framework Development
- Thrust 8: Strategic Positioning
- Thrust 9: Government Commitment

The Policy is to be implemented by phase approach. The first phase looks at capacity building of the people by investing in human resources; followed by the transition towards translating science into business, and finally the global presence of Malaysian biotechnology industries. The Policy has its goal to achieve as global player in biotechnology and will generate at least 20 global Malaysian companies doing business in that sector. Altogether, each phase will require five (5) years period for implementation.

As the world is rapidly developing, the policy will be reviewed on a regularly basis in order to remain relevant, competitive and up to speed with other developing countries. In line with the government's policy, it also provides competitive financial incentives under various packages that will promote more opportunities for local companies alike to embark in the industry.

3.3.4. National Green Technology Policy (2009)

The National Green Technology Policy (NGTP) was enacted in 2009 and is in the 3rd year of its implementation (MEGTW, 2009). Presently the Government is working on the Green Technology Roadmap to guide Malaysia towards a low carbon economy. More efforts will be put on energy, wastewater, building, transportation, manufacturing and ICT sector to ensure that the country is ready to pursue green technology. The Policy predicated four (4) primary pillars of energy, environment, economy and social perspective that will form the foundation of the country green technology agenda.

The country has its policy to be a driver to accelerate the national economy and promote sustainable development. Under the policy, green technology is defined as the development and application of products, equipment, and systems used to conserve the natural environment and resources, which minimises and reduces the negative impact of human activities. It also refers to products equipment or systems that satisfy the criteria of minimising the degradation of the environment, meeting zero or low greenhouse gases emission; technology that is safe to be used and promotes healthy and improved environment for all forms of life; conserving the use of energy and natural resources as well as promoting the use of renewable resources.

The establishment of this policy reflects the country seriousness in embarking in the green technology sector. Despite the many challenges that could impede the development of this particular sector, Malaysia will be banking on the five (5) strategic thrusts that were embedded in the policy to set the way forward, i.e.:

- Strengthen the institutional frameworks;
- Provide a conducive environment for green technology development;
- Intensify human capital development in green technology;
- Intensify green technology research and innovations; and
- Promotion and public awareness.

In order to realise the above strategies, introduction and implementation of innovative economic instruments, as well as the establishment of effective fiscal and financial mechanisms to support the growth of green industries must be in place. It is anticipated that this will be supported by greater promotion of foreign direct investments (FDI) on green technology to foster domestic direct investments (DDIs) and local industry participation. As a result of the policy, Malaysia will require skilled, qualified, competent and productive human resources as this is a crucial factor for green technology development, and capacity building programmes will be devised to ensure our readiness in coping with the new sector. It is imperative that the Government would take the lead by adopting green technology in their facilities and promotion, education and information dissemination to create buy-in of the public to support the policy and adopt best management practices.

Objectives of NGTP relevant to MBCA and which such objectives are supported by the activities being implemented within MBCA:

- To ensure sustainable development and conserve the environment for future generations; and
- To enhance public education and awareness on green technology and encourage its widespread use.

3.3.5. National Policy on Climate Change (2009)

Fraisse (2013) reports that Malaysia is ranked as tenth (10th) among emitters (including fossil fuels and Land Use Change), but with a great potential of carbon storage in the forests. The total emissions have been estimated to be 292.9 million tons, but with a sequestration by forests of 247.0 million tons, with the net emissions defined to be 45.9 million tons. Fraisse (2013: 2-3) noted that forest play a dual role in climate change, i.e.:

> "*…can be a source of greenhouse gases, emitting carbon dioxide to the atmosphere when they are burned or destroyed and forests can also act as a sink, removing carbon dioxide from the atmosphere and storing it as carbon in their biomass as they grow*.

Malaysia`s international role for global warming plays minimal significance and the effects only be experienced in the future end of 2090-2100 for precipitation and surface temperature, regionally instead of globally. This projection is based on cummulating GHG forcing.

Regionally, as according to 40 years historical records (1969-2009), a positive trend on surface temperature is observed. The rate of mean surface temperature increase for Malaysia ranges from 0.6°C to 1.2°C per half century as the highest increase rate at 1.2°C per 50 years for Sabah, 1.1°C per 50 years for the Peninsular and 0.6°C per 50 years for Sarawak. The rate of increase in minimum surface temperature is higher than the mean and maximum surface temperature. As for precipitation, there is no evidence of regular increase or decrease observed. However an increase in number of days of extreme rainfall event, extreme wind events and average number of annual thunderstorm days have been observed for the past 30 to 40 years. (Yap *et al.*, 2012).

Box 3.3: NPCC and its 5 principles

NPCC is guided by the 5 principles with 10 strategic thrusts.

P1: Development of a sustainable path
- ST1 – Facilitate the harmonisation of existing policies to address climate adaptation and mitigation in a balanced manner;
- ST2 – Institute measures to make development climate-resilient through low carbon economy to enhance global competitiveness and attain environmentally sustainable socio-economic growth;
- ST3 – Support climate-resilient development and investment including industrial development in pursuit of sustainable socio-economic growth

P2: Conservation of environment & natural resources
- ST4 – Adopt balanced adaptation and mitigation measures to strengthen environmental conservation and promote sustainability of natural resources;
- ST5 – Consolidate the energy policy incorporating management practices that enhance renewable energy (RE) and energy efficiency (EE).

P3: Coordinated implementation
- ST6 – Institutionalise measures to integrate cross-cutting issues in policies, plans, programmes and projects in order to increase resilience to climate change.
- ST7 – Support knowledge-based decision-making through intensive climate related research and development and capacity building of human resources.

P4: Effective participation
- ST8 – Improve collaboration through efficient communication and coordination among all stakeholders for effective implementation of climate change response.
- ST9 – Increase awareness and community participation to promote behavioural responses to climate change.

P5: Common but differentiated responsibilities and respective capabilities
- ST10 – Strengthen involvement in international programme on climate change based on the principle of common but differentiated responsibilities and respective capabilities.

Theoretically, the rise of temperature that partly contributed by the increase of deforestation activites, leave abundance of carbon dioxide and other green houses gases in the atmosphere which causes retention of heat in the air. To balance, excess of heat in the atmosphere is stored in the ocean surrounding the Bornea Island and Peninsular. This is one of the nature methods in balancing the abnormalities in their hydrogeochemical system. However, deforestation might gave severe loss for our biodiversity and there will be high potential of other terrestrial natural hazards such as erosion, extreme floods and drought to occur.

As for the future projections of surface temperature and precipitation for Malaysia, higher temperature is simulated for East Malaysia compared to the Peninsular. At the future end of 2090-2100, highest rise in temperatures for Sabah is ranging from 2.8°C – 3.0°C, Sarawak is 3.4°C – 3.8°C, and Peninsular is 2.9°C – 3.2°C. (Yap *et al.*, 2012).

The impact of climate change would affect hydrology, terrestrial ecosystem, animals, vegetations, physical processes, marine ecosystem and coastal zones, socioeconomic system, agriculture and commercial fisheries, energy, industry, human settlements and financial and insurance services, and human health (Smith *et al.*, 2001). Looking at the observed historical record and the future simulated projections for both temperature and precipitation, climate change is likely to affect the frequency or intensity of which once a natural hazards to an induced-natural-hazards.

In 2009, the National Policy on Climate Change (NPCC) was formulated to protect the climate system for the benefit of present and future generations (MONRE, 2010). The policy mission is to ensure climate resilient development to fulfil national aspirations for sustainability. The NPCC is, therefore, aimed to set the direction for Malaysia to implement strategies and programmes on the adaptation based on wise resource management and mitigation measures to enhance adaptation and sustainable development which shall serves as the framework to mobilise and guide the government agencies, industries, communities and other major stakeholders in addressing the challenges of climate change.

The objectives of the Policy are:

a. Mainstreaming climate change through wise management of resources and enhanced environmental conservation resulting in strengthened economic competitiveness and improved quality of life;
b. Integration of responses into national policies, plans and programmes to strengthen the resilience of development from arising and potential impacts of climate change; and
c. Strengthening of institutional and implementation capacity to better harness opportunities to reduce negative impacts of climate change.

The NPCC is guided by the 5 principles with 10 strategic thrusts that were identified (refer to **Box 3.3**). Under each of the above strategic thrust, there are 43 key actions altogether. The key actions, among others, are looking at integration of balanced adaptation and mitigation measures into policies and plans on environment and natural resources, developing national carbon accounting systems and also establishing and implementing national R&D agenda on climate change by taking into account the areas such as forestry and ecosystem services.

3.3.6. National Water Resources Policy (2012)

The National Water Resources Policy (2010-2050) was launched in March 2012, and is aimed at determining the future direction for the water resources sector based on a review of the national water resources (MoNRE, 2012). The policy is an important initiative gearing towards starting a process to ensure the security of water supply especially in the agriculture and industrial sectors, the growth of urban centres as well as the rapid increase in the population. The principle that is embedded in the policy does emphasise on the need for adequate water resources to guarantee sufficient food supply besides helping to upgrade the development of rural areas. There are 9 strategic thrusts with 18 targets formulated under the policy (refer to **Box 3.4**).

Box 3.4: National Water Resources Policy 2012-2050

The Policy has 9 strategic thrusts and 18 targets.

a. Strategic Thrusts

- ST1 - Water Resources Intelligence
- ST2 - Water Resources Integrity
- ST3 - Use of Alternative Water Resources and Sources
- ST4 - Water related Disaster Risk Reduction, Preparedness and Response
- ST5 - Criteria for Water Resources Characterization
- ST6 - Conservation and Protection of Water Resources and Bodies, both natural and artificial
- ST7 - Stakeholder Inclusiveness and Engagement
- ST8 - Shared Water Resources Governance
- ST9 - Capacity Building and Awareness

The policy is complementary in nature with other existing national policies, as it deals with aspects related to environment, social and economics. The policy has a statement as follows:

"*The security and sustainability of water resources shall be made a national priority to ensure adequate and safe water for all, through sustainable use, conservation and effective management of water resources enabled by a mechanism of shared partnership involving all stakeholders*" (MoNRE, 2012: 20).

The policy has the following objectives:

- To set out the direction and strategies for collective action so as to ensure the security and sustainability of water resources through integrated and collaborative mechanisms involving all stakeholders at all levels.
- To provide means and measures to complement existing policy directions related to water resources so as to ensure their sustainable and equitable use, as well as protect the integrity of the environment, ecosystems and natural heritage.
- To provide a platform to strengthen water resources intelligence as well as uniform practices through the streamlining of standards, measures, methods and approaches.
- To set out the means and measures for the adoption of water resources conservation plans at multiple scales so as to complement and strengthen existing land, resources, physical and other related development plans.

- To build the capacity of all stakeholders for effective participation and collaboration in water resources governance at multiple scales and levels focusing on developing human resources, science, technology and practice as well as encouraging investment in research, development and innovation.

3.4. State

At the state level, there are several guidelines or initiatives that assisted state development. Among others, the state's *Halatuju* has been in place since 2003 and is the basis of reference for state development. The State Land Utilisation Policy (SLUP) is another document that were formulated, including two more in preparation, i.e. Sabah Structural Plan and State's Environmental Policy.

Box 3.5: Economy agenda under the *Halatuju*

There are 3 sectors under this agenda, i.e. agriculture, tourism and manufacturing.

Agriculture sector
- Needs to be modernised;
- Increase in productivity and output of products;
- Generate more value-added products;
- Improve the quality of products;
- Reduce reliance of imported food products; and
- The introduction of the concept of zoning.

Tourism sector
- Expand the development of appropriate infrastructures;
- Attract more visitors through strategic marketing (targeting 2.7 million tourists within a period of 5 years);
- Explore new niche market/products; and
- Generate employment to serve the needs of the locals.

Manufacturing sector
- Strengthen the roles and contributions of SMIs and SMEs;
- Assist in developing necessary basis infrastructures; and
- Encourage the process of modernisation.

3.4.1. Halatuju

The Policy, which was enacted in 2003, sets the direction for the economic, social as well as the political dimensions to bring about the development for the State of Sabah and its people. Ever since the policy was launched, the state has been committed to implement the policy and it has produced positive impact towards the well-being of the people in Sabah. Greater emphasis was placed in three critical areas, i.e. improve the skills and competencies at all management levels of the organisation; improve the qualities of professionalism; and enhancing the culture of accountability for all parties.

The Policy is made of 6 sub-agenda, namely on economy, social development, political, human resource development, enhancing the delivery system and strengthening the Federal and State relationship. Under the economy agenda, it focuses on three thrust sectors, namely agriculture, tourism and manufacturing (refer to **Box 3.5**).

3.4.2. Sabah Land Utilisation Policy (SLUP)

The Sabah Land Utilisation Policy Study was commissioned by the State's Natural Resources Office (NRO) in 2009 and was approved by the Steering Committee, which was chaired by the State Secretary. In view of the urgent need to enhance the efficiency and effectiveness of land utilisation in Sabah, the policy was born and it sets out the policy guidelines that deal with the management of the land resources in an integrated approach.

The policy aimed to support a vision that is geared towards integrated effective utilisation of land resources in Sabah. It combined the important elements of sustainability and is dynamic in nature. In short the policy encourages for the wise use of the state natural resources and particularly land as to how it should be best used, what affects them and how can that be best protected and conserved.

The principles are:

- To ensure the basic needs of Sabah's human population are met and no one living according to the law in Sabah is unduly disadvantaged;
- To ensure that Sabah's freshwater, soils carbon stores including the forests, biodiversity and offshore marine ecosystem will be maintained and enhanced; and
- To sustain economic robustness in the face of challenging circumstances, and to provide appropriate revenues to the state in return for granting of rights over specific land areas for private economic activities.

Specific objectives of SLUP that are relevant to MBCA are:

- To regulate the size of oil palm plantation so not to encroach into land areas set aside as FR;
- To ensure the preservation of all species; and
- To ensure sustainable management of water resources.

As for the strategies, several were appropriate for consideration in MBCA:

- Sustainable management of water resources and integrated utilisation of water catchment areas; and
- Sustainable management of forest resources.

3.5. Others

Over the years, several new initiatives appeared, in the context of a transformation programme whereby the identification of several economic corridors were established in Malaysia, and in Sabah it was the establishment of Sabah Development Corridor (SDC) in 2008. The Heart of Borneo (HoB) Initiative is another one that had made significant inroad contribution to Sabah, with the main aim to conserve and sustainably manage a large area of contiguous tropical forest in central Borneo.

3.5.1. Sabah Development Corridor (SDC)

The Sabah Development Corridor (SDC) was launched on 29th January 2008, and 2013 marks the 5th year of its implementation. The agency responsible to implement programmes in SDC is Sabah Economic Development and Investment Authority (SEDIA), an authority enacted under the *Sabah Economic Development and Investment Authority Enactment 2009*. The programme, which is guided by various national policies such as the New Economic Model, Ninth Malaysia Plan

and continues until the Tenth Malaysia Plan, aims to enhance the quality of life of the people by accelerating the growth of Sabah's economy, promoting regional balance and bridging the rural-urban divide while ensuring sustainable management of the state's resources (IDS, 2007). While this programme is part of the five (5) economic corridors and the Economic Transformation Programme (ETP), it is also in line with the key thrusts and objectives of the *Halatuju* (refer to **section 3.4.1**), which outlines the direction of the state's development.

Under the SDC initiatives, there are a numbers of privately driven development projects that is meant to increase the growth national income, create more job opportunities and enhance trade and investments. This is aligned to the SDC theme that is *Harnessing Unity in Diversity for Wealth Creation and Social Well-Being*. Ultimately, the SDC programme is underpinned by three (3) key principles that will guide the development in Sabah. The following are the key principles:

- Capture higher economic value activities;
- Promote balanced economic growth with distribution; and
- Ensure sustainable growth through environmental conservation.

The key objectives of the SDC are:

- make Sabah a gateway for trade, investment and tourism;
- transform the state into a harmonious state regardless of race or religion;
- create job opportunities in the state;
- make the state more technology-savvy;
- make the state a comfortable state to live in; and
- SDC has a vision to be the leading economic region in Asia by being a preferred gateway for trade, investment and leisure for talents and businesses and thus the programmes has identified few important sectors that has potential to be elevated in terms of growth.

As a target, the SDC initiatives are to enhance Sabah liveability index, triple the Sabah's Gross Domestic Product (GDP) per capita via the implementation of the prioritised programmes, jobs creation as result of the programmes as well as poverty eradication in the state of Sabah.

The promoted sectors and key outcomes targeted under the SDC initiatives that are relevant to MBCA are:

i. General
   - Created more than 900,000 new jobs; and
   - Hardcore poverty eliminated.

ii. Tourism

This sector aims in enhancing Sabah's position as a premier eco-adventure destination, as well as a high-end second home destination with luxury holiday

villas and lifestyle activities. The strategy is to target high-yield and long stay visitors. It is targeted to:

- Increase average tourist spending from RM 2,517 in 2006 to RM 3,383 by 2012 and RM 5,364 by 2025;
- Increase tourism receipt from RM 2.88 billion in 2006 to RM 8 billion by 2012 and RM 48.5 billion by 2025; and
- Increase rural community tourism receipts (handicrafts and homestay) from RM 1.5 million in 2006 to RM 4.5 million by 2012 and RM 48 million by 2025.

3.5.2. Heart of Borneo (HoB) Initiative

A conservation agreement on Heart of Borneo (HoB) was signed on 12th February 2007 in Bali by the governments of Brunei, Indonesia and Malaysia. It provides the way forward for protection and sustainable management of its natural/biological resources. Having 220,000 km^2 in size, it is about 30.0% of the island of Borneo's land area.

In Sabah, a *Strategic Plan of Action (Sabah)* (SFD, 2009) was prepared with 5 programmes. The 5 programmes are broadly classified as:

i. Transboundary management;
ii. Protected areas management;
iii. Sustainable natural resources management;
iv. Ecotourism development; and
v. Capacity building.

Maliau Basin lies in the HoB landscape (refer to **Figure 3.2**), and therefore the management of Maliau Basin need to be aligned with the HoB Initiative. Among others, the initiative aims to carry out collaborative programmes on conservation and sustainable development through the implementation of effective management and conservation of a network of protected areas, sustainable management of productive forests and implementation of sustainable land-uses.

During the International Conference on "Heart of Borneo (HoB)+5 and Beyond: Shaping and Nurturing Sabah's Future Together" held on 4th – 5th November 2012 in Kota Kinabalu, a workshop was held to revise the older Strategic Plan of Actions (SFD, 2009). An ongoing effort is being made to work out the detailing of the proposal, based on the following themes:

a. Forests and biodiversity;
b. Agriculture and plantation;
c. Infrastructure and energy; and
d. Community development.

The completed document, *Strategic Plan of Action (Sabah): The Heart of Borneo Initiative (2014-2020)* (SFD, 2013b), was launched during the HoB International

Conference in Kota Kinabalu in November, 2013. It laid down several actions to be undertaken that are linked to MBCA, either directly or indirectly. Among others related to MBCA are:

- Establish and maintain critical corridors (2.1e: 69);
- Develop or revise, and implement management plans for all protected areas that are not currently covered by such documents (2.2a: 69);
- Nominate the Maliau Basin, Danum Valley and Imbak Canyon as a UNESCO World Heritage Site (2.6b: 70);
- All implementing agencies to observe EIA requirements (3.1.a.g: 73);
- Identify degraded areas in key protected areas and source funding for their rehabilitation (3.2.a: 73);
- Develop economic instruments and markets such as carbon trading and other ecological services markets (3.2.b: 73);
- Undertake study of comprehensive inventory of bird species in Sabah (3.4.1: 74);
- Promote trekking activities and heritage tourism (4.4.d: 76);
- Expand Sabah's reputation as a Centre of Excellence in Tropical Biology and expand research facilities at field sites across Sabah (5.2.f: 78);
- Establish Nature Centres throughout Sabah; with quality "interpretation materials" to ensure that the tourists, students and general public gain awareness and appreciation for the value of biodiversity and natural resources (5.3.d: 78);
- Establish Sabah as a regional centre for biodiversity training, research and education (5.4.e: 79);
- Carry out training and support programmes for communities involved in ecotourism (5.5.d: 79); and
- Expand and strengthen the Honorary Wildlife Warden (HWW) programme (and other programmes that engage local communities in conservation activities) (5.5.f: 79).

The revised strategic plan of action for Sabah Initiative are, among others, looking at potential synergies and conflicts surrounding the HoB landscape and its alignment with the green development objectives as stated within the National and State Policy context, revisiting the issues and challenges that were identified in the International HoB conference in 2012 consultation process, providing insights on the enabling factors for green development in Sabah and specific recommendation for the way forward. The abovementioned are expected to gear Sabah towards sustainable development of the HoB landscape while nurturing its future into a greener economy.

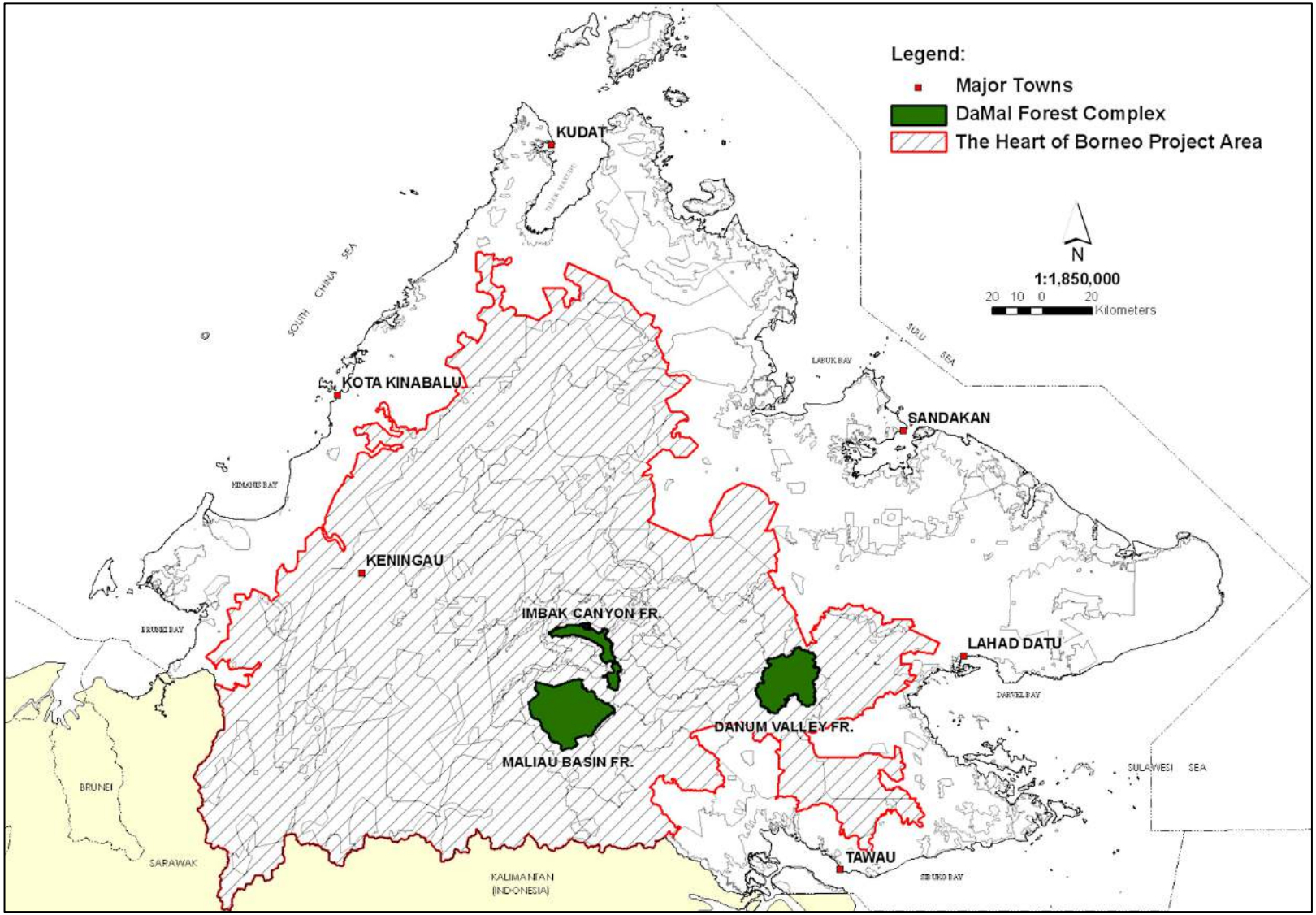


Figure 3.2: Map of Sabah's Heart of Borneo (HoB)

CHAPTER 4 LEGISLATIVE, POLICY AND PLANNING FRAMEWORK

4.1. Introduction

This chapter presents the protection accorded to Maliau Basin Conservation Area (MBCA) and the mechanism that provides for its protection through the management plan. It briefly discusses on the additional areas that were reclassified as Class I Forest Reserves that lies within Buffer Zones 1 and 2.

4.2. Legislation – Protective Designation

Maliau Basin Conservation Area was initially 39,000 ha, and was neatly defined by a catchment boundary following the rim of the basin. The *Forest Enactment 1968* is the principal legislation to management of forest resources in Sabah. This is the legislation that is related to the preservation or conservation of forest and the regulation - and control of dealings in forest produce. Maliau Basin Conservation Area was gazetted in 1997 under the abovementioned Enactment, when the Sabah State Legislative Assembly voted to gazette the MBCA as a Class I (Protection) Forest Reserve under the Sabah's *Forest Enactment 1968*, and to increase its area to 58,840 ha so as to include the outer slopes and Lake Linumunsut. The establishment of buffer zones surrounding the whole MBCA also added to its protection.

In reference to the section 5 of *Forest Enactment 1968*, an area gazetted as Class I (Protection) forest reserve is for the purpose of "maintenance of forest essential on climatic or physical grounds". Hence, no activities are allowed in such area, except for research or small-scale infrastructures, i.e. research stations, walking trails, overnight shelters. In general, no one is allowed to mark or fell trees, erects or constructs any building in a forest reserves (referring to section 20 of the *Enactment*). The security of all gazetted forest reserves are secured, as indicated under section 22 of the said *Enactment*:

> "*No Forest Reserve shall cease to be a Forest Reserve or any portion thereof shall be excised from such Reserve except by Enactment or except where it is required for conversion to a Park, a Game Sanctuary or a Bird Sanctuary under the law for the time being in force relating thereto*".

The gazettement of the *Forest (Maliau Basin Conservation Area) Rules 1998* legally established the Maliau Basin Management Committee (MBMC) to supervise the protection and development of the area, with Yayasan Sabah appointed as the day-to-day manager of the conservation area (GoS, 1998). The MBCA received additional protection in 1999 when it was gazetted as a Cultural Heritage Site under the Sabah's *Cultural Heritage (Conservation) Enactment 1997*.

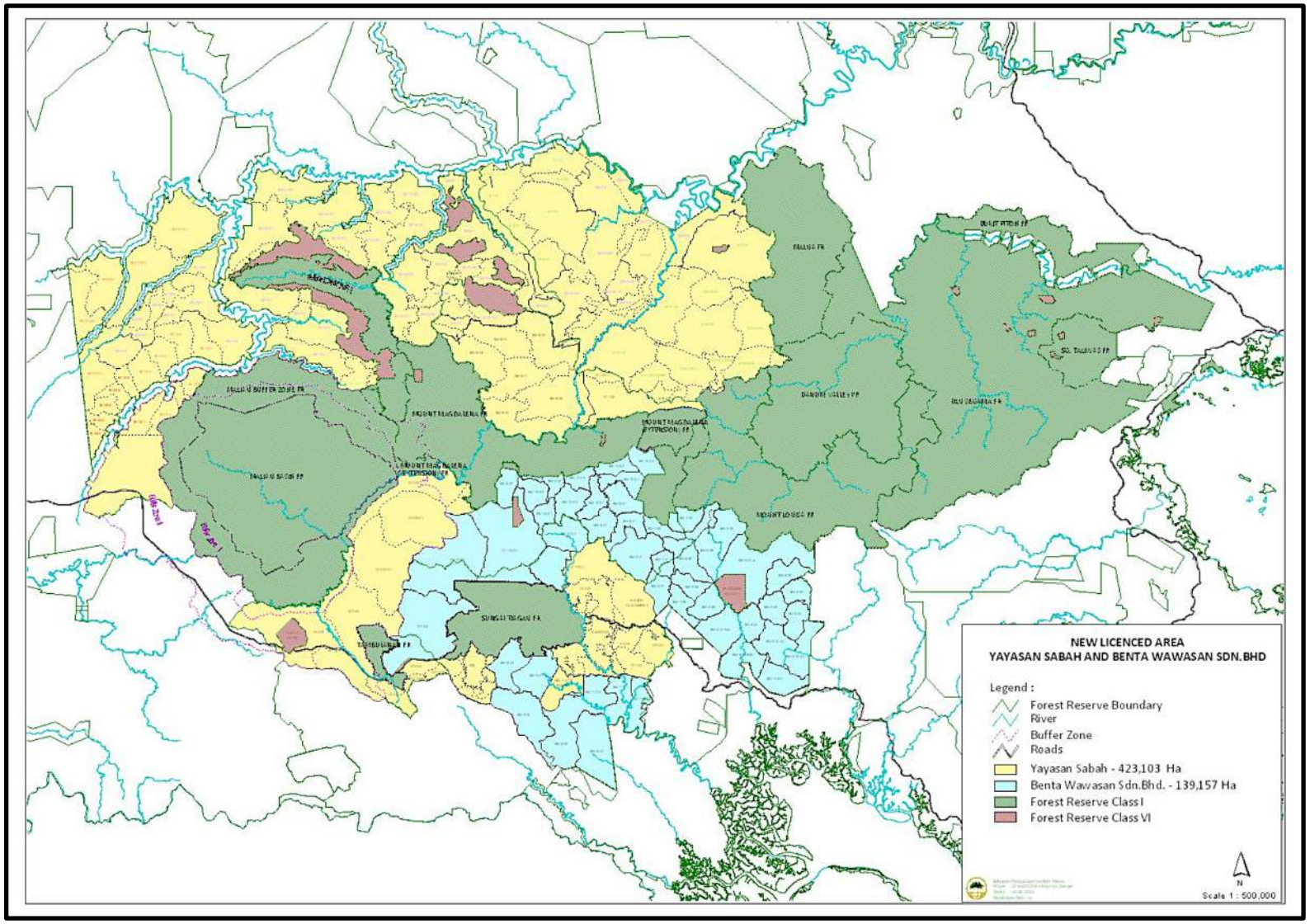


Figure 4.1: Class I (Protection) Forest Reserves in Yayasan Sabah Concession Area

The conservation area of 58,840 ha was furthered protected in April 2012 with the increased of Class I Forest Reserve around MBCA (GoS, 2012) and those of Imbak Canyon Conservation Area (ICCA) and Danum Valley Conservation Area (DVCA). The initiatives has provided an appropriate protection to the area and also created a corridor for biodiversity (especially for large mammals) (refer to **Figure 4.1**).

With reference to MBCA, the above exercise also saw the reclassification of most of Buffer Zone 1 and part of Buffer Zone 2 as Class I Forest Reserve, known as "Maliau Buffer Zone" (GoS, 2012). This protection surrounding MBCA is to provide a good cushion to ensure that the conservation initiative is strengthen. The additional area was reclassified from Class II to Class I (total 46,603 ha) under plan FD No. 102/94 and listed as "Maliau Buffer Zone" comprising of the following forest reserves (SFD, 2013a: 100):

- Sapulut FR = 7,644.0 ha
- Sg. Pinangah FR = 22,163.0 ha
- Gunung Rara FR = 16,796.0 ha

With the reclassification, it means that the conservation area is now protected by a buffer zone that is classified as Class I Forest Reserve (refer to **Figure 4.2**). Class I Forest Reserve are protected forest and cannot be logged but should be conserved for the stability of essential climatic, watershed and other environmental factors. The promotion of part of the buffer zone area, which was a logged over forest to totally protected area has given a new breath, and focus in the buffer zone area will be shifted into advancing a sustainable management of a protected area, i.e. from forest stratum mapping, forest rehabilitation and research. In addition, the balance area of about 3,200 ha (in Buffer Zone 1) should also be considered for gazettement to Class I Forest Reserve to prevent future development in the area and to further increase the protection of the core area.

Proper planning and identification of sensitive areas within the buffer zones need to be conducted but limitations in terms of funding, lack of man power, size of area and research stations is causing some setbacks to the current work to monitor the buffer zone areas.

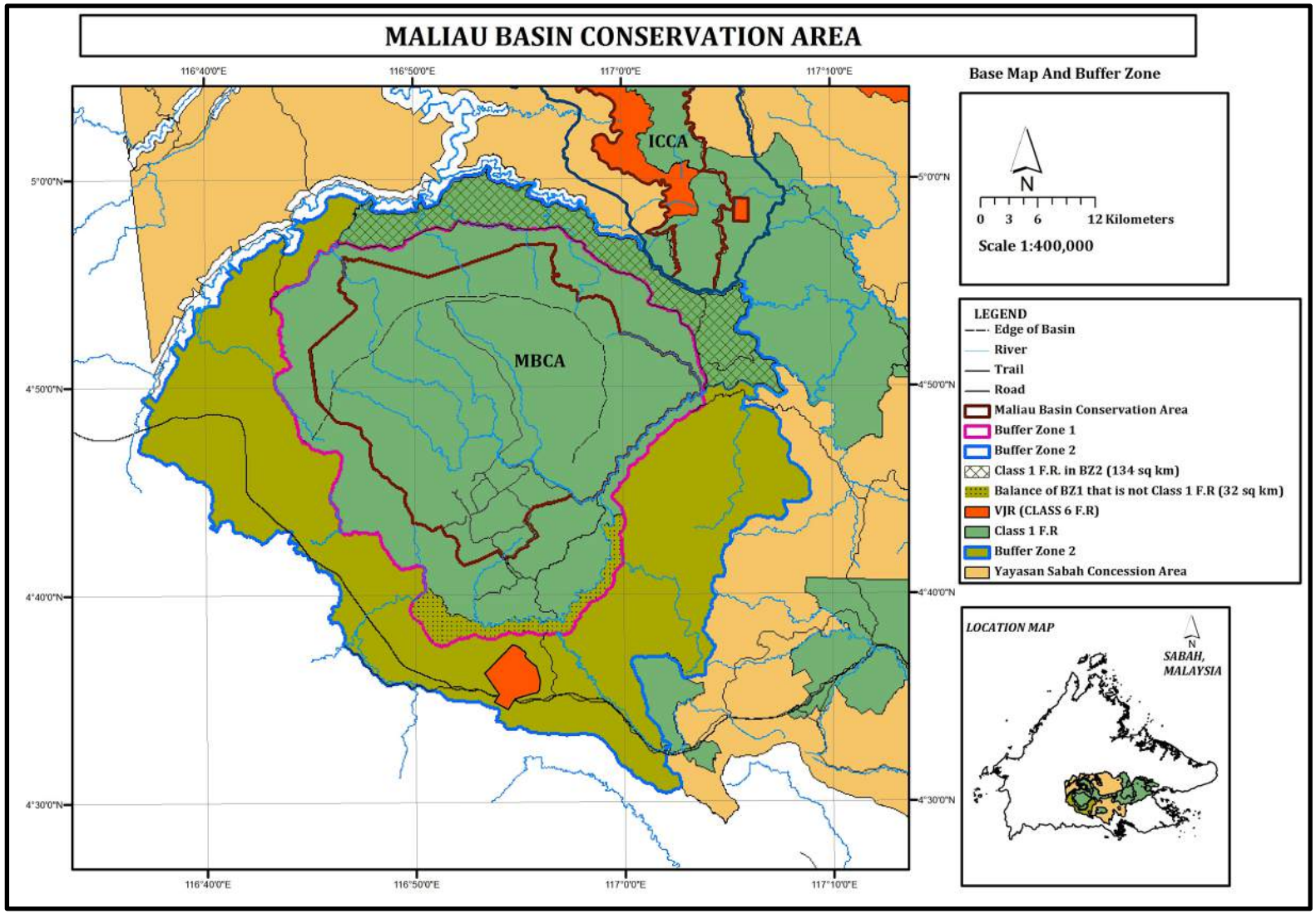


Figure 4.2: Newly established Class I Forest Reserves in buffer zones of MBCA

4.3. Policy Directions

While national and state policies have been discussed in Chapter 3, there are site-specific policies advocated in the former management plan. These site-specific policies were meant to provide clear policy directions for each of the subject matters. **Table 4.1** briefly shows the policy directions set for MBCA, based on the relevant subjects.

Table 4.1: Policy Directions of MBCA

Subject matter	Policy Direction
1. Management objectives	The management strategy will be implemented through an integrated process supported by effective and adaptive management systems based on well-led, well-trained and well-motivated staff using appropriate equipment and infrastructure. Adequate budgets will be needed, but cost recovery and sustainable financing mechanisms shall also be designed to ensure permanence of the conservation system in all foreseeable circumstances. (p. 13)
2. Resources to be conserved	MBCA belongs to the foremost rank of Malaysian conservation areas, alongside Taman Negara in Pahang, Kelantan and Terengganu, Mulu National Park in Sarawak and Kinabalu Park and Danum Valley Conservation Area in Sabah, all of which have the maximum possible priority for national and global biodiversity conservation. Consistent with state and national law and policy, and with Malaysia's international commitments, every effort will be made, therefore, to preserve in perpetuity the natural conditions prevailing within the MBCA. (p. 13)
3. Threats to the resources	Reviewing issues of land use around the conservation area, Greer (2002) concluded that "the MBCA is under an increasing number of development pressures, most of them invasive in nature and that unless proactive measures are taken, the area in the not so distant future will be under siege". This siege will be avoided systematically and continually detecting, understanding, neutralising and diverting threatening factors at all scales from the local and short-term to the state-wide and long-term. The preferred approach to this will be to build partnerships through research, dialogue and shared responsibility for conflict resolution among informed stakeholders. (p. 14)
4. Protective measures proposed	Threats to the MBCA will be neutralised through an integrated process with three main themes that respectively emphasise: • Promoting biological connectedness in the landscape surrounding the MBCA mainly through dialogue between conservation stakeholders and others, so as to avoid conflict between conservation and other land uses; • Managing a buffer zone surrounding the MBCA with the involvement of all local stakeholders, so that the use of resources there complements and supports the protection of the conservation area itself; and • Protecting the conservation area. (p. 15)
5. Enhancing management capacity	If the long-term conservation of the MBCA is to be achieved, adaptive management systems are needed that are able both to overcome challenges and to use opportunities creatively an effectively. These systems should bring smoothly together key elements of operational planning, budgetary accountability, clear line authority, performance monitoring, staff incentives and knowledge management arrangements. Institutional change, decentralisation, staff training and other measures will be needed to ensure that thus capacity is developed and maintained. (p. 16)
6. Education, tourism & public awareness	The ecosystems of the MBCA are knowledge resources that can be used to generate various kinds of sustainable benefit flows to Sabah, Malaysia and the world. Processes of education, tourism and public awareness are viewed as fundamentally connected and will be fully integrated with one another. In this approach, **education** will be used to help create new generations sensitised to the wonders of nature while harvesting revenues from those able to pay for learning experiences; **tourism** will be used to harvest revenues from visitors eager to learn about rain forest ecosystems; and **public awareness** will be promoted by systematic marketing and outreach, using materials in all media developed using rain forest knowledge resources, some of them distributed for free and some sold at profit. These themes strongly reinforce one another, and will be developed together. In all cases, preference will be given to activities that involve minimal risk to the MBCA while yielding

Subject matter	Policy Direction
	maximum benefits – including financial benefits – for conservation. (p. 17)
7. Research and environmental monitoring	The overall strategy for managing the MBCA is to save, study, teach about and use sustainably the components of biodiversity that occur within it, with the aim of preserving in perpetuity the natural conditions prevailing there. Research is the primary means of studying the resource and generating knowledge on what to teach about it, and how to use it sustainably. Both pure and commercial forms of research are desirable, but procedures are needed for allocating scarce resources with which to support researchers, and to ensure that studies are done on mutually agreed terms with a fair and equitable sharing of benefits. The research agenda also intersects with the need for environmental monitoring, both of ecosystem health and security, and of global environment trends to which the Maliau basin's unique isolation particularly lends itself. Environmental monitoring is vital to preserving ecosystems in perpetuity, since it provides feedback on their health and a check on whether conservation efforts are working. (p. 17)
8. Sustainable financing strategy	New techniques, technologies and international markets mean that the conservation sector is now capable of achieving and sustaining an economic role without necessarily conflicting conservation aims. Investments will be directed to this end, in full awareness that the diversity and novelty of a financing strategy based on sustainable use of biodiversity will require innovation, experiment and deliberate diversification of business activities and income streams. (p. 19)

Source: YS (2003)

Several of these policy directions are still relevant to ongoing initiatives in MBCA, and will be appropriately addressed in **Part B** of this report. Nevertheless, it is also necessary to relook at the management objectives, in order to see if these are still relevant to the current plan. The overall management objectives for MBCA (YS, 2003: 12) are:

- *Protection of biodiversity in all its forms;*
- *Promotion of research on intact ecosystems and on the disturbance and recovery of logged ecosystems;*
- *Promotion of education and training in conservation, natural history, ecology, forestry and related sciences;*
- *Promotion of appropriate recreation and nature tourism where this does not conflict with other priorities; and*
- *Integration of conservation, forestry and nature tourism in and around the reserve to create a model sustainable forest management area*.

In terms of the abovementioned management objectives, it might be retained unless there is any deviation or change of focus, e.g. climate change initiatives as a new theme to be considered. If this is so, then the management objectives need to reflect this and to remove those that are not relevant.

Thus, it is potentially necessary that it be expanded beyond just protecting biodiversity, but to include an increase in monitoring. As for education and training, it should no longer be just 'promotion' *per se* but increasing/expanding its standards/modules to ensure the impact is for perpetuity.

Also, the existing promotion of research towards recovery of logged ecosystem should be a standalone objective. Perhaps, it should be disassociated from the research part by promoting ecosystem recovery/ rehabilitation/ reforestation in the logged area (e.g. Buffer

Zone 2) as a standalone management objective. This would revive the buffer zone by its true meaning. While research in MBCA and its buffer zones can still continue, it would have added value by restoring that area. It is timely given that the certain portion of the area has been reclassified as Class 1 Protection Forest Reserve.

The promotion of renewable energy could be one of the important investments that can be made. However, this requires the management of MBMC agreement as whatever appears in the management objectives, it has to be agreed to the objectives and understand how and what they need to do in order to achieve it.

4.4. Planning Framework

In the context of planning, i.e. land use, for areas surrounding MBCA, the approved management plan will constitute an important document as reference. It was observed on several occasions where areas surrounding MBCA were meant to be logged, and on many occasions, the areas designated as buffer zone has been the saving grace.

The preparation of the Sabah Structure Plan 2013-2033 needs to consider the existing and revised management plans of MBCA. This is to ensure that all future activities (from logging to land conversion to agriculture) will take into account the conservation initiative conducted in MBCA and its buffer zones.

Thus, it is the responsibility of Maliau Basin Management Committee (MBMC) to eventually approve and endorsed this management plan, as it will be a guiding reference for potential activities that will be conducted adjacent to MBCA.

CHAPTER 5 BIOPHYSICAL DESCRIPTION

5.1. Introduction

This chapter presents the biotic and abiotic surroundings of Maliau Basin Conservation Area (MBCA) focusing on the physical and biological organisms. Most of the informations presented in this chapter are available through several publications, e.g. Hazebroek *et al.*, (2004), YS (2003) and series of technical reports produced under the YS-DANCED project.

5.2. Geomorphology

Maliau Basin exhibits a nearly circular shape with steep slopes on all sides. The elevation of the basin is affected by the slight tilt of the basin to the Southeast. Overall, the elevation of the basin is about 1,500m at the rim and drops gradually to about 800m at the centre of the basin (refer to **Figure 5.1**). Except for a narrow opening in the Southeast, it is enclosed on all sides. The size of the enclosed basin is about 390 km^2 with a maximum diameter of about 25km. The basin is carved by a set of radiating tributaries of Sg. Maliau, leaving behind erosional ridges and peneplains (Tongkul, 2002).

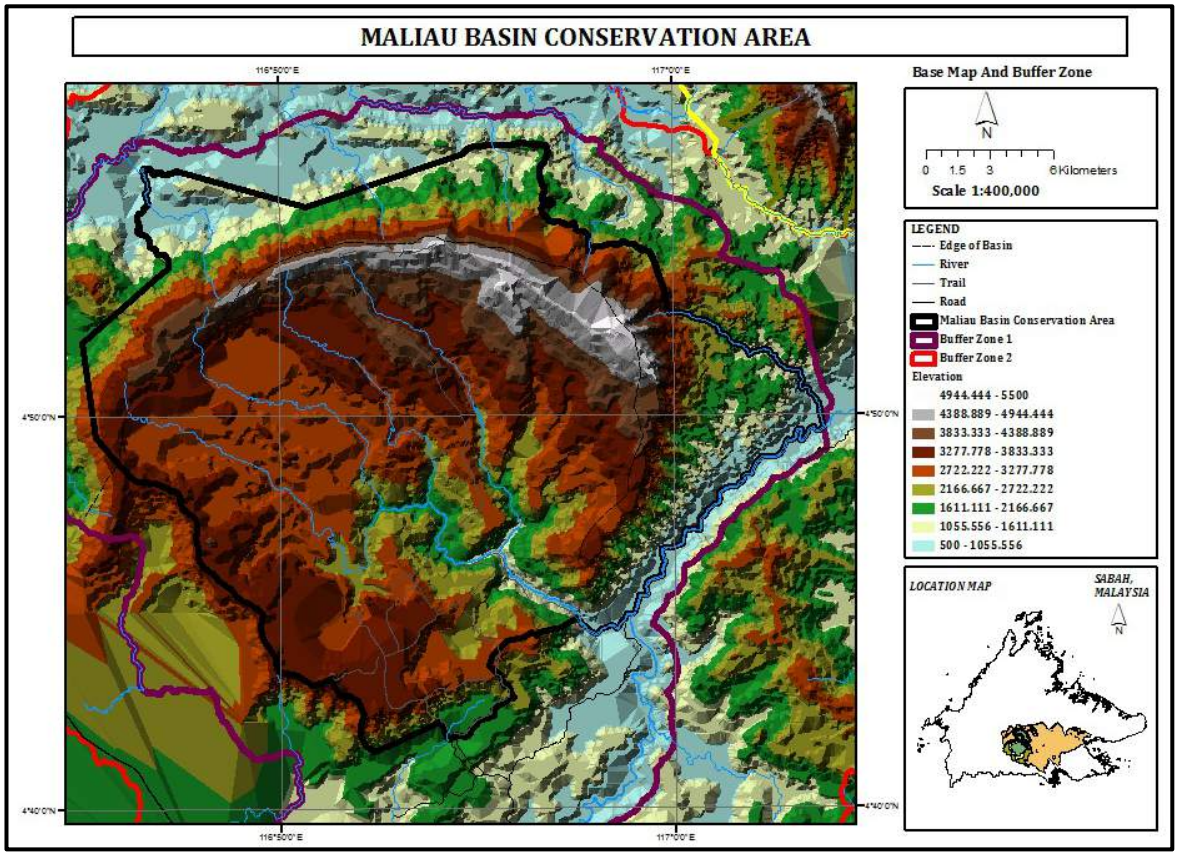


Figure 5.1: Geomorphology of MBCA

Maliau Basin is mainly made up of mudstone layers with some sandstone and siltstone, approximately 7,500 metres thick, which were deposited, in an ancient deltaic-coastal environment, between 9-15 million years ago. The layers at the base of the basin consist

mainly of mudstones reaching up to 2,000 metres thick. Near the rim of the basin, thick sandstone interbedded with thin mudstone and coal seams occur. Towards the centre of the basin a series of sandstone-dominated and mudstone-dominated strata of various thicknesses occur. The youngest sediment is located near the Camel Trophy Field Station (now known as the Nepenthes Camp), whereas the oldest can be found near Lake Linumunsut. The basin sits on older sedimentary rocks, also comprising of thick layers of sandstone and mudstone, with slight unconformity. The semi-circular shape of the basin generally follows the underlying structural trends of the older sediments. The E-W trending strike ridges of the older sedimentary rocks bounds the basin on the northern side whereas the NE-SW trending Lombunan-Pinangah and Lonod Faults bounds the basin on its western and eastern side. Based on the structural geometry of the basin, it is envisaged that the present southwestern rim of the basin originally extend for a few kilometres further south (Tongkul, 2002; Hazebroek *et al*., 2004).

The evolution of Maliau Basin was structurally controlled. Faults trending NW-SE and NE-SW together with the structural trends and topography of the underlying sedimentary rocks played important roles in the development of the basin. The underlying sedimentary rocks, which began its deposition about 20 million years ago on a large elongate basin trending NE-SW was subjected to NW-SE compression between 14-15 million years ago. The tectonic compression resulted in the gentle folding of the underlying sedimentary rocks forming the initial concentric shape of Maliau Basin. The newly formed concentric-shaped basin was subsequently filled by Neogene sediments until about 9 million years ago when the basin was uplifted above sea level due to continued compression in eastern Sabah. The compression resulted in the gentle folding of the sedimentary layers and at the same time accentuated the concentric shape of the basin; through the reactivation of old fault system. About 5 million years ago, Maliau Basin and the surrounding areas were probably uplifted to its present height with a slight tilt to the Southeast. Following the uplift, Maliau Basin and surrounding areas were subjected to intense weathering and erosion that continued up to this day.

The saucer-like surface of the Maliau Basin and the slight tilt of the basin to the Southeast Maliau Basin produce some of the most spectacular waterfalls in Malaysia. Tongkul (2002) notes that 29 waterfalls with heights more than 5 metres were observed in MBCA. The density of waterfalls is extremely high. For example, in an area of about 10 km^2 at the geological centre of the basin (near Nepenthes Camp), several spectacular waterfalls such as Giluk, Noh, Mempersona, Takob-akob, Epip and Alin, occur. Some of these waterfalls, like the Giluk Fall, are made up of several steps. The high density of waterfalls here can be attributed to the right combination of rock types (hard and soft layers), geological structures (vertical fractures and gentle dipping layers) and geological processes. The common occurrence of multi-storey waterfalls is related to the repetitive occurrence of resistant sandstone layers and weak mudstone layers.

5.2.1. Geological

Geologically, Maliau Basin is made of a syncline, folded and uplifted sediments, which are mainly mudstones, intercalated with layers of sandstone and some coal seams. These sediments are of Miocene age, laid down round a former river mouth. The sandstone is poor in nutrients giving rise to extreme podsolic soil conditions on plateaux at the edges of the basin. In the interior, a fan of Maliau River tributaries, with many spectacular waterfalls, dissects these plateaux. The Maliau River itself flows through a gorge out of the southeastern corner of the basin into the Kuamut River, which in turn feeds the Kinabatangan, which is the longest and largest river in Sabah (Hazebroek *et al*., 2004).

The presence of different lithological units, orientation of layers and fracture planes affects the ongoing geological processes that shape the unique landscape of Maliau Basin (Tongkul, 2002). It is important that these diverse lithologies and geological structures be taken into account when developing any part of the basin to avoid geological hazards. It is equally important to control any activities that can drastically alter the existing geological processes within the basin.

5.2.2. Hydrological

The Basin is one of a series of saucer-shaped structures found in central and southeastern Sabah. It is an integral part of the headwaters of the Kinabatangan River system, The saucer-shaped basin is a single water catchment, drained by one river only; the Maliau River, which flows through the Maliau Gorge, joining the Kuamut River and eventually the Kinabatangan River, Sabah's largest and most important waterway it also represents a single massive water catchment area and is drained by a set of radiating tributaries of the Maliau River, one of which descends a magnificent series of waterfalls, known as the Maliau Falls. Numerous smaller waterfalls have also been discovered throughout the Basin due to the narrow gorges, which runs along the fracture plane to create the primary drainage routes, while tributaries cut down towards them through layered rocks to produce horizontal benches vertical waterfalls at every fracture plane (Tongkul, 2002).

Due to its unique geomorphology, Maliau Basin has a spectacular array of more than 40 waterfalls located in close proximity; possibly one of the densest arrays of waterfalls in Malaysia (Hazebroek *et al.,* 2004). Many of Maliau's falls are multi-layered, including the iconic 7-tier Maliau Falls with the bottom tier being the most spectacular, spanning 200 metres across with a roaring 40 metre drop.

5.3. Rainfall & Climate

Figure 5.2 shows several stations of the stations established in and around MBCA to collect data on rainfall, temperature, relative humidity and wind direction. There are 4 stations in MBCA, and 3 outsides. Nevertheless, there are only 2 stations from MBCA that records are obtained, i.e. from Nepenthes and Belian camps. To date, only one station continues to provide regular data, i.e. the station at MBSC (i.e. Belian Camp) (**Picture 5.1**).

Picture 5.1: Automatic weather Station (AWS) at MBSC

The Maliau Basin's rainfall regime is similar to that of Danum Valley's with intra-year seasonality influenced by monsoon winds, and inter-year variability influenced by the El Niño-Southern Oscillation (ENSO) phenomenon, which is associated with occasional droughts. The total rainfall recorded in 2012 was 2,756.0 mm, with a monthly average of 218.6 mm (the results averaged across five recording stations in the conservation area). The total rainfall recorded for 2012 was not much difference from the mean average of 14 years (from 1986 till 1999) of 2,712 mm (YS, 2003). The lowest amount of monthly rainfall recorded was 85.2 mm in September, and the highest 433.6 mm in April of 2012.

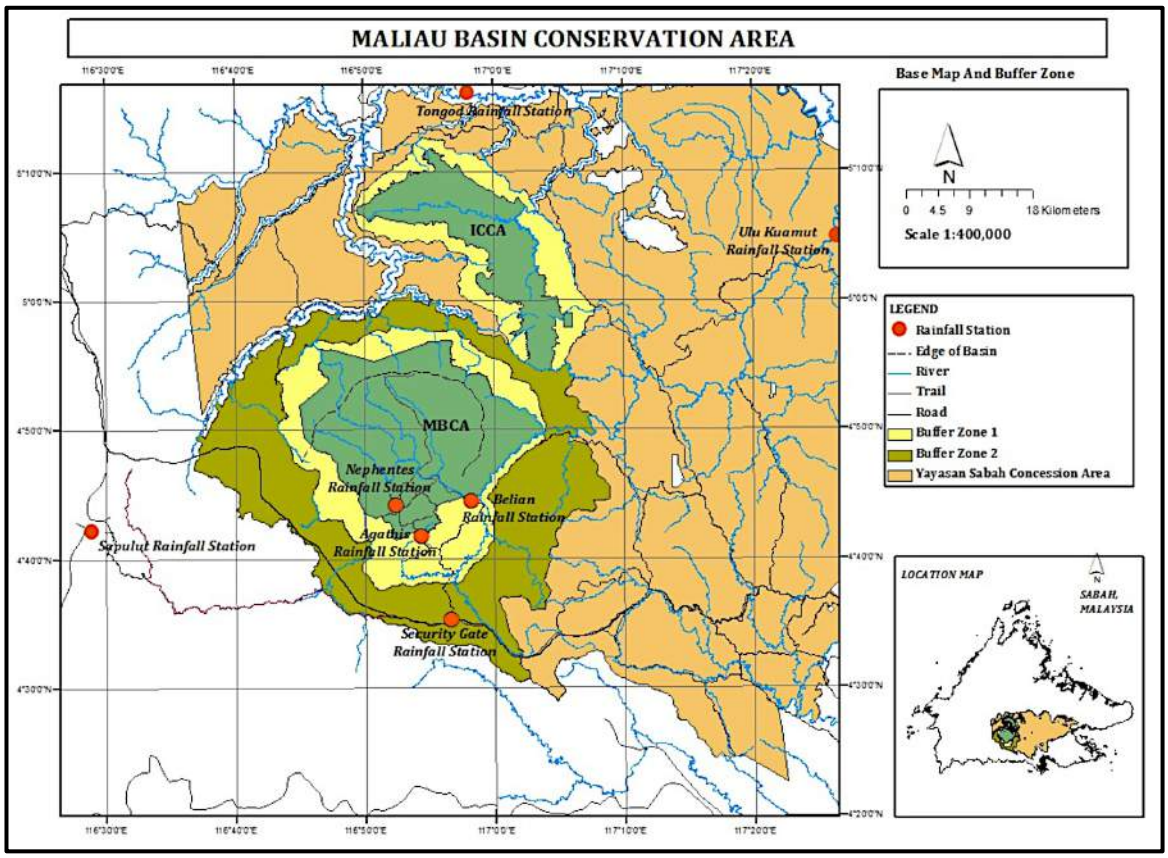


Figure 5.2: Rainfall stations within MBCA and its surrounding

Daytime shade temperatures in the lowlands rarely exceed 33° C, and rarely fall below 20° C at night (YS, 2003). Data recorded in 2012 at two stations in Maliau indicated a mean daily temperature of 23.4° C, with the lowest mean temperatures in January (20.5° C) and the highest in October (26.6° C). Average temperatures decline by about 0.75° C per 100 m ascended, which combines with other edaphic factors such as cloud, mist and water to modify the forest considerably with increasing altitude.

5.4. Flora

Other than areas that have been cleared for helipads and camps, landslides, rivers and Lake Linumunsut, Maliau Basin is covered entirely by evergreen tropical rain forest, which consists of a mixture of tree species with at least 12 distinct forest types (Hazebroek *et. al,* 2004), These mixtures of species are responsible for the variation in the appearance of the forest floristic composition structure.

Table 5.1 shows the forest formation in MBCA as described in the earlier management plan (YS, 2003). A report by Saw and Marsh (1989) suggests that there are four main forest formations, but subsequently it was regrouped into three major structural categories, i.e. lowland, lower montane and upper montane forests (Webb and Ali, 2002).

Table 5.1: Major Forest Formations in MBCA

A. Lowland Rainforest (upto about 600 m asl) • *Lowland (dipterocarp) forest*, confined to the lower valleys of Sungai Maliau and its main tributaries, and outside the basin to areas around Lake Linumunsut, along the southern foot of the basin wall from Belian to Agathis camps, and along Sungai Kuamut; • *Floodplain forest*, up to about 300 m from the Sg Maliau below Maliau Gorge; and • *Riverine (riparian) forest*, adjacent to the rivers where the soils are rocky and subject to flooding.
B. Lower Montane Rainforest (from 600 to 1,200 m asl) • *Upper dipterocarp forest*, from 600-1,000 m and comprising: o *Dry ridge forest* on yellow sand soils (6,669 ha). o *Clay upland forest* on clay soils (12,150 ha). • *Lower montane Agathis forest*, on sandy soils from 1,000-1,200 m; and • *Lower montane heath forest*, on white sand soils from 900-1,200 m.
C. Upper Montane Rainforest (from 1,200 to 1,500 m asl and above) • *Oak-conifer forest* on clay soils; • *Upper montane Agathis forest*, on yellow sand soils; • *Upper montane heath forest* on white sand soils; and • *Montane ericaceous* or *rim forest* on sandy soils at peak elevations.

Source: YS (2003: 50)

Compilations of historical developments to record the biodiversity of MBCA were conducted over several scientific expeditions and its outputs were published as shown in **Table 5.2**. To date, the current records stand as shown, with the complete lists as shown in the appendices.

Table 5.2: Summary of Biodiversities in MBCA

Reference	No. of Species					Note
	Lower Plants	Higher Plants	Mammals	Birds	Frogs	
YS (Yayasan Sabah) (2003)	1,806		70	238	50	
Hazebroek *et al*. (2004)	1,687		89	264	48	• There are a total of 1,723 species of lower plants and higher plants listed. However, those labelled as "*Gen. sp*" are removed from the list due yo uncertainty of the genus. • Species that do not exist in MBCA are removed, i.e. *Licuala longipes* and *Licuala sabahana.*
ASM (Academy of Sciences Malaysia) (2008)						• For higher plants and lower plants, there are a total of 176 new species discovered and recorded.
Ibrahim Komoo *et al*. (2010)			82	270		
Current (2014), 2nd MBCA MP.	716	1,148	92	278	53	• Total of 1,864 species for lower and higher plants

With reference to status of the flora in MBCA (refer to **Table 5.3, Appendix G & H**), floras in MBCA are divided into two categories, i.e. trees (**Appendix G**) and lower plants (**Appendix H**). Trees included large tree, tree shrubs, tree-lets, lianas, flowerless seed plants such as conifers, woody climbers and epiphytes. Meanwhile lower plant includes herbaceous climbers or shrubs, ferns, arborescent plants, woody vines plant, mosses, woody climbers and hemiparasites, pitcher plants, grasses, orchids and other flowering plants.

For higher and lower plant species, as in 2014 a total of 176 new species discovered and addition of 4 new familes which are Hookeriaceae, Prionodontaceae, Pterobryacea and Thuidiaceae. Most of the new added species are classified under lower plants. Current total species of trees are 1,148 where 88 species are listed under IUCN Red List (**Appendix G**), and for lower plants at 716, where 20 species are listed under IUCN Red List (refer to **Appendix H**).

a. Trees

There are 1,148 species of trees under a total of 76 families known in MBCA with 38 of the total species are listed as threatened under IUCN Red List, 3 species listed under CITES and 26 species listed under WCE (refer to **Table 5.3** and **Appendix G**). Among the listed species are from the family *Dipterocarpaceae* (Meranti) which most of its species is under threatened. These threatened species includes *Dipterocarpus crinitus*, *Shorea platycarpa* and *Shorea gibbosa*. Currently, there are 38 species of trees in MBCA that are classified as threatened out of 88 species listed in Red List. Extensive harvesting of this particular tree species due to its high value in the market as timber product may be the caused of their decreasing number.

b. Lower Plants

For lower plants (**Table 5.3**), there are 716 species under a total of 92 families known in MBCA with 20 of the total species are listed under IUCN Red List, with 2 species listed as threatened (i.e. *Illicium kinabaluensis* and *Nepenthes lowii*), 111 species listed under CITES and 142 species listed under WCE (**Appendix H**).

Table 5.3: Summary and Status of Flora and Fauna in MBCA

Descriptions	Mammals	Birds	Frogs	Trees	Lower Plants
Family	32	52	6	76	92
Species (total)	92	278	53	1148	716
Endemic to Borneo	19	20	-	-	-
IUCN Red List (Threatened)	13	9	1	38	2
CITES	88	16	0	3	111
Wildlife Conservation Enactment (WCE)	48	56	0	26	142

It must also be noted that two plants mentioned in Hazebroek *et al*., (2004: 201), i.e. *Licuala longipes* is not found in Borneo (it is only known from Peninsular Malaysia and Sumatra), and *Licuala sabahana* is restricted to North-east Sabah and never recorded from Maliau Basin. Among the listed species are from the family *Orchidaceae* (orchids), *Nepenthaceae* (pitcher plants) and *Zingiberaceae* (gingers). Most of the listed species falls on class II for both CITES and WCE. These types of plants are often treat as a luxury ornamental plant and may be used for traditional medication purpose which may explained why it is more threatened in regionally instead of global scale.

5.4.1. Lowland Forest

In the lowland forest (between 100-300 m) area of the basin, restricted to the lower slopes of the Maliau River valley and its main tributaries, mixed dipterocarp forest is the dominant type of forest. It occurs at the full circumference of the Conservation Area from Belian camp to between Lake Linumunsut and boundary, and within the basin (Bambangan and Rafflesia camp). Due to the high productivity and the unstable soils on which this vegetation type occurs, the forest is relatively highly disturbed. The tallest tree such as the *Koompasia excelsa* occurs on the ridges, where soil movement is relatively slow.

The forest consists of tall dipterocarp trees usually 25-45 m high. This forest type is where the greatest diversity of species of plants and animals is found and covers about 12% of the basin. 74 species of dipterocarps of the genera *Shorea*, *Dipterocarpus*, *Parashorea*, *Dryobalanops*, *Vatica* and *Hopea* occur in this forest type. Other canopy species such as the bean family, Fabaceae and *kendondong*, and wild relatives of fruit trees (durian, rambutan, breadfruit, mangosteen, etc.) also occur in Maliau's mixed dipterocarp forest. Within this forest, at a low-lying terrain adjacent to rivers and large streams, *Koompassia excelsa* or the *Menggaris* tree of bean family (Fabaceae) occurs as the natural vegetative. It is one of the tallest trees in Sabah's rain forest – can reach up to 88 m tall and 2.7 m diameter. A bonsai-like shrub occasionally perched on rocks (*Osmoxylon borneense*), endemic to Borneo is often seen near waterfalls.

5.4.2. Lower Montane Forest

A lower forest consists of trees around 15-30 m high flourished in about 750-850 m elevation. This lower montane forest has fewer big trees with even canopy but more epiphytes. The majority of trees are of the family Fagaceae (oaks and chestnuts), Lauraceae (laurels), Myrtaceae (myrtles) and Clusiaceae (mangosteen family). In 2002, more than 25 species of oaks and chestnuts in Maliau has been recorded (Webb & Ali, 2002). The conifers dominate the forest of Maliau as majority of its forest are made of high elevations trees. There are two main groups of conifers based on its leaves characteristic:

a. Broad, flat leaves
Three common species – *Agathis borneensis*, *Phyllocladus hypophyllus* and *Podocarpus polystachys*

b. Scale-like leaves
Dacrycarpus imbricatus and *Dacrydium* sp.

The lower and upper montane forest together comprises 67% of the basin – majority being the lower montane forest (Saw & Marsh, 1989). The transition of zone (ecotone) where lower montane forest and tropical heath forest overlaps and intergrades, species from both types of forests mixed together producing small

groves or patches. These groves could appear as separate forests types such as Agathis forest (*Agathis borneensis*) and Casuarina forest (*Gymnostoma sumatrana*). The ecotone, where the two types of forest exist in a hybrid condition, is where botanists have recorded unique plant forms (Wong, 2001) and also orchids and other rare plants (Lamb & Wong, 1989).

5.4.3. Upper Montane Forest

At elevation above about 1,200 m, is the upper montane forest – a dwarf forest typified by dense, stunted tree growth with leathery leaves where the ground is largely covered by tangled roots in moss and peat. The trees here are short not more than 4 m tall. The pitcher plant of *Nephentes stenophylla* is commonly scattered over the stunted trees. Common vegetative in this forest include members of the Ericaceae, Myrtaceae, Lauraceae, Clusiaceae and conifers (Saw & Marsh, 1989). Other species present in Maliau's upper montane forest are Calophyllum spp., *Podocarpus neriifolius*, Ilex spp., Rapanea spp., *Lithocarpus lucidus*, *Chionanthus* cr. *cuspidatus*, the delicate liana *Embelia myrtillus*, Weinmannia spp., *Drymis piperata*, *Eugenia bankense*, Syzygium spp., Vaccinium spp., Rhododendron spp., Tristaniopsis sp., *Dacrydium elatum*, *Disepalum anomalum*, Prunus spp. and *Tetractomia tetrandra*.

5.5. Fauna

Maliau Basin has a list of 89 mammal species, 16 of the species are recorded only in the buffer zone (Juul-Nielsen, 2000; Traeholt, 2001a, 2001b, 2002; Malim, 2002; Olsen, 2002). However, the list was upgraded after the large scale wildlife inventory held in June 2013 to that of 92 species of mammals under a total of 32 families recorded in MBCA, with 13 of the total species listed as threatened under IUCN Red List, 88 species listed under CITES and 48 species listed under Wildlife Conservation Enactment (WCE) (refer to **Table 5.3** and **Appendix I)**. The three new species added to the list are those from Chiroptera (bats), i.e. Creagh's Horseshoe bat (*Rhinolophus creaghi*), Bicolor Roundleaf bat (*Hipposideros bicolor*) and Pygmy Fruit bat (*Aethalops alecto*). A total of 19 species are endemic to Borneo. Most of the listed species are carnivores, primates and cloven-hoofed mammals. The list of mammals categorised as threatened include that of Clouded leopard (*Neofelis diardi*), Bay cat (*Pardofelis badia*), Bearcat or Binturong (*Arctictis binturong*), Sunbear (*Helarctos malayanus*) and Sumatran rhino (*Dicerorhinus sumatrensis*). Most of these mammals are often hunted by humans for their precious skin, furs and horns, however for some mammals such as the Bearded pig (*Sus barbatus*) and Sambar deer (*Rusa unicolor*) made into the threatened and protected list may have different explanation. One of the common assumptions that can be deduced is that humans also hunt this wildlife as a food source by locals. Second, it may also because of the deteriorating natural forest of their habitat that is encroached for unsustainable urbanisation and development. Third, it is their food source that is limited or scarcely available as the mass fruiting and flowering has

change due to current climate change that may or may not affecting the tree phenology within these past few years.

A bird list of 278 species from 52 families has been recorded, with 9 of the total species listed as threatened under IUCN Red List, 16 species under CITES, and 56 species under the *Wildlife Conservation Enactment* (WCE) for protected and totally protected species (refer to **Table 5.3** and **Appendix J**). Some of the species recorded are the rare Bulwer's Pheasant (*Lophura bulweri*), Crimson-Headed Partridge (*Haematortyx sanguiniceps*), Waterfall Swift (*Hydrochous gigas*) and Borneon Bristlehead (*Pityriasis gymnocephala*), plus a new record for the Borneon Forktail (*Enicurus borneensis*) found within the core area during the June 2013 Wildlife Resource Survey. This includes 20 endemic bird species (refer to **Table 5.3**). About 33 species has been identified to be only recorded in the buffer zone (Biun & Lakim, 2002; Lakim, Biun & Moeller, 2006). No less than one quarter of the bird species present were listed by the IUCN as threatened or near threatened. The vast number of bird species in Maliau made the basin a global hot spot for bird biodiversity. The basin's bird population also comprises of northern wintering species such as the Siberian-Blue Robin (*Erithacus cyane*), Grey Wagtail (*Motacilla cinerea*) and Arctic Warbler (*Phylloscopus borealis*).

MBCA is a designated Important Bird Area (IBA) by BirdLife International (with 55 IBAs in Malaysia, and 14 in Sabah) (Yeap, Sebastian & Davison, 2005). Several globally threatened species are to be found in MBCA (IBA #25), including that of Wallace's Hawk-Eagle (*Spitzaetus nanus*), Bulwer's Pheasant (*Lophura bulweri*), Large Green Pigeon (*Treron capellei*), Blue-Banded Kingfisher (*Alcedo euryzona*), Blue-Headed Pitta (*Pitta baudii*), Straw-Headed Bulbul (*Pynonotus zeylanicus*) and Large-Billed Blue Flycatcher (*Cyornis caerulatus*). Of particular interest is the occurrence of all 9 species of Barbets (*Ramphastidae)* and all 8 species of Hornbills (*Bucerotidae)* in Maliau Basin, the latter being particularly important agents in the forest ecosystem due to their dispersal of seeds from fruit trees, etc.

45 species of amphibian in 6 different families has been recorded (Traeholt, 2001b, 2002; Ahmad & Wong, 1998) and is based on the samples collected in Maliau Basin and Tembadau Valley (Ahmad & Wong, 1998). It also shows variable between forest types of frog fauna (Ahmad & Wong, 1998). So far there are 53 species of frogs recorded under a total of 6 families known in MBCA with one listed under IUCN Red List and only 2 species are threatened. These species are, Blue-spotted tree frog (*Rhocophorus bimaculatus*), Golden-legged bush frog (*Philautus aurantium*). This number however, may not represent the real number of species of frogs in MBCA as more on-going research are still conducted with new species discovered. Among the species recorded, two species are new records for Sabah – an endemic species to Borneo, Brown torrent frog (*Meristogenys phaeomerus*), and Sarawak slender litter frog (*Leptolalax gracilis*).

The aquatic ecosystem of Maliau's rivers and streams is associated with low productivity due to its nature for being highly acidic, low ion concentration, low transparency, and low dissolved and suspended solids which give its tea-coloured water or 'blackwater'. As to this reason accompanied by the many vertical and overhanging waterfalls, which prevented movement of fish into the drainage system, the fish diversity and abundance is limited. One species of catfish (*Mystus nemurus*) were found to be confined in the basin's large stream, a species of the cyprinidae family (*Puntius sealei*) in all types of streams and the largest of betta species (*Betta unimaculata*) in small streams (Marsh, 1989; Martin-Smith, 1998).

5.6. Discussion

Maliau Basin is one of the few remaining area that is virtually untouched and also known as wilderness area which is defined by the IUCN - Protected Areas as "a large area of unmodified or slightly modified land and/or sea, retaining its natural character and influence, which is protected and managed so as to preserve its natural condition" (Dudley, 2008: 14).

The World Wildlife Fund has divided Borneo into seven ecoregions: five areas of lowland forests; the central Borneo montane rain forests; and the Kinabalu montane alpine meadows (Wikramanayake *et. al.*, 2001). Maliau Basin lies in the "Borneo lowland rain forest" ecoregion, within the Tropical and subtropical moist broadleaf forests. In other aspect, MBCA is part of the Heart of Borneo (HoB) initiative (SFD, 2013a), and designated as an Important Bird Area (IBA) (Yeap *et. al.*, 2005).

Forests are home to almost half of the world's species, with some of the richest biodiversity found in Maliau Basin protected forests. Maliau is believed to be formed and protected by its inner rim flora and fauna since the high-latitude glaciation last 2 million years ago. As for this, many rare and endangered species (most are endemic), such as Orang Utan (*Pongo pygmeus*) depend on dense patches of isolated forest. The basin is recognised globally as centre of plant diversity (IUCN and WWF) and a key area for restricted-range birds (Myers, 1988 & 1990). Although the list of recorded species of flora is far from complete, 40 identified species has been listed as "threatened" by IUCN. A total of 1,864 species of flora (trees and lower plants) has been recorded to date, up from the earlier 1,806 species of (YS, 2003). It includes 10 species of Nepenthaceae, where one species is new (*Nephentes veitchii*) to Sabah and the other, a new hybrid (N. *veitchii X N. stenophylla*) which are larger than either of its parent (Lamb & Wong, 1989), 153 species of orchids which includes one new for Sabah, a new *Bulpophyllum* and others are rare species. Other new species are *Thismia* of Burmanniaceae family, *Benincasa* and *Zehneria* of Cucurbitaceae family and a new *Gymnostoma* species of Casuarinaceae family. The lowland forest is among the most abundance of species present of all Maliau's ecosystem. A highest priority for conservation of the basin should be accorded, as majority of the species present are the most endangered. Forest types of higher elevation should also be given priority for

conservation, as the species are impressively diverse, unique and rare especially in the case of forest dominated by the Casuarinaceae family, *Gymnostoma sumatrana.*

Wide physical conditions of Maliau (e.g. elevation ranges, soil types from sandy to clay soils, drainage, and exposure) made its ecosystem to "house" species in each location with diverse chemical and genetic types, and morphological variety within each species and also other species group. Genetic diversity is as important as species diversity in maintaining ecological processes. Forests are incredible repositories of genetic diversity. Individuals of a given species may appear to be uniform, but in many cases there is a great deal of variability. Almost all tree species are highly variable genetically, especially widespread, long-lived, wind-pollinated species. Tree species with widespread distribution and late successional status generally maintain most of their variability within populations, and there is often little difference among populations. Species with insect pollination instead of wind pollination, and particularly those with isolated patchy occurrence, often exhibit more genetic variability among populations. In Maliau Basin, over hundred species was recorded and all single species give a high value on genetic variation. Endemism is an ecological state where the existence of species is exclusive to that region or location. Endemism is cause by physical, climatic, and biological factors. Endemic species is important in maintaining the genetic diversity and due to the species adaptability to their ecosystem, their interactions with one another is mutually beneficial.

As what has been accepted by mankind for generations, extinction is a natural process since the beginning of time although at a much slower rate than what we experience today. The question is: If extinction is a natural process, then why the effort of trying to save or conserve certain, if not, the entire species? For example, the extinction from Borneo of the Malayan Tapir (*Tapirus indicus*) and Javan Rhinoceros (*Rhinoceros sondaicus*) from Borneo (Cranbrook, 1986) were well discussed. These species are not only important for economic and social benefits (ecotourism), but these species whether its plants or of the animal kingdom, may provide us with more valuable benefits.

In agricultural sector, plant disease is a major problem for smallholders and is also the reason of massive usage of chemicals (pesticides and herbicides). Conserving species from extinction means we could have more time researching, which would increase the possibility for discovering potential medicinal, agricultural, structural, energy and other advancement. The ecosystem functions as water purification, recharging of ground water, soil generation and maintenance, chemical cycling via oxygen production by rainforest, and energy fixation sites. If biological diversity of an ecosystem is destroyed, MBCA will lose these natural abilities. Hence, replacing or repairing this function will be costly eventually.

CHAPTER 6 SOCIO-ECONOMIC

6.1. Introduction

This part of the report presents the distribution and economic activities of the local communities and villages surrounding Maliau Basin Conservation Area (MBCA). Several studies were conducted during the YS-DANCED project in 1999-2003, with outputs in the form of Technical Reports.

6.2. Local Communities

MBCA is surrounded by four main districts comprising of roughly almost 56,000 populations (Wong & Guntavid, 2000; Baptist *et al*., 2000). The districts are Tongod, Kalabakan, Sook, and Nabawan/Pensiangan (refer to **Table 6.1** and **Figure 6.1**). The districts are further sub-divided to divisions or "*mukim*".

Table 6.1: Local Communities from Districts surrounding MBCA

a. Tongod District (50 villages) (29,938 population)		
Tongod Division (10)	Kg. Kuala Tongod. Kg. Maligatan, Kg. Purutawoi, Kg. Bulot (Sinarupl), Kg. Kiliwatong, Kg. Kiandongo Darat, Kg. Talibu, Kg. Imbak, Kg. Tongodon, Kg. Sogo-sogo	3,218
Pinangah Division (15)	Kg. Penangalt, Kg. Tamplsak, Kg. Dewara, Kg. Malikup, Kg. Mengkavago, Kg. Masoum, Kg. Masoum II, Kg. Saguon, Kg. Alitang, Kg. Langga dan Kg. Inarad I, Kg. Inarad II, Kg. Pianangah, Kg. Saup Baru, Kg. Liupampang	4,933
Entilibon Division (15)	Kg. Langkabong, Kg. Mananam, Kg. Maliau, Kg. Namukon, Kg. Minusoh, , Kg. Lanung, Kg. Napagang, kg Linayukan, Kg. Sanan, Kg. Kirongu, Kg. Bobotong, Kg. Simundoh, Kg. Entilibon Asal, Kg Simpang Entilibon, Kg Singgahmata	7,215
Kuamut Division (10)	Kg. Desa Permai, Kg. Kuamut, Kg. Tungkuyan dan Kg. Tulang-Tulang, Kg. Bangkulat, Kg. Tenaga Baru, Kg. Karamuak Dalam, Kg Karamuak Luar, Kg. Tenaga Baru, Kg. Kenang-Kenangan	2,425
b. Kalabakan District (2,235 population)		
	Batu Lima Tibou, Seludung Laut, Pinang Kalabakan, Kg. Ruu Kalabakan. Lubang Buaya. Rancangan Kalabakan, Kg. Mangga, Batu 2 Kalabakan, Kalabakan Pekan, Luasong and Makandot 1 Luasong	
c. Nabawan/Pensiangan District (79 villages) (19,081 population)		
	Kg. Laiyon, Kg. Malinja Tiga, Kg. Pulutan, Kg. Sikalabot, Kg. EmJBt (Murni), Kg. Kagulangu, Kg. Sandukan, Kg. Kainggalan, Kg. Salong, Kg. Panabaan, Kg. Salangan, Kg. Tataluan. Kg. Padang Talangkai and Kg. Sapulut	
d. Sook District (86 villages) (17,271 population)		
	Kg. Sinua, Kg. Paplr Barn. Kg. Lohan Lara, Kg. Kuit Lanas, Kg. Lanas Station, Kg. Matima and Kg. Nukakaton Baru.	

Sources: Baptist *et al*. (2000); Wong & Guntavid (2000)

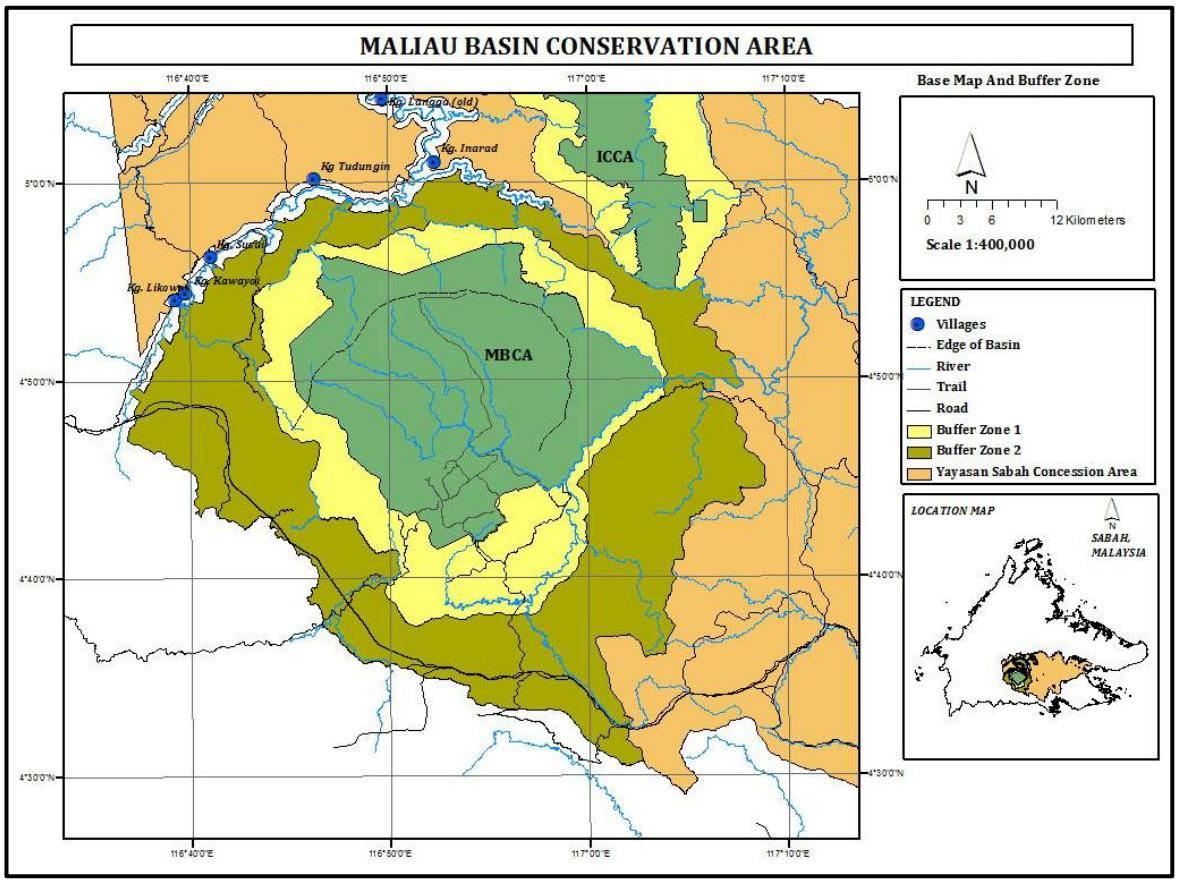


Figure 6.1: Villages surrounding MBCA

6.2.1. Distribution

The communities surrounding MBCA is scattered around, covering four main districts (Tongod, Kalabakan, Sook and Nabawan/Pensiangan), which are made of about 210 villages. There are only 5 villages that are located at the perimeter of Buffer Zone 2, and another one just outside, totalling 6 villages as shown in **Figure 6.1**.

Tongod district comprised of four main divisions or 'mukim', i.e. Mukim Tongod, Mukim Pinangah, Mukim Kuamut and Mukim Entilibon (refer to **Table 6.1**). Tongod district is very remote compared to other districts, it is right in the centre of Sabah where one of its division "Pinangah" came from the word *'Tangah'*, which means right in the centre; and with population scattered around.

6.2.2. Population

In 1988, the total population in Tongod District was 6,569 peop1e (Clive and Barnabas, 1988 in Wong & Guntavid, 2000: 1) but increased two and half times to 17,791 people in July 2000. The biggest village is Kg Minusoh of Entilibon comprised of 2,391 peop1e due to the resettlement scheme introduced in 1982, followed by Kg. Alitang (977 people), Tampasak (670 people) is divided into Tampasak Darat and Tampasak Laut; and Pinangah (647 people), also divided into three parts, i.e.

Pinangah Daral, Pinangah Tengah and Pinangah Laut. The other villages mostly comprised of about few hundred people, in an average of about 400 people.

The main transportation is by boat even though there are logging roads or gravel roads from Telupid to Pinangah, Tongod and Langga. Most of the villages are accessible by river because they are located near the river banks (Wong & Guntavid, 2000).

Table 6.2 shows the populations from the 6 villages adjacent to the boundary of Buffer Zone 2 as of 2013. Most are working on their agricultural lands, i.e. planting hill padi and other cash crops. However, there are indications that oil palm is slowly being introduced for smallholders by the state government.

Table 6.2: Villages surrounding MBCA

Village	Household (keluarga)	Population	Main economic activities
1. Kg. Inarad I (Pinangah Division)	47	255	• Swidden agriculture (Hill padi & Tapioca) • Fishing • Forest Produce (Hunting & Wild Meat, Plants)
2. Kg. Inarad II (Kg. Likowon, Kg. Kawayoi, Kg. Susui, Kg. Tudungin)	80	269	• Swidden agriculture
3. Kg. Langga (Pinangah Division)	31	145	• Swidden agriculture (Hill padi & Tapioca) • Forest Produce (Hunting & Wild Meat, Plants)
Total	**158**	**669**	

Source: CEMD *pers. comm*. (2013)

6.3. Economic Activities

The main economic activities for the local communities are farming activities using some modern techniques, traditional agriculture such as shifting cultivation, hunting, fishing, cash cropping, raising livestock, cottage industries and logging (Baptist *et al*., 2000). Hunting and fishing is also one of the major providers for important sources of protein for communities practicing shifting cultivation in the area.

Other source of potential income for the locals, which could help reduce hunting and collection on non-timber forest produce pressure in MBCA, is to involve the local people in the MBCA by providing job opportunities as tourist guides or rangers. However, this may involve an educational programme. This would also require the long-term presence of people on the ground to integrate people's needs and aspirations with those of the wildlife (Juul, 2001).

The local community's livelihood and source of food should not just be restricted to areas outside of Maliau, potential access to the buffer zone areas for subsistence hunting and collecting of forest produce may be considered (especially on Buffer Zone 2 – Class II forest reserve), if the MBMC wants to have the support from the community for their conservation work. A forest 'tagal area' or designated zone for communities (as Class III – Domestic Forest) use can be identified for the community. However, such activity is to be prohibited from all Class I forest reserve.

6.3.1. Within MBCA

Support and collaboration is essential from the local communities and there is a need to encourage greater participation of the local communities in the management of MBCA and its surroundings. This can be done via:

a. Education and awareness – ensuring communities understand the concept of conservation and sustainable use of resources, problems of unsustainably high levels of hunting, etc.; and
b. Monitoring of wildlife populations by the local communities in a co-management system, via the Honorary Wildlife Warden (HWW), Honorary Forest Ranger (HFR) and the SMART (Spatial Monitoring and Reporting Tool) training (www.smartconservationsoftware.org).

Another direct benefit to the local community's is creation of opportunity for their employment. **Table 6.3** provides some of the potential roles for local communities that can be initiated in MBCA.

Table 6.3: Roles of local communities in MBCA

Areas of Engagement	Notes
a. Porters and Guides	Since they live and have been using the forest areas for their source of daily living, they would have knowledge on the surroundings very well. It would make sense then to hire them as naturalist, porter or guide. But this will require a lot of trainings to build their competencies in dealing with tourists or visitors to Maliau.
b. Hospitality unit	With proper training and support the local youths especially the women can be hired in the housekeeping unit of Maliau to assist with the room preparation and clean-up for visitors/research. They can also be considered to work as the cook, indirectly they can introduce their traditional food to the visitors, which can be promoted also as a tourism product for Maliau.
c. Forest rangers/Honorary Wildlife Warden (HWW) /Honorary Forest Ranger (HFR)	Traditional knowledge and of the natural resources of the areas is an added advantage for them that can be a good selling point for them to be hired as the local forest ranger; this will also require a lot of training and guidance to build their competencies to become the eyes and ears of Maliau. In addition, these communities can be trained and appointed as HWW or HFR and assist the resource manager in enforcement and trained under SMART programme for monitoring

Creating these opportunities for the local communities can at the very least increase their livelihood and it may indirectly reduce their dependence on the forest area. But proper study need to be conducted to assess the viability of doing this mechanism as this will involve also the local communities right of use and traditional ecological knowledge (TEK) of the natural forests for subsistence. Recognition of indigenous knowledge in managing the forest, including traditional rules and customs is needed to avoid over exploitation. Conserving biodiversity should be as important as conserving cultural diversity, as local people have been practising 'sustainable management' of their resources for generations. However, the recent finding on sales of wildlife meats in the markets of Nabawan (The Star, December 11, 2013 - http://www.thestar.com.my/News/Nation/2013/12/11/Sabah-War-On-Wildlife-Poaching.aspx/) is of great concern on the changing patters of consumption by the locals.

Also, assessment on the availability of the younger generation (youths) in the nearby villages needs to be conducted for they would be the ideal target group for employment in Maliau.

6.3.2. Outside MBCA

The majority of the local communities living near Maliau buffer zone practice shifting agriculture, hunting for subsistence, and fishing (refer to **Table 6.2**). Nevertheless, there are several smallholders who are already involved with oil palm.

The contributions from the increased in visitors' activities in MBCA over the years has contributed an "economic spin-off", especially for little towns (e.g. Keningau, Sook, Nabawan & Kalabakan) between Kota Kinabalu and Tawau. Such economic activities are from transportation, fuels, sundries, coffee shops, restaurants, etc.

6.4. Other Activities

Cash crops, particularly oil palm, is being introduced in Kg. Langga (Porodong *et al*., 2011), in which an oil palm company is to develop part of the village land and all the development cost will be under the company's responsibility and the local's will be given priority over labour supply. As for the yield, 70% is believed will go to the company and 30% will be distributed among the head of household residing in the village for the next 25 years.

This can be a new and quick money return type of economic activities for local communities. But, opening up land for oil palm would usually involve total land clearing; this should be monitored to ensure that no side effects from the land opening is affecting Maliau buffer zone as the village is nearby the Buffer Zone 2.

CHAPTER 7 CONSERVATION VALUES AND SIGNIFICANCE

7.1. Introduction

Values provided by Maliau Basin Conservation Area (MBCA) can be considerable from the services it provides. This chapter will briefly put together the overall values that it had contributed to that of potentially available in the near future. Dubgaard (2002) provides some of these values through the cost-benefit analysis, from carbon to tourism, etc.

7.2. Values

MBCA is an area that is rich in natural resources especially coal and timber. Fortunately, while MBCA has been identified to having abundance of mineral deposits, it is not exploitable due its protection status. Therefore, it is imperative that the protection status will remain to be uphold to preserve the natural resources from exploitation. Should these resources be exploited, the impact is damaging and irreversible- and nothing can be done to bring back "the lost world".

It was recorded that at least 70 species of dipterocarps (of the genera *Shorea, Dipterocarpus, Parashorea, Dryobalanops, Vatica* and *Hopea*) occur in Maliau's mixed dipterocarp forest (Hazebroek *et al*, 2004). The diversity of forest produce and services provides timber and non-timber goods in the forestry sector, food and the regulation of good water, air, temperature and carbon sequestration amongst others. The quality of timber species is of high class as the natural pristine forest was undisturbed for a period of time. Many of the timber species do provide good value and it dominates the timber market locally and internationally.

Despite its high value in terms of timber pricing, coupled with its protection status and future world recognition as a "World Heritage Site", these natural resources that are to be found in Buffer Zone 2 should be managed appropriately in reference to sustainable forest management practices (including the use of Reduced Impacts Logging mechanism). An ongoing exercise to reclassify part of these buffer zone 2 from Class II forest reserve to Class I forest reserve is being promoted under the UNDP-GEF project (refer to **Figure 9.3**). Thus, it is critical that a possible trade off is met to ensure that the natural resources remained unexploited by means of exploring the REDD+ or PES mechanism alike, in order to derive greater opportunities and return for MBCA.

7.2.1. Ecosystem and Biodiversity Values

The commercial value of biodiversity is apparent through the multi-billion dollar market values of bio-products, which include human health-related products, lifestyle products, and food and agriculture. Growing user interest in genetic resources, which in turn stimulates the growth in value of traditional knowledge, further intensifies this value.

Figure 7.1 illustrates how MBCA and its buffer zones can contribute to the overall ecosystem and biodiversity values.

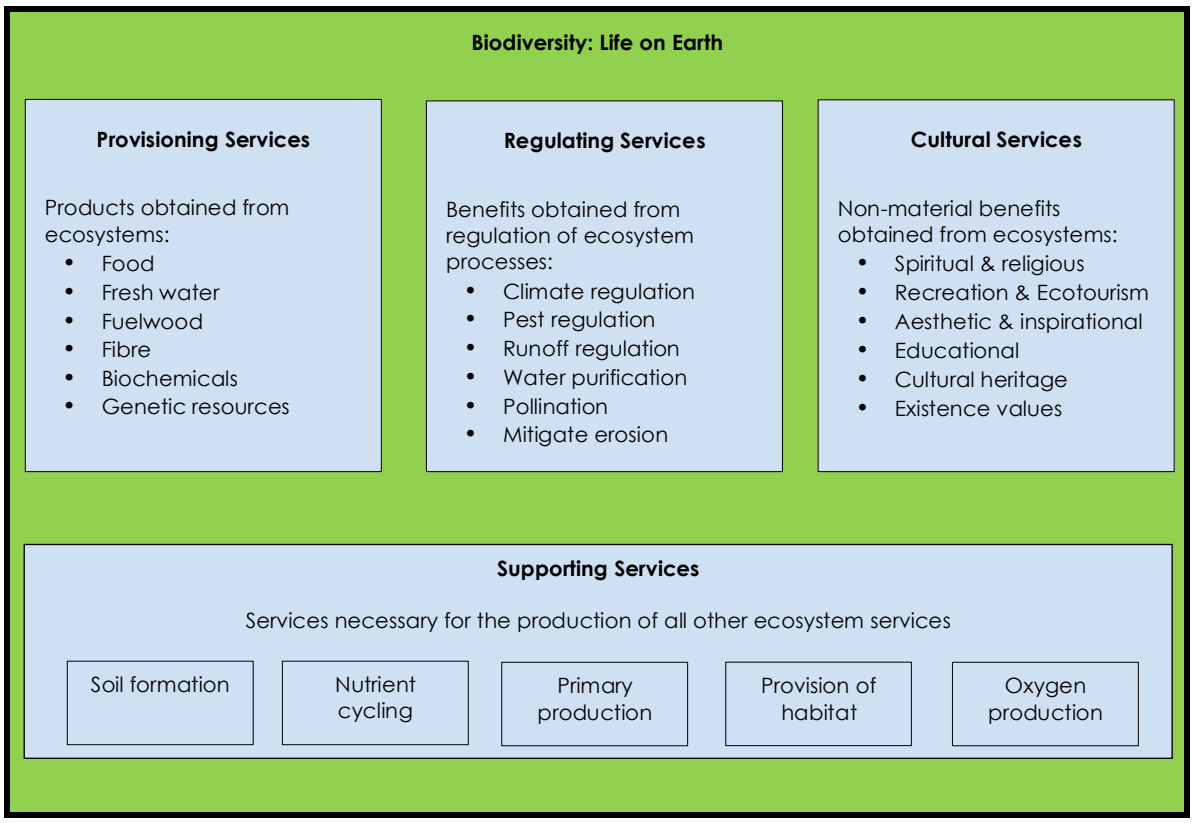
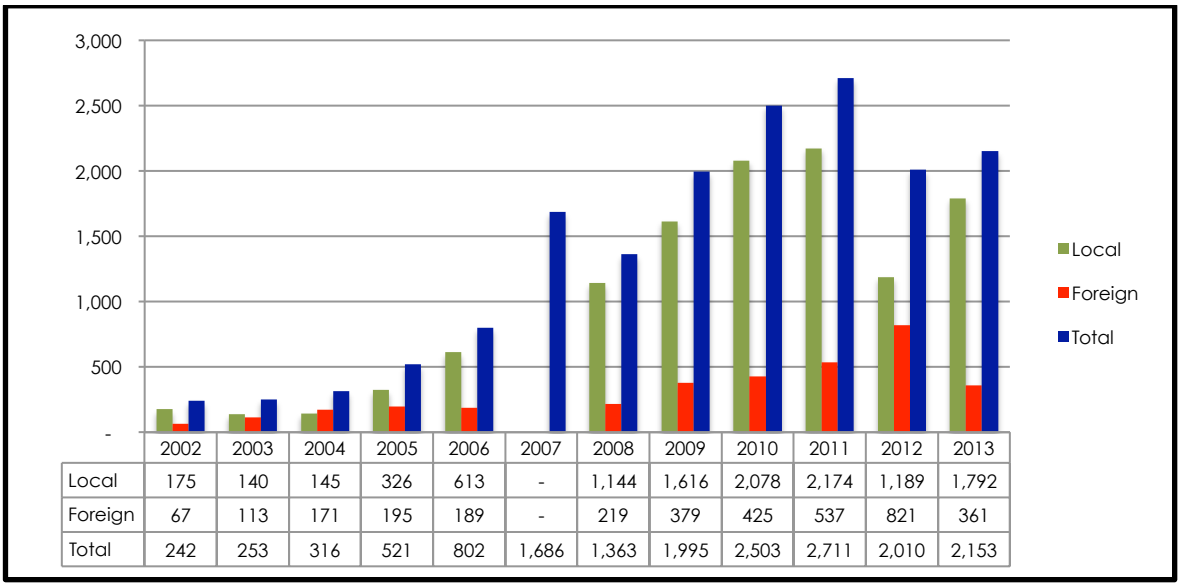


Figure 7.1: Potential services from MBCA including its buffer zones

7.2.2. Aesthetic, Ethical and Tourism Values

The objective of the tourism development in Maliau is to establish ecotourism activities that support and complement the conservation of the MBCA. Tourism is one of the significant arguments for conservation of the Maliau Basin, with economic importance. For tourism purposes, the conservation of the buffer area outside MBCA is a very important element. A large part of the wildlife, of particular interest to tourists, is to be found in the buffer zones (Traeholt, 2001) and many of the tourism activities will take place in the buffer zones.

Over the years, visitors' arrivals in MBCA have increased steadily as shown in **Figure 7.2**. This can be attributed to an increase in awareness, promotions and publications made on MBCA at the local and international levels. The higher arrivals for 2010 and 2011 were due to the preparation of the launching of MBSC on 29th January, 2011.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Local	175	140	145	326	613	-	1,144	1,616	2,078	2,174	1,189	1,792
Foreign	67	113	171	195	189	-	219	379	425	537	821	361
Total	242	253	316	521	802	1,686	1,363	1,995	2,503	2,711	2,010	2,153

Figure 7.2: Visitor arrivals to MBCA

The records kept in MBCA indicate that visitors are grouped into the following categories:

- Trekking;
- Maliau Basin Studies Centre (MBSC);
- Working – YSG;
- Working – others; and
- Research, Look see & EEP, Volunteer

Records indicate that large numbers of visitors to MBSC were those categorised as on study tours, familiarisation visits, and those doing trekking inside the core area to view the landscape, waterfalls and flora/fauna.

7.2.3. Educational Values

MBCA is fast becoming as one of the education site/research destinations for local and international scientists and students. This is based on the number of research activities (**Appendix D**) and environmental education program conducted in MBCA, either by local or international research institutions.

Majority of the environmental education programmes in MBSC were conducted by the Sabah Nature Club (SNC). SNC was initially introduced in schools during the 80s with the sole purpose of instilling awareness among students of the importance and role of the environment. To better market the EE program of Maliau it is suggested that the Maliau Management to look at developing and establishing a package for short or long period programmes. The program then can be used to be marketed to the relevant agencies or departments interested or to tour companies, individuals or corporates, schools and universities. The programme needs a thorough study before development so it can cater to the needs of users

based on available resources, and be manageable by the current staff based in MBCA. It is recommended that MBMC consider hiring a Conservation Marketing person to specifically develop the EE programmes and market it.

Records from MBCA indicate that during the period of 2004 till end of 2013, all EE programmes were conducted by SNC:

a. EE programme in MBCA (i.e. MBSC):
   - ✓ Nature Orientation Course = 10 times;
   - ✓ EE for teachers = 1 time in 2011;
   - ✓ EE (opening of the Shell's Maliau Basin Reception & Information Centre in 2007) = 1 time;
   - ✓ Total participants (2004 – 2013) = 266 participants; and
   - ✓ Total schools attended = 62 schools.
b. SNC Outreach programme 2006-2011:
   - ✓ Total of 24 schools in Tambunan, Keningau, Tenom, Nabawan, Tawau and Semporna.

7.3. Contributions

The arrivals if visitors to MBCA, including those of researchers, have contributed significantly to its revenue.

7.3.1. Revenue Generation

The revenue generated from visitors to MBCA is as shown in **Table 7.1**. Sundries recorded a higher part of revenue and it includes meals and accommodation. Over the years, since 2007, the Conservation Funds contributed a total sum of RM201,680 over a period of 6 years and is still increasing.

Table 7.1: Income Generated from MBCA, 2003-2012

Year	Conservation Fund	Sundries	Gift & Souvenir Shop	Restaurant	Total
2003	-	-	-	-	**40,794.00**
2004	82,344.50		13,915.50	10,425.60	**107,685.60**
2005	93,283.00		19,645.50	2,415.20	**115,343.70**
2006	95,891.30		21,590.00	7,838.65	**125,319.95**
2007	12,800.00	275,298.82	29,664.50	2,044.80	**319,808.12**
2008	17,335.00	346,894.00	46,454.50	6,259.70	**416,943.20**
2009	30,560.00	567,553.80	20,057.00	15,413.90	**633,584.70**
2010	31,740.00	671,123.00	46,974.25	10,425.60	**760,263.55**
2011	43,135.00	731,442.20	68,837.25	7,838.65	**851,253.10**
2012	66,110.00	452,559.00	59,582.90	6,225.60	**584,477.50**

7.3.2. Expenditure

The expenditure in managing MBCA is as shown in **Table 7.2**, and it was inclusive of infrastructure development. In general, expenditures has exceeded income over the years recorded. There were no capital expenditures for 2004, 2011 and 2012 by Yayasan Sabah. Thus, it is reasonable to propose in the coming years that activities that could generate additional revenues for MBCA need to be considered; so long it is inline with the objectives of MBCA (as established under the legislation).

Table 7.2: Expenditure from MBCA, 2003-2012

Year	Administrative & General	Capital	Total
2003	1,056,050.00	183,969.00	1,240,019.00
2004	1,022,315.00	0	1,022,315.00
2005	1,253,686.00	839,400.00	2,093,086.00
2006	1,693,025.00	26,345.00	1,719,370.00
2007	1,949,693.00	6,695.00	1,956,388.00
2008	3,576,973.00	61,511.00	3,638,484.00
2009	4,637,212.00	127,499.00	4,764,711.00
2010	2,610,302.00	111,443.00	2,721,745.00
2011	2,889,582.00	0	2,889,582.00
2012	2,238,427.25	0	2,238,427.25

It must also be noted that the generous support from other organisations (e.g. Shell Malaysia Berhad, IKEA, etc.) has made it possible to develop certain facilities in MBCA. Such supports must be encouraged and extended to large corporations from within the country.

CHAPTER 8 CURRENT AND POTENTIAL THREATS/ISSUES

8.1. Introduction

Threats to Maliau Basin Conservation Area (MBCA) from human activities or naturally will continue to linger, even though the area is classified as Class I forest reserve. These were evident from the findings during the June 2013 Wildlife Resource Survey whereby activities like encroachment, illegal harvesting of resources (including wildlife) were recorded.

8.2. Existing Threats/Issues

There are several existing threats identified during the workshop conducted in December 2012 and from the Wildlife Resource Survey Forum in 2013. This section will briefly outline the existing threats to be found inside the core area of MBCA and its buffer zones.

8.2.1. Infrastructure

Rubbish has been one of the main issues at certain facilities in MBCA. As an example, to ensure the cleanliness of the waterfalls, Bambangan Camp has been closed down due to accumulating rubbish and litter in the area that would pollute the waterfalls, and also because there is no water supply to the camp's residents residing in Bambangan camp.

The sealed road infrastructure Keningau-Tawau has made MBCA to be more accessible by the public with ease which in turn, is a good opportunity for MBCA to gain sustainable revenues from tourism, executing Environmental Education Programme (EEP) should be more feasible, and to attract more local researchers as well as international researchers. The accessibility's downside is that it could increase more encroachment activity. It was reported that the MBCA has been illegally intruded for poaching of *gaharu* (*Aquilaria*), hornbill ivory and other trophies, *tembadau* meats, and Sumatran rhino body-parts, the later species now being extinct in the MBCA.

The access road within the MBCA is fund reliant for a consistent maintenance and the forest trails are regularly being maintained, but no further work for upgrading. In addition, the buildings and other constructions, i.e. those made of timber, need constant monitoring and maintenance.

8.2.2. Management Capacity

In general, several of the planned outputs or activities in MBCA could not be implemented due to high turnover among staffs. The resignation of staff maybe due to the location of MBCA for being isolated, and/or a much more better opportunities offered by other companies/institutions (trained staff being more experienced, skilful and marketable). Current staffs are exposed to various training and courses where the practicality of the programs is questioned.

8.2.3. Research

MBCA is in need for a research coordinator to lead and conduct Maliau Basin-related research. The main problems for researchers are the high cost of research (fees for researchers and its facilities), and the laboratory is not fully equipped with research apparatus, which resulted the researchers to bring their own equipment. Other issue is there are a low number of researchers and students from local academic institution doing their research in MBCA because the cost of living in MBCA is expensive with limited internet availability, bad road condition, and lack of recreational room for entertainment. It is advised that for Maliau to build on its research program it must relook and simplify the user fees for researchers, it can refer to Danum structure to (standardised) and adopt an open door policy for research.

8.2.4. Public Awareness

Public awareness is an essential part of MBCA livelihood. The objective is to provide knowledge to the masses such as the location, status, and the existence of MBCA. One of the first steps that could be done was publishing more books and reports, cheap and affordable booklets or pamphlets for the public; digitisation of books, journals and reports so it could be easily viewed or purchased online by public and researchers globally.

Raising the awareness among the public is a current challenge for MBCA in term of requiring a number of properly trained staff in a specific area to carry out the mission for public awareness. The current concerns are: the current workforce is not adequate to reach to the masses, who will be carrying out the job, and how to increase public awareness more effectively. Other issue includes the inactive MBCA website – www.maliaubasin.org, but this has technically been addressed with new look and updating, and it is currently operational.

8.2.5. Illegal Hunting/Poaching activities

From the recent survey in June 2013 it was concluded that illegal hunting for *gaharu* and poaching activities is still a major threat for Maliau. This is based from the 8 out of the 12 camps set-up in various locations in Maliau during the surveys, which have detected evidence for such activities. These illegal activities have seen an increase over the years due to easier accesses from abandoned logging roads and opening of new access roads around MBCA.

As an example, wildlife meats including protected species are being sold openly at a market in Sabah's interior Nabawan town about 200 km from Sabah's capital, and just 110 km from the main entrance of MBCA. In December 2013, several pictures showing slaughtered protected species were forwarded by members of the public to the relevant authority, i.e. Sabah Wildlife Department. A raid was

conducted by the authority, whereby three people were arrested and three others escaped from the scene at a market in Nabawan.

Nabawan district has become a hotspot for the sale of illegal bushmeat (refer to **Picture 8.1**) in recent years due to the vast road networks all the way to Tawau and it is not a surprise if this bushmeat was illegally hunted in Maliau Basin or as far as some protected Forest Reserves in Tawau and Lahad Datu.

Source: All pictures from *The Star* (13 December 2013)

Picture 8.1: Protected wildlife sold openly at a market in Nabawan (Dec, 2013)

8.3. Potential Threats/Issues

Several threats are potentially of concern, and if not tackled at an early stage, can affect the overall performance of the new recommendations that will be formulated in the report.

8.3.1. Infrastructure

If the existing dirt road (Keningau-Tawau) is completed, this will provide greater accessibility to poachers or *gaharu* collectors and this will expose MBCA to such threat. Therefore, the frequency of patrolling should be increased to monitor the boundary of MBCA. As such the few identified entry points should be at all-time guarded and provided with telecommunication aid, vehicle as well as SOP for implementation.

The magnitude of current and future illegal activities in MBCA can be eradicated by strengthening enforcement and patrolling activities of the area. Ranger posts around the MBCA parameter – and hotspots needed to be identified as suitable place will increase the effectiveness of monitoring activities. For hotspot identification, a wildlife survey is necessary but this requires substantial amount of funding to carry out such activity. Without appropriate survey, the management might end up with nonfunctioning posts and eventually economic loss.

Improvement on waste management practice for chemical and lab waste disposal to avoid land and water contamination. The following require careful consideration:

- Proper waste collection point for maximum coverage; and
- Waterless pump pipe for waste transport.

8.3.2. Research

Protected areas that were set up to safeguard biodiversity and ecological processes are likely to be affected by climate change in a number of ways. Climate change is expected to cause species to migrate to areas with more favourable temperature and precipitation. There is a high probability that competing, sometimes invasive species, more adapted to a new climate, will move in. Such movements could leave some protected areas with a different habitat and species assemblage than they were initially designed to protect.

In this regard, studies in regard of climate change impact on MBCA are lacking and must be done as a conservation action plan. Particular attention must be given to keystone habitats, by mapping and strengthening management (e.g. conduct research activities to maintain it in good conditions). Such keystone habitats, that provide critical resources for a range of wildlife and species concern, are like the lowland dipterocarp forest, lower montane heath and Agathis forests, and the Oak-conifer forest (refer to **Table 5.1** on major forest formations).

Clearly, the degree and rate of climate change may exceed the thresholds for persistence of many species and habitats despite efforts to enhance corridors or provide refugia. However, resource managers should act to improve resilience to future change as best they can, guided by available information and first principles of ecology and conservation biology, or, at a minimum, ensure that the novel ecosystems that emerge have as many of the original species as possible. Actions aimed at maintaining healthy climate change corridors and keystone habitats within protected areas offer managers one of the few practical means of buffering climate change impacts. These activities can easily make the jump from well-intentioned planning documents to field implementation as they constitute management actions - habitat restoration, invasive control, fire management -

that would be carried out and budgeted for anyway, with climate change corridors given priority or added attention.

Further protection of MBCA's endemic species is essential, as it is highly threatened by various factors – climate change, poaching, logging, etc. In aiming to reduce the impacts of climate change, a greater understanding of the role of biological diversity in ecosystem functioning will be required. Current attempts to understand the importance and functioning of biological diversity and the influence of climate change are hampered by ongoing environmental degradation. Principal causes of biodiversity loss worldwide include habitat destruction, pollution, invasive species, and over-exploitation of resources such as fisheries and forests. High amongst the driving forces behind these problems are demographic change and population growth, inequitable consumption patterns, inefficient energy use and commodity trade structures. The net result of these many stresses is a loss of biological diversity.

In recent years, biologists have begun to shift their attention from species-based conservation approaches toward strategies that are centred upon the maintenance of the full range of undiminished ecosystem processes and biological diversity. The ability of ecosystems to respond to and recover from disturbance is termed resilience, and there is considerable evidence that species diversity strengthens resilience, especially where redundancy or overlap in functional groups of species within ecosystems exists. Where several species are able to perform the same functions in an ecosystem, they will exhibit different tolerances to disturbance.

In addition, it would be appropriate that MBCA pursue membership to the International Union for Conservation of Nature (IUCN), whereby support on capacity building and protection (IUCN Red List) can be addressed.

8.3.3. Public Awareness and Tourism

Poorly-planned/supervised tourism or unsustainable tourism could lead to disturbance of MBCA's natural environment and social condition, and hence losing its pristine condition. Social condition is here referred to existing circumstance, state or surroundings affecting the welfare, life and relations of human beings within the community. It is often the result of circumstances or even a country's legislations. Such disturbance might arise from tour operators (over-crowding, littering, footpath erosion), business monopolising by tour operator's company, and unplanned development of accommodation facilities and others by investors. Promoting MBCA can be achieved through volunteerism and through improved use of the internet for distributing general information and news from Maliau. The status of MBCA might be neglected with ineffective public awareness – low to no funding, less development and maintenance.

8.3.4. Other Potential Threats

a. Forest fire

Two of six forest types in MBCA are susceptible to fire, and the logging activity surrounding the conservation area could pose a potential threat for forest fire. Potential fire might ignite the coal seams in and around MBCA, which could burn for years. However, with appropriate Standard Operating Procedure (SOP) implemented by the relevant forest managers from the relevant Forest Management Units (FMUs) surrounding MBCA, this threat is considered as low risk.

b. Unsustainable logging

The unsustainable practices of logging activities in the surrounding area is well known for being effective and is getting worse by the year, it may reach the perimeter of MBCA, if not monitored. Forest rehabilitation and the future land-use of logged forest areas in the buffer zones and adjacent areas to the MBCA are of crucial importance for the long-term conservation of the MBCA.

c. Poaching from logging road access

Poaching around the perimeter and inside of MBCA has been well documented and mentioned in reports. It continues to be a threat and must be addressed appropriately with proper monitoring and surveillance. This has also been discussed in **section 8.2.5**.

d. Landuse changes

As mentioned earlier on the changes in landuse surrounding MBCA, some of the new changes include agroforestry plantation (namely oil palm), mosaic planting, and the continue extraction of timbers from Buffer Zone 2, and oil palm from small holders outside of Buffer Zone 2. **Table 8.1** shows the breakdown on landuse in MBCA.

Table 8.1: Tables on landuse in MBCA (March 2014)

Management Zones		**Management**	**Classes**	**Area (ha)**	
Core Area	Maliau Basin Forest Reserve	Maliau Basin Management Committee (MBMC)	Class I (protection)	58,840.0	58,840.0
Buffer Zone 1	Maliau Basin Buffer Zone			46,603.0	46,603.0
Buffer Zone 2	Nurod-Urod FR	SFD	Class VI (Virgin Jungle Reserve)	1,705.0	87,247.0
	Part of FMU 14 (Sapulut FR)	Sapulut Forest Development S/B	Class II (commercial)	20,651.0	
	Part of FMU 16 (Sg. Pinangah FR) - mosaic	Indah Serimas S/B		15,503.0	
	Others	SFD & YS		49,388.0	
Total Area (ha)					**192,690.0**

Figure 8.1 shows the locations of the mosaic plantations in Buffer Zone 2 and north of MBCA. A new study warns that non-native trees introduced to a tropical rainforest can change its basic ecological structure, rendering it less hospitable to the myriad plant and animal species that depend on its resources (Peh, 2010)). In addition, it was also noted that the native plants survived, but introduced also survived and rapidly colonised the burned areas, threatening the recovery of native species (Tunison *et al*., 1995).

It is important to reduce these man-made pressures that cause the fragmentation, degradation, over-exploitation and pollution of ecosystems, so-called "ecosystem climate-proofing". Climate change predictions have to be built into protected areas management. Here, green infrastructure offers a path, which can enhance the coherence and interconnectivity between protected areas - with buffer zones, corridors and forest rehabilitations.

While species dispersal is likely to be the most important mechanism of species adaptation to climate change, habitat fragmentation and modification can hinder this process. Integrated management of the greater part of the protected areas in the Yayasan Sabah concession area, it is necessary to alleviate the overall pressure on biodiversity and facilitate movement of species between these conservation areas (i.e. Danum, Maliau and Imbak).

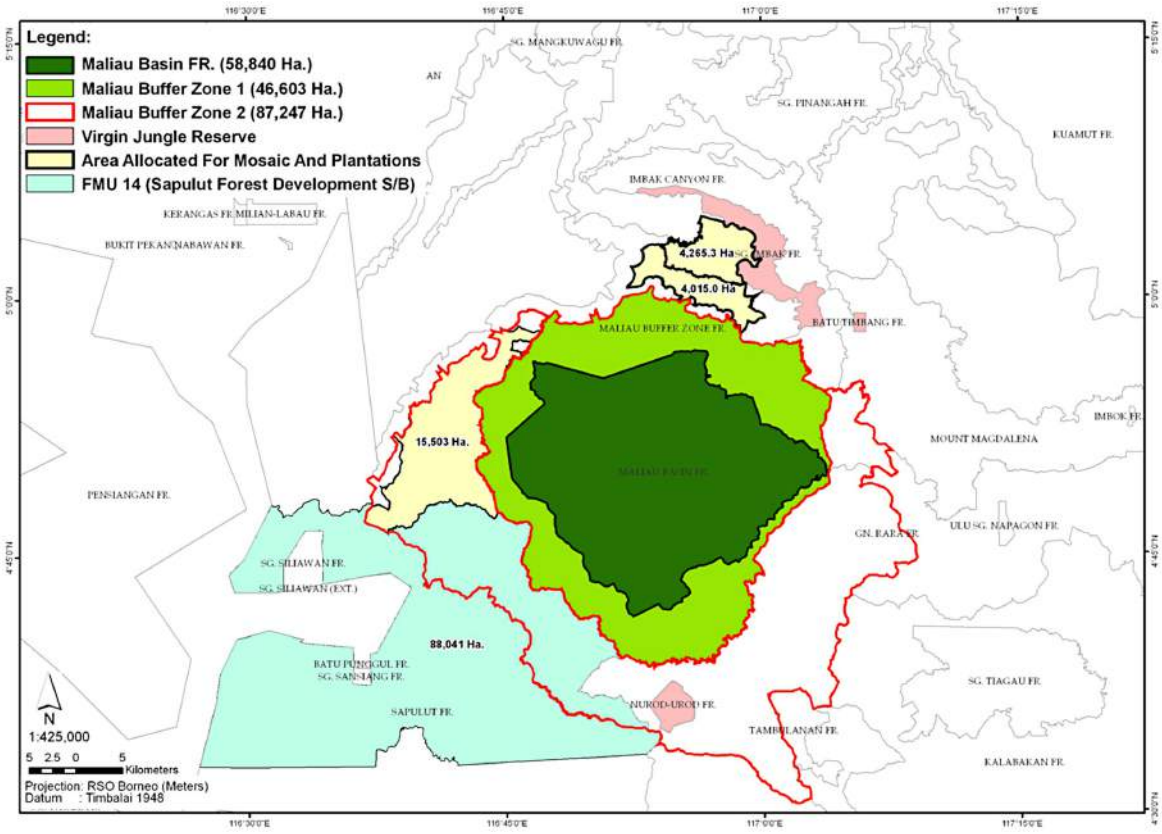


Figure 8.1: Locations of mosaic plantation (March 2014)

PART B – THE WAY FORWARD

CHAPTER 9 SETTING THE DIRECTION

9.1. Introduction

The second part of this report presents the way forward in managing MBCA for the next ten years, i.e. the lifespan of this document. A simple management framework is formulated to guide resource manager on three key areas, i.e. resource management, visitor management and service management. A detail revision of the management zones (mainly on the revision of the buffer zones) is also presented with management guidelines. The programme in MBCA will have several themes, and these are further elaborated on the expected outputs.

9.2. Vision and Mission

The proposed vision and mission of MBCA were presented to the Maliau Basin Management Committee (MBMC) during the 14th MBMC meeting held on 16th December 2013, and it was technically approved. It will provide a clear direction for MBCA and the programmes and outputs to be undertaken will ensure that it will be in line with the agreed vision and mission, and remain consistent with the objectives of MBCA.

VISION

To be a renown Centre of Excellence for protected area management.

MISSION

Effective and vital action taken to ensure that by 2023, MBCA is recognised as a Centre of Excellence for protected area management; and ensuring that the flora and fauna assemblages contained in MBCA are protected, valued, and managed in perpetuity for the purposes of conservation, education, research and recreation.

9.3. Objectives of MBCA

In accordance to the *Forest (Maliau Basin Conservation Area) Rules 1998* (refer to **Appendix A**), the management objectives of establishing MBCA are (YS, 2003: 137):

a. The protection in perpetuity of as much as possible of the biological diversity expressed at genetic, individual, sub-species, habitat and ecosystem levels of organisation;

b. The promotion of research into all aspects of the composition and functioning of the Reserve's ecosystem including comparative studies of disturbance and recovery processes following logging of nearby areas;

c. The promotion of education and training in conservation, natural history, ecology, forestry and related sciences;

d. The promotion of the Reserve for appropriate recreation and nature tourism, provided such activities do not significantly compromise the management objectives stated above; and

e. The integration of the objectives for the Reserve with other planned development in surrounding areas so as to create a model forest management area that combines conservation, forestry and nature tourism activities on a sustainable long-term basis.

9.4. MBCA Management Framework

The management of MBCA and the provision of services represent key strategies in order to achieve the vision and management objectives of the area. The success in managing MBCA will largely be dependent on four factors:

- The quality of the resources and its protection;
- Professionalism in all aspects by the staffs;
- An involved and appreciative public; and
- Partnership with the private sectors.

In addition to the above, there is another factor to be considered. Despite recognition on the part of governments and the private sector that MBCA can, and do, provide multiple economic and social benefits, there are too often gaps in the capability to effectively manage it. Staff development and capacity has been defined as one of its greatest needs, as discussed in several workshops. External technical assistance may be required to bridge such gaps - not injection of capital, but the interim sharing of expertise between protected area professionals dedicated to common objectives with the intent of developing self- help capability.

As for the promotion of ecotourism in MBCA and the success of the state government in attracting international visitors to Sabah, there are also limitations and dangers in promoting it. Firstly, many of these areas are considered not appealing as tourist destinations. It is impossible to observe the larger mammals, especially the big 3 (elephant, sumatran rhino & *tembadau*) at any given time. Due to the heavily dense forest, observing wildlife can be difficult as compared to doing wildlife safari in Africa. Secondly, in seeking to maximise economic benefits, there is the tendency to develop inappropriate facilities or attractions to attract visitors. Such development will eventually leads to mass tourism, which is actually in conflict with the initial objectives of conservation and not in-line with the concept of ecotourism development.

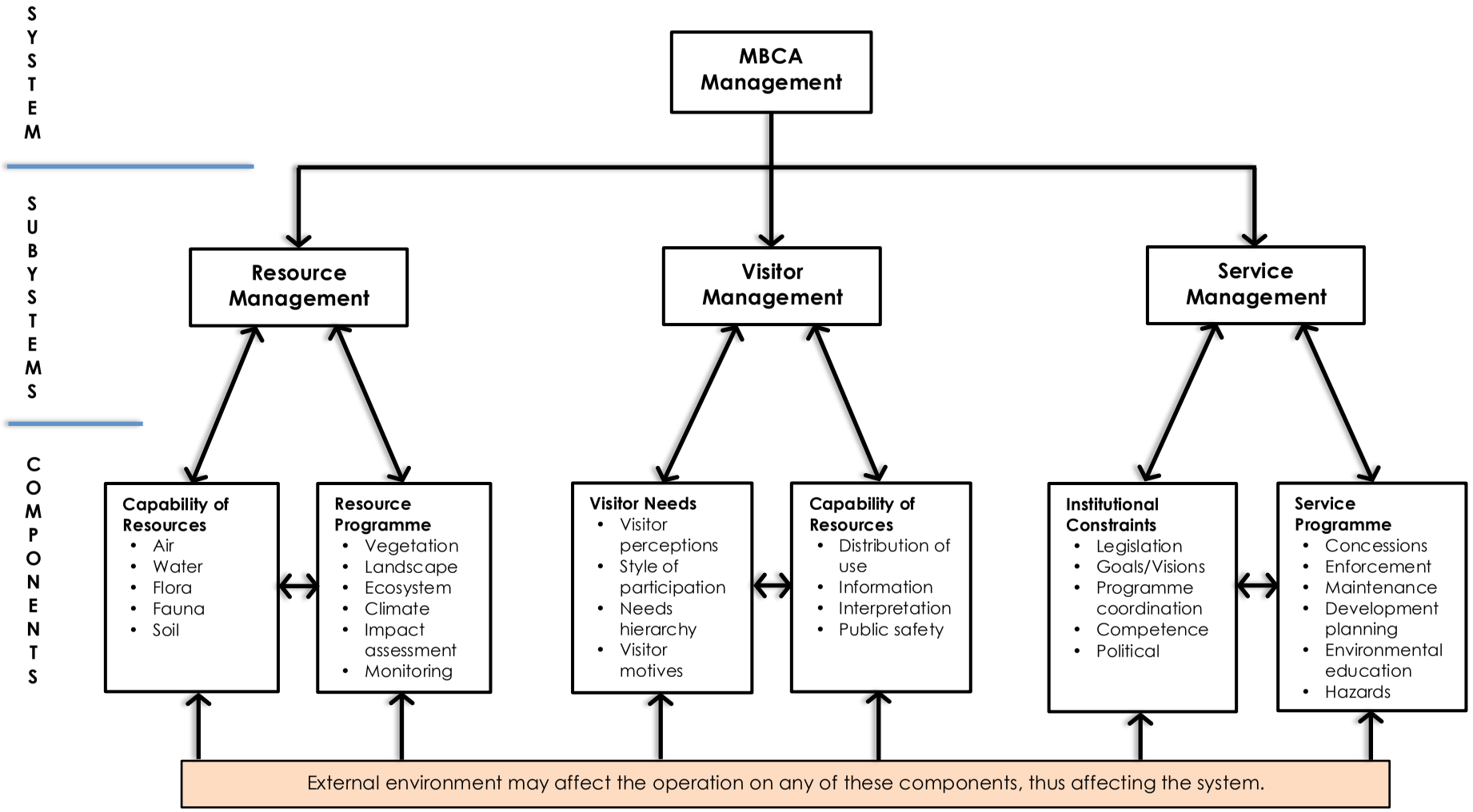


Figure 9.1: Management System in MBCA

In managing MBCA, the resource manager faces many complex problems, more often being influenced by several external factors. Hence, the framework shown in **Figure 9.1** will help in understanding the complexities and identify the areas where there is a need of baseline information and further research. The MBCA management framework is being influenced by three components: resource management, visitor management and service management, with each having its own sub-components. Many of the problems encountered in managing protected areas stem from conflicts that developed between different goals and policies laid by the different agencies or political master.

The following sub-sections will discuss on the nature of each sub-system and its components, in relation to MBCA. The ultimate goal of the framework is toward providing a better understanding on the system by the resource manager and his team on the ground, which will eventually provide adequate protection and management of resources found in MBCA, and eventually visitors' satisfaction.

9.4.1. Resource Management

Resource means different things to different people, especially when people perceived it as having utility or value. Environmental resources are the physical environment or the non-human world around us, which is also able to provide the goods and services sought by human. Mather and Chapman (1995) suggest that environmental resources provide three different sets of values, namely as:

- Raw materials and energy sources used by humans;
- Those providing services rather than material goods, such as those for recreation and appreciation of wildlife and scenery; and
- Those providing an essential life-support system for humans. Here, resource management is concerned with the physical or biological functioning of part of the environment, including the allocation of resources (Jubenville & Twight, 1993).

The availability of environmental resources is a major issue, in terms of its capability, scarcity or abundance. The management model (refer to **Figure 9.1**) illustrates the importance of maintaining the resources and it can only be accomplished through monitoring the effects of existing custodial programmes. Monitoring of resources is important, as it tells us how healthy the situation is which will then provide resource manager the required direction for the programme. Such programme includes biodiversity and ecosystem managements.

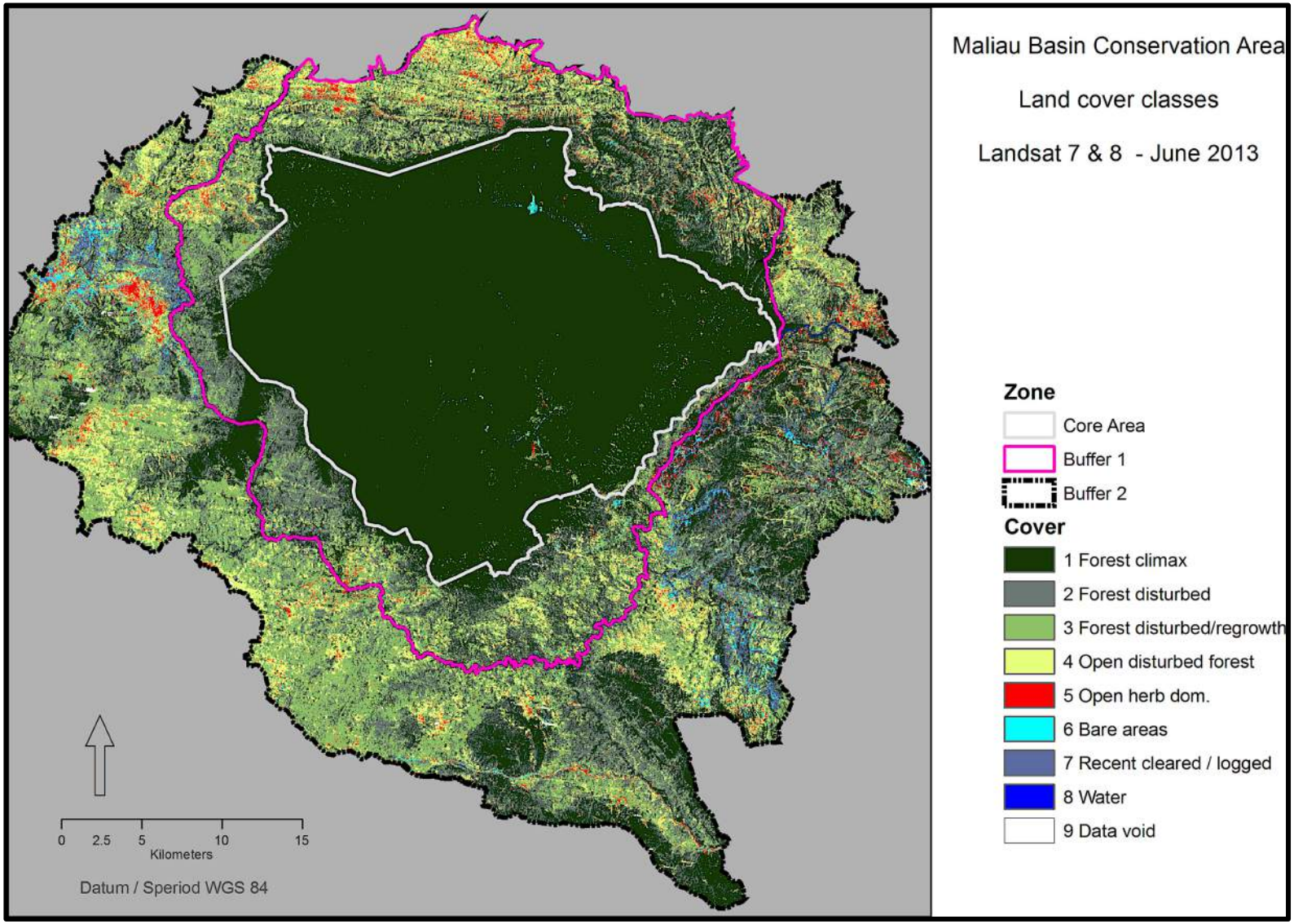


Figure 9.2: Status of Forested Areas in MBCA and its Buffer Zones

In recent decades, conversion and degradation of forests have accelerated, resulting in habitat loss and fragmentation. These factors have contributed to loss of biodiversity, including local extinctions, and have reduced the ecological 'resilience' of remaining areas of natural forest. Huge area of forested land surrounding MBCA, including the newly reclassified Buffer Zone 1, were logged over the last 10-years.

A paper by Prins (2013) indicates that MBCA has undergone a severe degradation, especially at the lowland and hill dipterocarp areas in Buffer Zones 1 and 2 (refer to **Figure 9.2**). The approximate breakdown of the degraded areas and types are as shown in **Table 9.1**. It is to be noted that the actual area and the calculated area are not precise. The calculation was done in RSO projection and the difference in area is statistically marginal at 0.003% - compared to the layer info. However, it is written in the layers that the boundaries were not well surveyed, especially for Buffer Zones 1 & 2 (Prins, *pers com*., January 2014).

Table 9.1: Breakdown on quality of the forest in MBCA (January 2014)

Type	Core	Buffer Zone 1	Buffer Zone 2	Total
Forest - climax	57,134.0	16,511.0	22,791.0	96,436.0
Forest – disturbed	402.0	11,711.0	20,057.0	32,170.0
Forest – disturbed/regrowth	554.0	10,701.0	26,389.0	37,644.0
Open disturbed forest	125.0	5,427.0	10,714.0	16,266.0
Open herb dominance	57.0	1,680.0	3,207.0	4,944.0
Bare areas	77.0	199.0	1,565.0	1,841.0
Recently logged	16.0	231.0	2,568.0	2,815.0
Water	23.0	42.0	72.0	137.0
Non-classed	5.0	41.0	187.0	233.0
Total (approx.) (ha)	**58,393.0**	**46,543.0**	**87,550.0**	**192,486.0**
Revised (actual)	**58,840.0**	**46,603.0**	**86,191.0**	**191,634.0**

There are several underlying causes on shrinkage and degradation of forested land in Sabah over the decades:

- Inappropriate activities on extraction of resources that does not follow the approved management plan;
- Inappropriate government policies which at times hastened land conversion to other uses;
- Population pressure; and
- Inadequate management, control and manpower.

As for the declining populations of wildlife, there are several reasons that can attribute to it happening:

- Severe loss of wildlife habitats due to development of plantations, inclusive of monocrops plants;
- Destruction of wildlife deemed as pests, e.g. elephants;
- Trade of wildlife products; and
- Severe hunting/poaching pressures.

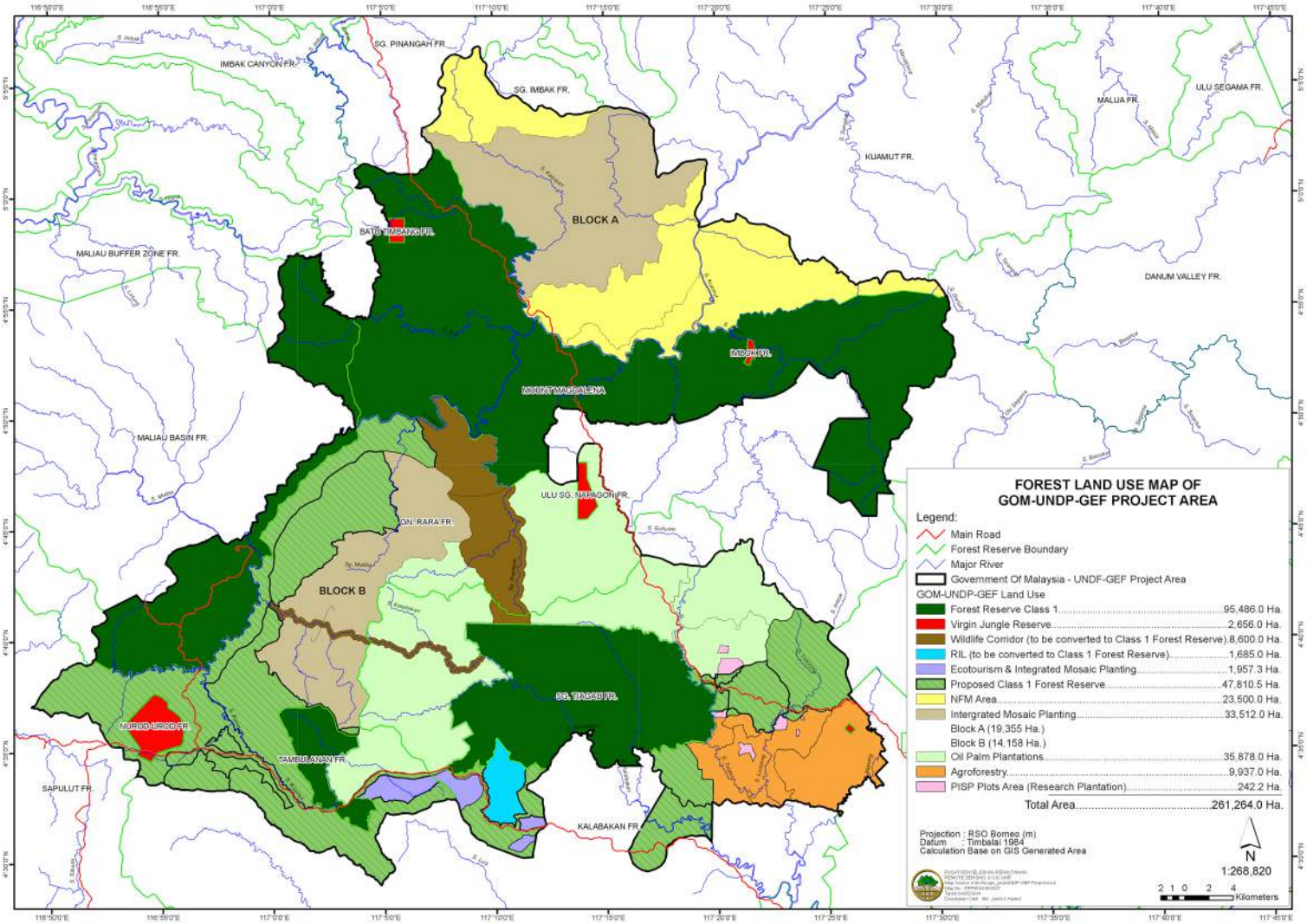


Figure 9.3: Multiple-use forest landscape project by GOM and UNDP-GEF (May 2014)

Lately, the multiple uses of forest have created much attention, among others, especially those surrounding MBCA. One such initiative is a 6-year programme between the Government of Malaysia and the UNDP-GEF on "Biodiversity conservation in multiple-use forest landscapes in Sabah". The project is to address the increasing pressures on the sustainable use of the forests and the ecosystems in Sabah, with three potential outcomes:

- Provisioning of an enabling environment for optimised multiple use planning, financing, management and protection of forest landscape;
- Demonstration of multiple-use forest landscape planning and management system; and
- Demonstration of innovative sustainable financing methods for multiple-use forest landscape management.

Nevertheless, the Technical Working Group (TWG) members of the project on several meetings held in Dec 2013 and January 2014 were concerned with regards to agroforestry (oil palm) and mosaic planting (where the concept is still poorly understood by most). During the TWG meeting held in April 2014, a revised proposal was submitted to Sabah Forestry Department (SFD), and the decision to revise the landuse in the project area was submitted. Initial verbal approval by SFD was obtained, with the prospect of new reclassification of Class I forest reserve indicated in **Figure 9.3**.

9.4.2. Visitor Management

In many countries, the number of visitors to protected areas has been growing at a faster pace than research needed to understand and manage both the experience and the environment on a sustainable basis (McArthur, 1994). With the expansion of tourism infrastructure and facilities, accompanied by the diverse nature of activities undertaken by visitors, balancing the dual objectives of conservation and recreation becomes more difficult.

Over the years, there has been a growing trend on visitor arrivals to MBCA (refer to **Figure 7.2**), from 242 in 2002 to 2012 in 2010. The number will increase with the completion of the highway linking Sapulut with Kalabakan, providing better access for those from eastern part of Sabah to move easily towards Kota Kinabalu via Keningau. The pressure from visitors will increase, mainly at the main entrance (Tourism Zone 1 – Maliau) (**Picture 9.1**).

Managing visitors is often a vital strategy in mitigating conflicts because the conservation purpose of protected areas resists extensive manipulation of the natural and cultural resources (Manning, 1979). The success of managing MBCA therefore involves fulfilling visitor needs while at the same time protecting the resource base of tourism supply. The function of visitor management was proposed by Pigram (1983: 89) as "that of enhancing the social environment in order to

maximise the recreation experience and is considered to be fundamental in park management".

Picture 9.1: Main entrance to MBCA – Shell Maliau Basin Reception & Information Building

In most protected areas, certain specific locations tend to be highly in demand (i.e. honeypots), often creating problems of over-use, while leaving a large area of the protected area undisturbed. Although such areas only occupy a small proportion of the protected area, most visitors will continue using the degenerated "honeypots" which will eventually influence their perception of the destination. Resource managers have options to control the deterioration of such areas, either by the manipulation of the resource or the visitors.

Tourism and recreational activities has substantially changed the nature of managing MBCA over the years. Machlis and Tichnell (1985) identified three different forms of management problem associated with visitors. The first is produced by the sheer popularity of some protected areas in which increasing numbers of visitors have produced management problems, causing long-term damage to natural environment. Secondly, the contacts between wildlife and human, whereby the chance of encounters between wildlife and human who are unfamiliar with nature can produce unpleasant results for both. Thirdly, the problem developed entirely among visitors or between groups of visitors, as each visitor may have different interests, motivations, and expectations for their visits as conflicts can arise from such differences.

As the objectives of MBCA discourage extensive manipulation of the resource base, the manipulation of visitors is often a better alternative since they are relatively responsive to such measures. Through the manipulation of visitors, Jim (1989) classifies the visitor management measures into three categories: in the

sequence of soft (influencing user behaviour), to intermediate (redistributing use), and finally to regimenting (rationing use).

Here, the resource manager of MBCA needs information and training on alternative methods for controlling impacts upon resources. Currently, many resource planners limit the number of park visitors in hopes of mitigating negative environmental impacts. This approach can appear capricious, is difficult to justify, and can limit the full potential of tourism. Setting visitor limits does not necessarily prevent impacts. Research indicates that the relationship between the number and satisfaction of visitors and the resulting impacts often does not correlate (Eagles, 1999). Satisfaction is more closely correlated with environmental quality, the adequacy of facilities and programmes and the accuracy of expectations. Ecological impacts are more complex. Impacts are affected by the distribution of use, type of user group, party size, and environmental durability of an area, e.g. soil, topographic and vegetation characteristics. There are numerous examples where user limits are ineffective in controlling negative ecological impacts. Helgarth (1975) found in one park that erosion problems were actually more severe on lightly used trails. In this case, although the trails were not heavily used, greater erosion occurred because fewer resources were committed to trail design and maintenance. Here, attempting to stop erosion by further limiting use would not have addressed the cause of the problem.

For ecotourism to remain viable, the management must control visitor numbers through its carrying capacity if other strategies of visitors' manipulation are not adequate. Here, carrying capacity is the maximum number of visitors an area can tolerate and once it has reached the limit, it has a negative effect on the host population and the resources. Stankey, McCool and Stokes (1984) expressed the concept of carrying capacity in terms of the Limits of Acceptable Change (LAC) involving the identification of the desired social and resource conditions that the management is committed to maintain. Several authors have discussed such control in terms of the area carrying capacity (Mathieson & Wall, 1982; Boo, 1990), Recreational Opportunity Spectrum (ROS) (Clark & Stankey, 1979), Limits of Acceptable Changes (LAC) (Stankey *et al*., 1985), and Visitors Impact Management (VIM) (Graefe *et al*., 1990).

Providing appropriate information (be it verbal or non-verbal) improves personal decision making of visitors, promotes general welfare, and protects the resource where activities take place (Jubenville and Twight, 1993). It must be noted that one of the weakest links in tourism is that of imparting information to visitors. Information is about communication, and different media are available for resource managers to utilise. Amongst others, it includes visitor centre, area signage, publications, mass media, on-site contact and group contacts. Targeting the appropriate audience is important as at times resource managers tend to talk to those who agree with

them or the parks' objectives, but not enough has been done to those who do not agree.

The presence of interpretative services or nature-based tour guides can enhance visitors' experiences to MBCA and can be important in convincing visitors to act in a more favourable way. Studies by Clark, Burgess & Hendee (1972) and Sharpe & Gensler (1978) have shown several benefits of interpretation as a management tool. In brief, interpretation had:

- Increased compliance with park regulations;
- Increased safety;
- Increased public support for policies and management practices;
- Decreased vandalism; and
- Decreased depreciative behaviour.

Interpretation is a technique that helps to reduce the negative recreational impacts by communicating with the visitors on the overall purpose of MBCA. It can enrich visitors' experience while motivating them to protect the environment in a logical and sensible way (Sharpe, 1976; Jubenville *et al*., 1987). Therefore, interpretation must be able to provide the necessary information in alleviating the pressure of visitors in MBCA. It must function as to inform and direct visitors, in addition to the traditional nature knowledge and appreciation messages.

From the above, interpretation is more than instruction or educational training. It passes on the meaning of something and develops a deeper understanding revealing a larger truth that lies behind any statement of fact or exhibits. As a management tool it can broadly be categorised into three main objectives:

- Assisting visitors in developing a keener awareness, appreciation, and understanding of the area, thus enhancing visitor experience;
- Accomplishing management goals, by either encouraging thoughtful use of the recreation resource on the part of the visitor or reducing negative impacts on the resource by guiding people away from fragile or overused areas into areas that can withstand heavier use; and
- Promoting public understanding of MBCA and its programmes.

"Interpretation" differs from "information" because it does not only state facts but attempts to explain concepts, meanings, and the inter-relationship of natural phenomena. Knudson *et al*. (1995: 4) point that "interpretation conveys the meaning of something through exposition or explanation, (while) information is the knowledge derived from study, experience or instruction". However, it is often observed that in the preparation of interpretative programmes or mediums, too often an interpretative programme reflects the needs of the staff rather than the needs of the visitors or objectives of the area; and the design and formulation of interpretative materials often revolve around the interpreter's expertise and

interests rather than on management objectives or visitor expectations. All in all, visitor management is deemed to be capable of offsetting some of the adverse impacts caused by the increasing number of visitors, since it is able to control the type and amount of activities at a site. In addition, effective visitor management programmes require park personnel and guides with knowledge in social, behavioural, and communication sciences as well as in the natural and biological sciences.

9.4.3. Service Management

Service management refers to "the provisioning of facilities, services, and related ancillary programs to accommodate the visitors" (Jubenville & Twight, 1993: 21). It offers basic features, including access, facilities, and other accommodations that commensurate with institutional constraints, resource limitations, and visitor uses.

The big question is "will the development of tourism facilities fit into the overall natural setting and accomplish the management objectives of MBCA?". Providing facilities and services to accommodate visitors is an essential role in service management. Nevertheless, there have always been substantial differences that exist between resource managers and that of visitor perceptions on the ideal locations, designs, facilities and maintenance. To be in accordance with these different perceptions, all provisioning must be planned under appropriate criteria. For judging appropriate criteria, the Recreation Opportunity Spectrum (ROS) framework may provide effective guidelines (Clark & Stankey, 1979), whereby its logic dictates that fewer facilities are allocated at the more primitive portion of the protected area. Such facilities should be rustic in character, requiring little servicing and self-reliance.

Here, the provision of services is often the responsibility of the resource manager of MBCA, but how well the team performs is at times influenced by its management strategies, effectiveness, and efficiency in managing available system (refer to **Figure 9.1**). Of important to this management plan are site and area planning, concessions and nature tourist guides.

Here, accommodation demand will vary, depending on the markets attracted to a destination's range of experience opportunities. This is not to suggest that fixed roof accommodation should be allowed in any location simply because demand exists. It is important that the suitability of the location and site for a fixed roof facility should be examined. However, this should be done within the context of the planning, design, construction and operational technologies and techniques that are proposed and the relationship with the local community and private sector. Hence, the preparation of a master plan for development in the identified tourism development zones (TDZs) need to be prepared and approved by the MBMC.

a. Concessions

The provision of concession services helps to enhance the quality of visitors' experience, and it can be conducted in partnership with the private sector. However, MBCA's resource manager needs to identify what services are needed and more important where it should be located. Services should be provided based upon "necessity" and "desirability". It should be necessary for visitors' enjoyment, e.g. accommodation, food services, activities, etc., and desirable based upon its spatial positioning towards minimising impacts.

Table 9.2: MBCA (Public) versus Privatisation (Private operators)

	Advantages	**Disadvantages**
MBCA	• Quality of goods & services can be given a high priority (perhaps a higher priority than profits); • Complete control in all staffing & personnel matters; • Complete control over all financial transactions; • Tight control of stocks & records; and • Control of visitor use & movement so that disturbance to wildlife or other park's resources are minimised.	• The large capital investment which may be required to construct facilities may not be available from government sources; • Staff personnel can consume excessive amount of time, sometimes to the detriment of other management activities; • There may be difficulties in securing a qualified & experienced concession manager, as well as qualified staff; and • When profit motivation is not critical to the operation, there may be inefficient employment of staff.
Privatisation	• Capital investment is the responsibility of the operator, relieving government of financial obligation; • It is essential that profits are realised, ensuring on-site management for optimum returns on the environment; • Service staff are closely supervised and controlled; • Much emphasis is placed on efficiency & cost control in labour & service; • If one concession operates a number of facilities, there may be a better opportunity to realise savings on purchase of goods & saleable products; and • All personnel matters are the responsibility of the operator.	• Profit motivation may lead to inferior goods & services; • It may be difficult to control quality of service to the public, while the public assumes the operation is government-operated; and • Leasing or granting concession rights may result in political pressures to increase the type & availability of certain services not deemed appropriate for the park.

The means by which facilities and services to be provided are highly dependent on the area identified through proper resource inventory and allocation. **Table 9.2** illustrates the advantages and disadvantages of services rendered through public or private sectors. The option would either be through a contractual arrangement with a private operator, normally known as the concessionaire, or self-operation by the resource managers. At this juncture, there are several examples of protected areas in Sabah and Sarawak with privatisation arrangements, e.g. at Kinabalu Park, Tuanku Abdul Rahman Marine Park, Danum Valley and Gunung Mulu National Park. Some examples that can be mentioned are those that allowed resource manager to concentrate on managing the property (e.g. enforcement, research, awareness & education):

- Hospitality services handled by private sectors;
- Guiding services are handled by associations or resorts; and

- Logistic (transport) are privatised.

b. Nature Tourist Guides

The contribution and role of guides in protected areas has been discussed by Moore (1981), de Groot (1983) and Kenchington (1989). Here, the guide is someone who is responsible for the delivery of the nature-based tour experience in the field and whose duty is to impart information to the group in an efficient and professional manner while being knowledgeable in the subject. Guides are responsible for providing quality experience to visitors without causing intolerable ecological and social damage, and for increasing their overall awareness. It is to be noted that when visitors obtain a satisfying experience while in MBCA, they will come closer to supporting the philosophy of the site's management.

Having guides in protected areas serves two primary functions: to control visitors' activities towards achieving its objectives in visitor management, and to inform visitors on the natural history and conservation efforts being carried out by parks.

Although additional costs (financial and manpower) are incurred by training guides on certain aspects of visitor management, the end result will affect both throughput of visitors and perceived quality of the visitor experience. Furthermore, few protected areas can adequately provide effective visitor services, thus the tourism industry can cooperate with protected areas to accomplish their goals through the effective use of tour guides as intermediary.

Properly trained guides in protected areas are able to increase visitors' knowledge on the ecology and management policies of protected areas, which consequently contributes to minimum impact behaviour. In addition, it reduces the "visual-contact" between the staffs and visitors, thus providing more time for staffs to concentrate on other important issues relating to protected area management (refer to **Figure 9.1**).

In MBCA, it has been a norm that rangers have played the role as intermediaries in facilitating responsible visitor behaviour. However, with the high number of visitors, shortage of manpower and budgetary limitations, it is essential that guides be utilised. The engagement of local communities as guides be encouraged, as a means of promoting the goals of the park through informing and educating visitors, and assuring visitors conform to park regulations.

9.4.4. Others

The provision of environmental education programme (EEP), long-term research, and the introduction of forest rehabilitation within the newly reclassified Class I (i.e. Maliau Buffer Zone) are among some of the key activities to be conducted in

MBCA in the next 10-years of the management plan. More outputs and activities will be prescribed further in the following chapters.

a. Environmental Education Programme (EEP)

The state government of Sabah launched the Sabah Environmental Education Network (SEEN) in March 2005, with the aim to enhance environmental education, communication and awareness efforts in Sabah through networking, cooperation and coordination among all members. There are 25 members in SEEN, and Yayasan Sabah is represented by the CEMD team.

On November 2009, the Sabah Environmental Education Policy (SEEP) was launched by the state government, and defined EEP as a:

> "…*learning process in which individuals and groups acquire awareness, knowledge and skills about the total environment, resulting in attitudinal and behavioural changes, thus, contributing towards environmental conservation and sustainable environmental management*" (MTCE, 2009: 6).

The objective of the policy is "to instil environmental stewardship and sustainable lifestyle among the people in Sabah" via the following 6 strategies:

- Government agencies should actively implement environmental education;
- Non-governmental organisations, the media, private sector, professional bodies and the public should be actively involved in environmental education;
- Efficiency and effectiveness of environmental education programme and activities should be enhanced;
- Strengthen the functions of Sabah Environmental Education Network (SEEN) and other similar networks; and
- Strengthen the capacity and capability of

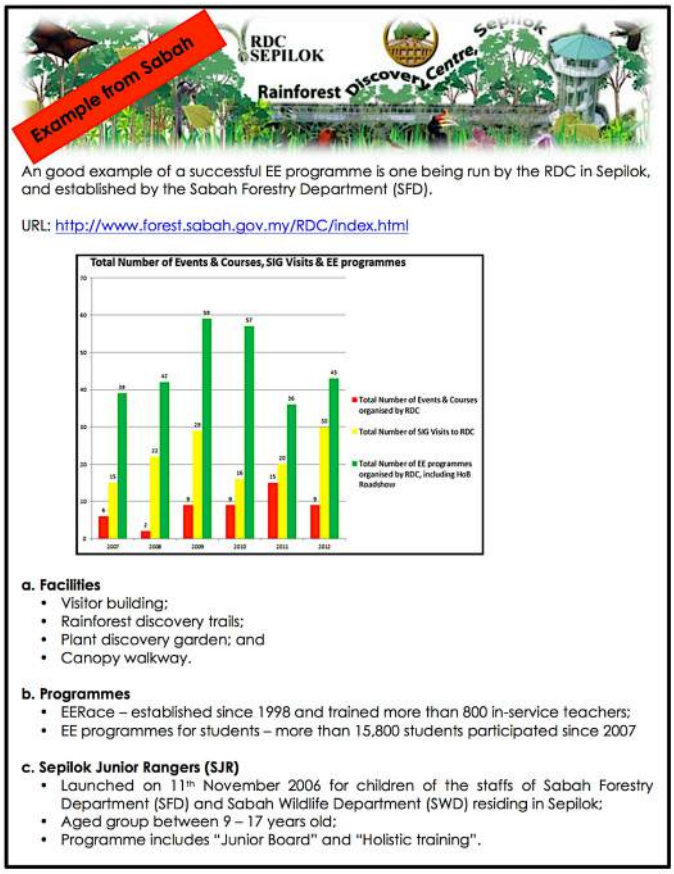


Figure 9.4: Rainforest Discovery Centre (RDC) in Sandakan

environmental education personnel.

Clearly from the stated strategies, MBCA can tap into SEEN for technical assistance and to build the human capital of staffs in implementing EEP. One of the most successful EEP in Sabah is the Rainforest Discovery Centre (RDC) in Sandakan (refer to **Figure 9.4**). The Centre is run by the Sabah Forestry Department with full-time dedicated staffs. It had attracted more than 15,800 students since 2007, and assisted in the establishment of the Sepilok Junior Rangers.

Within Yayasan Sabah Group (YSG), Sabah Nature Club (SNC) was established in 1988 with the objective of instilling awareness among students on the importance and role of the environment. To date, more than 180 schools had formed their own clubs with over 41,000 members throughout the state.

The module of the EEP under SNC is based on the existing ecosystems that can be found in MBCA, covering the following:

- Bird watching;
- River ecology;
- Orienteering;
- Forest ecosystem;
- Night walk; and
- Forest canopy ecosystem.

An ongoing effort by MBCA in partnership with IKEA is a 3-year programme to raise awareness for students from the vicinity on nature and its ecosystems, and the need to protect it. The programme is a replication of the one conducted by SNC, with durations of 3 days/2 nights and 5 days/4 nights. The target groups are students from the primary school near to MBCA, and secondary schools too.

Table 9.3: Numbers of school within easy access from MBCA, 2013

District	Town	Primary	Secondary	Total
Keningau	Keningau	32	8	40
	Sook	40	2	42
Pensiangan	Nabawan	5	2	7
	Pamunterian	5	-	5
	Sapulut	4	1	5
	Pegalungan	7	-	7
	Pensiangan	5	-	5
Tawau	Kalabakan	14	2	16
	Tawau	45	19	64
Total		**157**	**34**	**191**

Several other opportunities can be created, e.g. school visits by the EE team to conduct awareness briefing about the EEP in MBCA, and a half-day programme at the main entrance. The numbers of school within easy access from MBCA are about 191 schools (as shown in **Table 9.3**).

The potential of expanding and introducing a half-day programme for students or visitors is to be considered. This is simply with the completion of the Sapulut – Kalabakan road, the main entry of MBCA at the existing Security Gate will be a honeypot for visitors. Easy access from East – West of that road will see an increase in numbers of visitors. Also, it will reduce logistical arrangement to bring students from nearby villages or towns by conducting the EEP at the point of entry.

b. Research

Future research activities in MBCA need to be addressed, including the need to review the Research Management Plan 2006-2012 (Draft) (YS, 2006). In the draft research management plan, there were 10 strategies formulated (refer to **Figure 9.5**). In the revised management plan, the need to continue conducting data collection on the weather and establishment of research plots are to be given priority.

With reference to the Convention of Biological Diversity (CBD) and its AICHI Targets (refer to **Appendix G**), the following goals are relevant to research in MBCA:

- **Goal B:** Reduce the direct pressure on biodiversity and promote sustainable use. Mainly on targets #7 and #9;
- **Goal C:** Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity. Mainly on target #12.

The *Strategic Plan of Action (Sabah): The Heart of Borneo Initiative (2014-2020)* (SFD 2013b) laid down several outputs that are relevant to MBCA (refer to **Section 3.5.2**). The research management plan should be aligned to the Strategic Plan of Action (SFD, 2013b), including to its prescribed activities.

The partnership or complimentary efforts with the Royal Society's South East Asian Rainforest Research Programme (SEARRP) through several of its initiatives shall be considered, i.e. Stability of Altered Forest Ecosystems (SAFE), Sabah Biodiversity Experimental plot, and a 50 ha plot for Centre for Tropical Forest Science (CTFS). To date, there has been an increase in the numbers of researchers in MBCA, and the SAFE programme is positively promoting MBCA.

In general, it is encouraged that MBCA adopts an open door policy to accommodate research, as this will be able to attract many potential researchers. Restricting to specific focus area will be hindrances in attracting researchers to the area, due to costs and expertise. The appointment of a Research Coordinator

(with the rank of manager) is to be conducted, as the person will be able to lead in the preparation of the revised management plan, coordinate research in MBCA, and conduct networking with potential/existing partners.

RESEARCH MANAGEMENT PLAN 2006-2012 (Draft) (2006)– extract

Table 4.3: Research Strategies in MBCA

Strategy	Description
S1	To enrich the knowledge resource through ecological studies and taxonomic inventories, in order to improve the quality of the educational experience for paying visitors and to provide a knowledge infrastructure for applied research.
S2	To give priorities in filling gaps on basic forest biology (e.g. through taxonomic inventory work focussed on invertebrates, studies on the identification and ecology of lianas, and preparation of identification manuals).
S3	To conduct studies of poorly-known, threatened or endangered species and ecosystem types.
S4	To monitor weather patterns and interactions among climate, hydrology, vegetation and soils.
S5	To contribute to the monitoring of global climate change using the pristine rain forest ecosystem and unpolluted water catchment.
S6	To document and find ways to accelerate the process of recovery of buffer zone areas after logging, including studies of post-logging tree mortality, microclimate restoration and the re-growth of a fire-resistant environment in the buffer zone.
S7	To investigate the consequences for fragile organisms of microclimate disruption caused by logging, and the role of biodiversity reservoirs large enough to retain intact microclimates in preventing widespread extinctions in and promoting recolonisation and fire resistance of logged-over landscapes.
S8	To conduct long-term studies aimed at monitoring and understanding the interactions among phenomena such as forest leaf-flushing, flowering and fruiting at different elevations, and the abundance of bearded pigs, migratory birds and other wildlife populations at different places over time.
S9	To conduct participatory research involving local communities from support zone communities, focusing both on the resources available to them and on monitoring impacts and environmental changes, including possible training and involvement in biodiversity inventories as parataxonomists.
S10	To enter into agreement on bioprospecting with private-sector partners on agreed terms towards identifying and developing commercial opportunities for new products and processes based on local components of biodiversity.

Source: YS (Yayasan Sabah) (2006). *Research Management Plan 2006-2012: Maliau Basin Conservation Area*. Draft. Kota Kinabalu: Yayasan Sabah Group.

4.2 VISION FOR RESEARCH IN MBCA

A basic role of MBCA is as a site for scientific research, and the more is known about its rich natural resources, the more interesting it will become and the easier it will be to promote and manage. However, on the other hand, research projects impose costs on management, in terms of their need for staff time, accommodation, laboratory space and other limited resources. Hence, research activities in MBCA should be guided towards projects that can help meet specific management needs, such as :

- those that can enrich knowledge of poorly-known taxonomic groups (e.g. invertebrates, lianas, etc.);
- those that are known to be vulnerable and important (e.g. "flagship" species like Sumatran rhinos, tembadau, Borneo pygmy elephants, and orang utans);
- that clarify key features of population connectedness (e.g. gene flow, migration); and
- ecosystem recovery from disturbance.

4.6.1 Areas of Research

MBCA is able to provide several potential interesting areas of research:

- Water catchments- no external impacts (excluding rainfall);
- Weather and climate (monitoring);
- Water-plant Interaction;
- Zoological studies (wide range-studies in undisturbed forest);
- Genetic variation-isolation (Bio-prospecting?);
- Altitude variation/zoning (ecologica/plants-heath forest, zoological, soil, biodiversity);
- Vegetation variation;
- Geological geomorphology; and
- Ecological studies.

MALIAU BASIN CONSERVATION AREA
SABAH

RESEARCH MANAGEMENT PLAN
2006 – 2012

Research and Development Division
YAYASAN SABAH GROUP

Figure 9.5: Extracts from the Research Management Plan 2006-2012 (Draft)

c. Forest Rehabilitation

As the climate changes, factors such as disturbance, extreme events, variations in weather patterns and changes in natural processes such as fires and pest outbreaks are expected to lead to habitat change and shifts in species' ranges. Protected areas provide safe havens (refugia) for species under climate change, and can also allow their dispersal to suitable habitats as conditions change. Protected areas with high ecological integrity and connectivity will be relatively resilient to change: i.e. they may be more resistant to change in the first place and/or better able to tolerate and adapt to new climatic conditions without completely transforming to a new type of system. Restoration that maintains or increases genetic diversity and the tolerance of ecological communities to change can help to build resilience to climate change (Maestre *et al*., 2012).

Ecosystem loss and degradation are major causes of the greenhouse gas emissions that cause climate change. Protected areas help to *secure* carbon stored in terrestrial, soil and sediments and also protect the natural ecosystems that will continue to sequester additional carbon. Restoration can help to maintain and enhance these stores.

Forests can serve many functions at the local, landscape, national and global levels, but only if they are in good health. It can contribute to the global quest to conserve biodiversity and reduce atmospheric carbon. Restoring, rehabilitating, managing and protecting forests for such functions are undeniably important tasks. The restoration and management of degraded and secondary forests and the rehabilitation of degraded forested lands must be based on the priorities and objectives of all concerned stakeholders.

The term "forest degradation" refers to the reduction of the capacity of a forest to produce goods and services (ITTO, 2002). A degraded forest delivers a reduced supply of goods and services from a given site and maintains only limited biological diversity. It has lost the structure, function, species composition and/or productivity normally associated with the natural forest type expected at that site. The restoration, management and rehabilitation of degraded and secondary forests should take into account the complementary roles of various landscape components in sustaining a broad range of goods and services over a long period of time. This means that although individual forest stands alone cannot be expected to supply all major goods and services, it is important to ensure that the mosaic of land-uses in a landscape meets the full range of society's needs.

Keenleyside *et al*. (2012: 3) describe the key concepts of ecological restoration as:

- Restoration in and around protected areas contributes to many societal goals and objectives associated with biodiversity conservation and human well-being;
- Reasons for implementing restoration projects vary and may include, for example, recovery of individual species, the strengthening of landscape- or seascape-scale ecosystem function or connectivity, improvement of visitor experience opportunities, or the re-establishment or enhancement of various ecosystem services;
- Restoration can contribute to climate change adaptation by strengthening resilience to change and providing ecosystem services. It can contribute to climate change mitigation by capturing carbon in ecosystems;
- Rapid climate change and other global changes create additional challenges for restoration and underscore the need for adaptive management; and
- Protected area managers need to work with stakeholders and partners inside and outside protected area boundaries to ensure successful restoration within and between protected areas.

In October 2010 in Nagoya Japan, the tenth meeting of the Conference of the Parties (CoP) to the CBD set the stage for an increased global focus on ecological restoration through the adoption of a new Strategic Plan for Biodiversity 2011- 2020 and 20 headline targets (known as the Aichi Biodiversity Targets), as well as through decisions related to protected areas, plant conservation and the third Biodiversity Outlook report. In relation to the Aichi Targets, Targets #14 and #15 are related to MBCA (refer to **Box 9.1**).

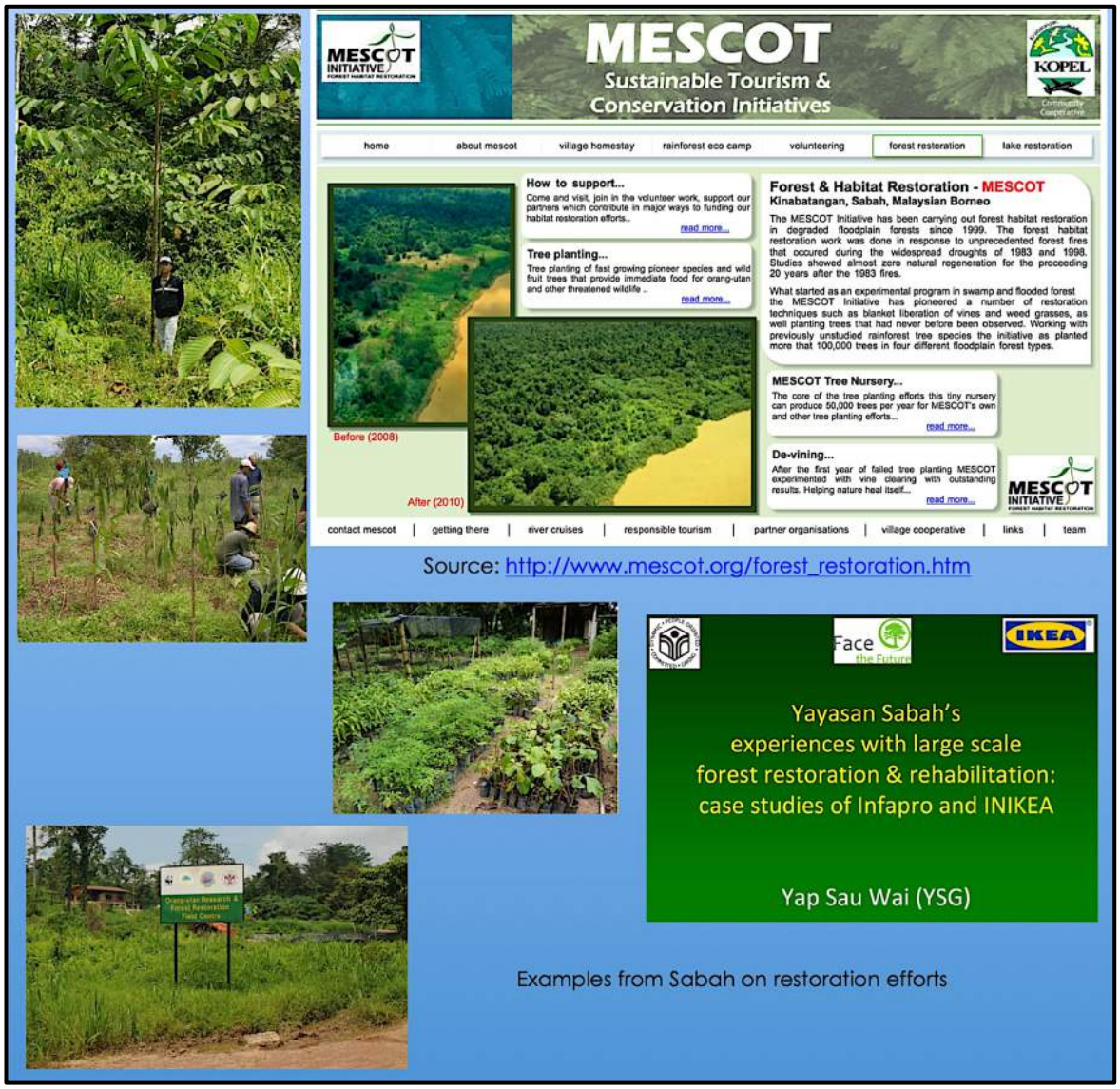
Box 9.1: Strategic Plan 2011-20 and the Aichi Biodiversity Targets

The restoration of protected areas and surrounding and connecting lands and waters will contribute to achievement of the goals of this Strategic Plan and the Aichi Biodiversity Targets, in particular Targets 14, and 15:

Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

In the case of MBCA, the area of priority for forest rehabilitation will be Buffer Zone 1 (i.e. the newly reclassified Class I forest reserve totalling 46,603 ha). Proper assessments on the forest stratum need to be conducted to determine the priority plan of action. Based on the estimated figures as indicated in **Table 9.1** and **Figure 9.2**, an estimated area of about 11,000 ha is classified as disturbed forest, and this is possibly the area of concern for restoration.



Picture 9.2: Several examples of successful restoration initiatives in Sabah

Picture 9.2 illustrates examples of successful forest restoration initiatives in Sabah, i.e. under MESCOT (www.mescot.org), INFAPRO and INIKEA, plus the large area in Ulu-Segama Malua Forest Reserve (FMU 19, 20 & 21). Also, the extensive restoration efforts by the state government together with other partners can be observed in Trus Madi Forest Reserve (FMU 10) and Kinabatangan Corridor of Life (KCoL).

Within Yayasan Sabah (YS), a large area within its concession has been restored under the INFAPRO and INIKEA projects, totalling 11,825.6 ha and 11,700 ha respectively as of end 2013. The framework utilised by YS on restoration efforts in the INFAPRO programme is as shown in **Figure 9.6**.

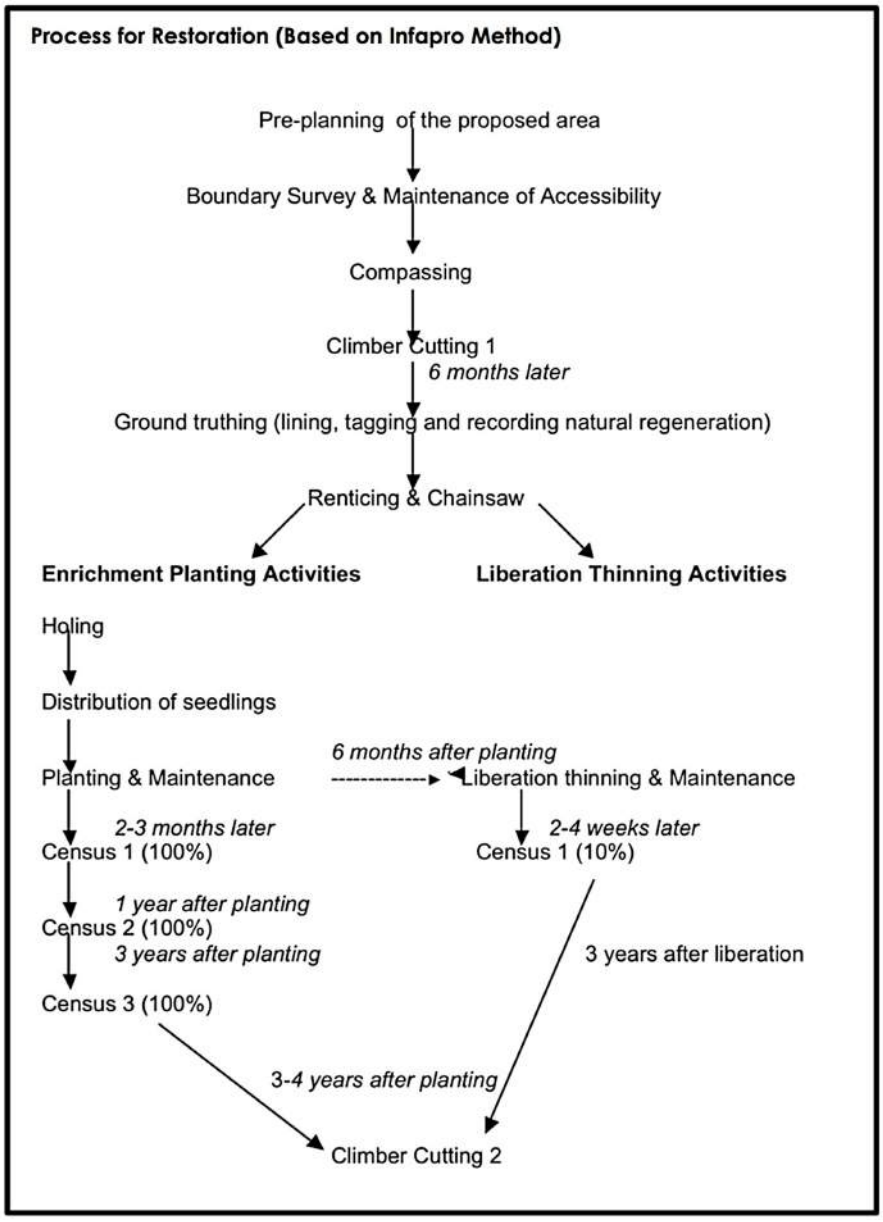


Figure 9.6: Framework of Forest Restoration by YS

CHAPTER 10 MANAGEMENT ZONES AND PRESCRIPTIONS

10.1. Introduction

This chapter presents the fundamental part of managing MBCA, i.e. formulation and revision of the management zones including its management prescriptions. There has been changes in the landuse surrounding Maliau Basin Forest Reserve over the years, from reclassifications of several Class II (Commercial) Forest Reserves to Class I (Protection) Forest Reserves; to that of the 261,264.0 ha initiative known as "Biodiversity Conservation in multiple-use forest landscapes in Sabah, Malaysia" under the Government of Malaysia – UNDP-GEF Project in FMUs #23, #24 and #26 of Yayasan Sabah SFMLA area.

10.2. Management Zones

The gazettement of Maliau Buffer Zone, as gazetted in April 2012 (GoS, 2012), has made it necessary to revise the overall internal demarcation of the buffer zones. The background of the new Maliau Buffer Zone has been discussed in **section 4.2** of the report. While the overall area of MBCA and its buffer zones remain at 191,634.0 ha (refer to **Table 10.1** for revised hectarage, i.e. 192,690.0 ha), the sizes of Buffer Zone 1 and 2 will significantly changed. This will be discussed further in the following sub-sections.

10.2.1. Rationales to Revise the Management Zones

With the incorporation of the Maliau Buffer Zone and it being reclassified as Class I (Protective) Forest Reserve by the state government, and placing it under the authority of the Maliau Basin Management Committee (MBMC) (GoS, 2012), it is appropriate that Maliau Buffer Zone be integrated as Buffer Zone 1 for MBCA. The total area of Maliau Buffer Zone is 46,603.0 ha, i.e. comprising of part of Sapulut Forest Reserve (7,644.0 ha), part of Sg. Pinangah Forest Reserve (22,163.0 ha) and part of Gunung Rara Forest Reserve (16,796.0 ha) (SFD, 2013a).

Table 10.1 illustrates the changes in area for the buffer zones in MBCA, while retaining the overall area for MBCA at 191,634.0 ha. The revision to the buffer zones is as shown in **Figure 10.1,** from data profided by Sabah Forestry Department.

Table 10.1: Revised Buffer Zones for MBCA

Description	Old Area (ha)	Revision (ha)
Maliau Basin Forest Reserve (Core Area)	58,840.0	58,840.0
Buffer Zone 1 (Maliau Buffer Zone)	38,837.0	46,603.0
Buffer Zone 2	93,957.0	87,247.0
Total (ha)	**191,634.0**	**192,690.0**

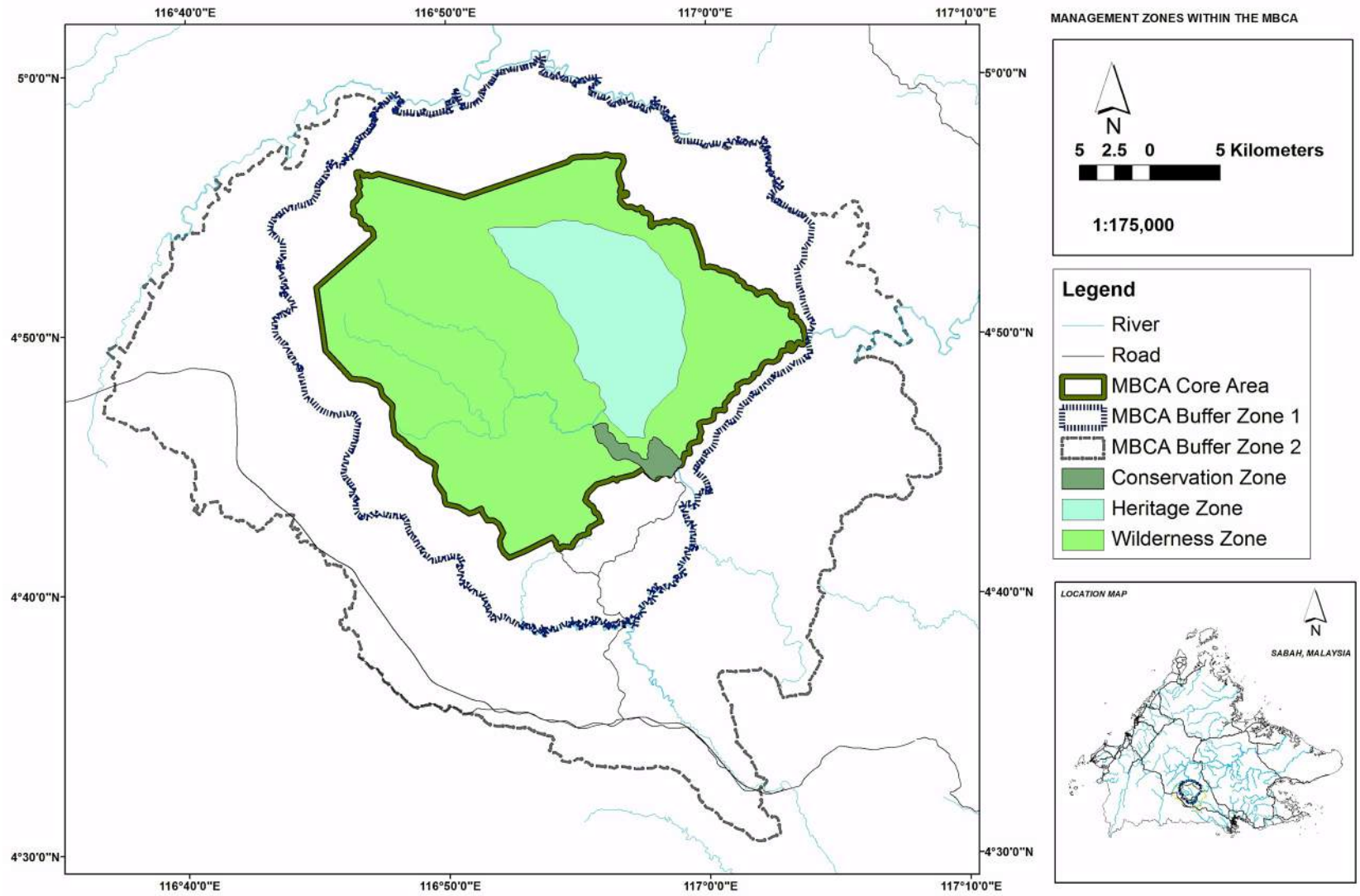


Figure 10.1: Revised Management Zones for MBCA

10.2.2. Management Zones

Table 10.2 and **Figure 10.1** show the revised management zones, including the newly approved Maliau Buffer Zone, and revision to zoning within the Core Area of MBCA. In the earlier management plan (YS, 2003) several activity-oriented zones were mentioned within the core area (i.e. recuperation zone, research zone and education zone). These activity-oriented zones have been removed and the revision in this report now presents only the Heritage Zone, Conservation Zone and Wilderness Zone. Activities such as recuperation, research and education can be held at any of the zones (except for the Heritage zone) that will be prescribed in **section 10.3** of this report.

Table 10.2: Revised Management Zones in MBCA

Description		Forest Classification	Area (ha)	Total (ha)
Maliau Basin Forest Reserve (Core Area)	Heritage	Class I Forest Reserve	11,345.0	58,840.0
	Conservation		918.0	
	Wilderness		46,577.0	
Buffer Zone 1 (Maliau Buffer Zone)			46,603.0	46,603.0
Buffer Zone 2		Class II Forest Reserve	87,247.0	87,247.0
Total Area (ha)				**192,690.0**

In addition to the mentioned zones as shown in **Table 10.2**, another equally important zone that will be placed and distributed appropriately after a detailed resource inventories is the "tourism development zone (TDZ)". Several areas have been potentially earmarked for such zone (refer to **Figure 10.2**), and the exact areas (size) and locations can only be determined from the recommendations of the resources survey. Four of the five areas earmarked are located in Buffer Zone 2, while one is in Buffer Zone 1.

With the revision of the buffer zones, the altitudinal zonation as shown in **Table 10.3** shows the areas based on the altitude. It is noted that some of the valleys inside the core area have dipterocarp forest quite high up - these places may be have high resilience for future climate change and can act as refuge area for species / biodiversity in the very long run. The total area is approximate (based on GIS).

Table 10.3: Distribution of forested area in MBCA based on altitudinal zonation

Description		Elevation (m)	Core	Buffer Zone 1	Buffer Zone 2	Total (ha)
a. Sub-alpine		Over 3,000	0	0	0	0
b. Montane	Upper	1,800 – 3,000	0	0	0	0
	Lower	1,000 – 1,800	31,872.7	1,613.3	1,577.0	35,063.0
c. Dipterocarp	Upland	500 – 1,000	23,682.2	27,673.7	70.609.0	121,964.9
	Lowland	Below 500	2,817.5	17,283.6	21,726.0	41,827.1
Overall Total (ha)			**58,372.4**	**46,570.6**	**93,909.0**	**198,855.0**

Source: Robert Ong, SFD (Jan 2014) (*pers. comm*) *Altitudinal zonation and its elevations based on discussion

Table 10.4: Management Zones of MBCA and its Governance

Management Zone		Descriptions	Authority/Rightsholders[1]	Area (ha)		Forest Classification	Ref.
1	Heritage	Strict preservation. An area set aside pending management decisions by future generation in 2050	Maliau Basin Management Committee (MBMC)	11,345.0	58,840.0	Class I (Protection)	To be known as the "core area" of MBCA; Gazetted on April 1998 as per FD Plan No. 91/88C and known as "Maliau Basin Forest Reserve"; and Refer to the *Forest (Maliau Basin Conservation Area) Rules, 1998* that came into operation on 31st December 1997.
2	Conservation	Protection. Natural conservation is a priority, but low impact or environmentally compatible activities are acceptable		918.0			
3	Wilderness	Controlled use. Limited areas of natural environment where intensive outdoor recreation is acceptable		46,577.0			
4	Buffer Zone 1	Areas that will act as "wall" to protect the core area (i.e. Maliau Basin Forest Reserve).		46,603.0	46,603.0		Described as "Maliau Buffer Zone", and gazetted on November 2012 as per FD Plan No. 102/94; and Refer to *Forest (Maliau Basin Conservation Area) (Amendment) Rules 2012* that came into operation on 1st April 2012.
5	Buffer Zone 2	An area identified and approved in the earlier management plan,	Sabah Forest Department (SFD), Yayasan Sabah (YS) & Sapulut Forest Development S/B	87,247.0	87,247.0	Class II (Production)	Boundary of Buffer Zone II remains as approved under the former management plan. Inclusive of Nurod-Urod FR (Class VI) (1,705.0 ha)
Total (ha)				**192,690.0**	**192,690.0**		
6	Tourism Development	Major tourist attractions where the environment is hardened or modified to minimise impacts.	Maliau Basin Management Committee (MBMC)	Variable		-	-

Note:

[1] Terminology used by IUCN (IUCN, 2013:15) as "actors socially endowed with legal or customary rights with respect to land, water and natural resources"; while stakeholders are those who "posses direct or indirect interests and concerns about those, but do not necessarily enjoy legally or socially recognised entitlement to them".

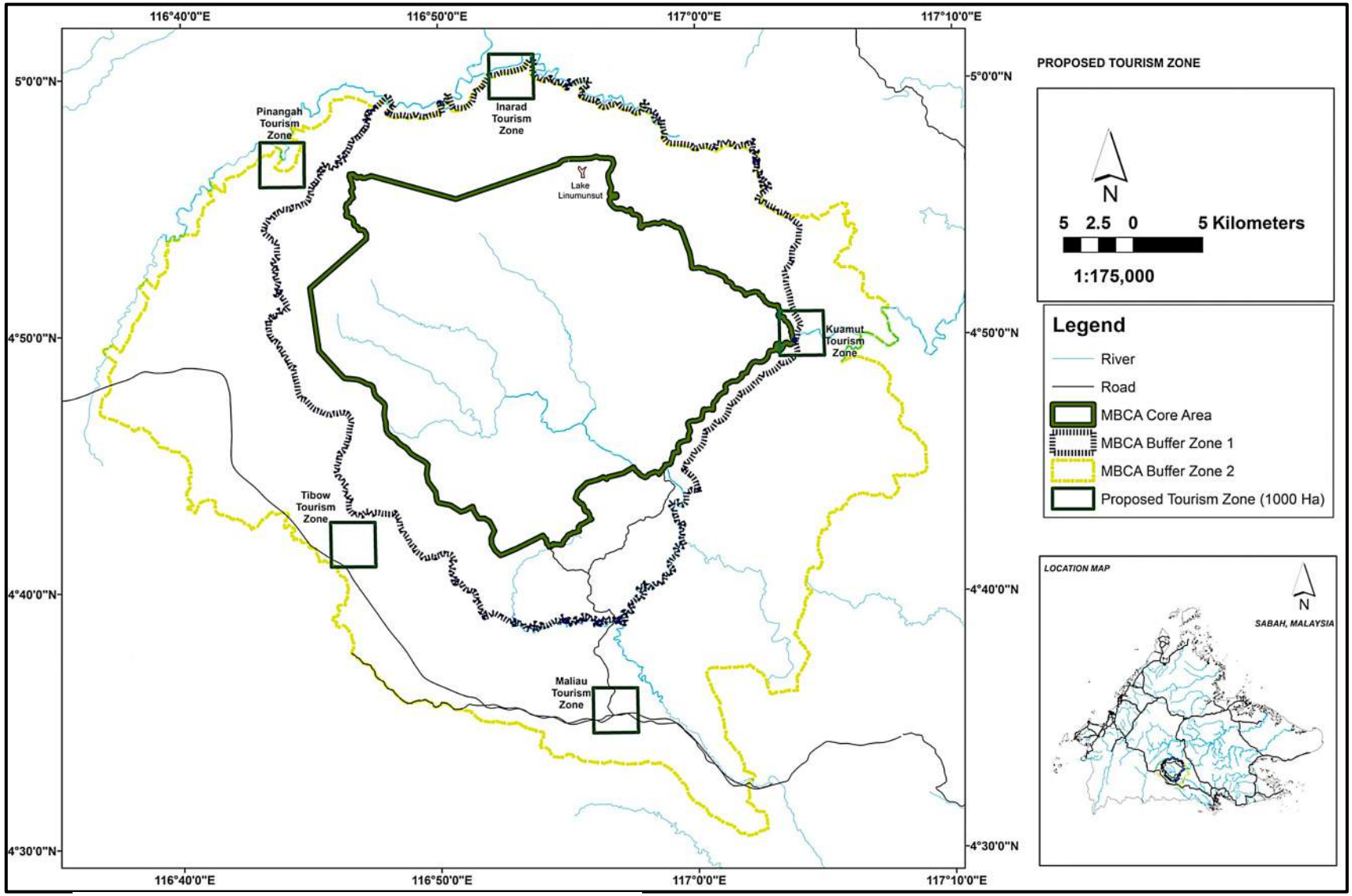


Figure 10.2: Potential Tourism Zones in MBCA

10.2.3 Governance

The Maliau Basin Management Committee (MBMC) is responsible to administer the core area and Buffer Zone 1 (i.e. Maliau Buffer Zone) of MBCA, as provided under the legislation (GoS, 1998 & 2012). **Table 10.4** shows that Buffer Zone 2 is being administered by three bodies, i.e. Sabah Forest Department, Yayasan Sabah and also Sapulut Forest Development Sdn Bhd (SFMLA holder for FMU #14).

In pursuant to section 2(2) of the *Forest (Maliau Basin Conservation Area) Rules 1998* (GoS, 1998), there are 11 committee members in the management committee. With part of FMU #14 added to Maliau Buffer Zone (i.e. 7,644.0 ha – Sapulut Forest Reserve) (refer to **section 4.2**), Sapulut Forest Development Sdn Bhd is included as a member of the management committee in 2012 (GoS, 2012). Buffer Zone 2 remains a Class II (Commercial) forest reserve, thus extraction activities will continue to exist in accordance to procedures that requires proper detailed workplan and Environmental Impact Assessment (EIA).

Recommendation: It is recommended that all tourism development zones (TDZs) be placed under the administration of the Maliau Basin Management Committee (MBMC).

Table 10.5: Management Guidelines in MBCA and its Zones

Management Zone		Descriptions	Accessibility	Development	Permissible activities
1	Heritage	Strict preservation. An area set aside pending management decisions by future generation in 2050	Not accessible to any visitor or researcher.	Nil	Nil
2	Conservation	Protection. Natural conservation is a priority, but low impact or environmentally compatible activities are acceptable	Accessible (by trekking or any other means of transportation) to researchers assisted by research assistants.	Permanent or temporary facilities, designed and built that best serve its intentions.	Research (long-term, short-term or as when needed). Open fires not permitted.
3	Wilderness	Controlled use. Limited areas of natural environment where intensive outdoor recreation is acceptable.	Accessible (by trekking) to researchers; and visitors with approval from the Manager of MBCA. Nature Guide – 1 guide to 6 pax (max)	Field stations and recreational trails, with overnight facilities (including rest huts) for visitors. Restricted to 24 pax (max) per facilities.	Photography, birdwatching, wildlife viewing. Open fires not permitted.
4	Buffer Zone 1	Areas that will act as "wall" to protect the core area (i.e. Maliau Basin Forest Reserve).	Limited to management and researchers.	Field stations, and any others as prescribed and approved under the new management plan.	Mainly restoration of degraded forest.
5	Buffer Zone 2	An area identified and approved in the earlier management plan,	Based on the management guidelines of each area, i.e. on the placement of the Tourism Zones.	Development that is compatible to the objectives of MBCA, and fulfilling all legal requirements.	Activities that are compatible to the objectives of MBCA, and fulfilling all legal requirements. For logging activity, all legal requirements must be fulfilled, and utilising RIL technique.
6	Tourism Zone	Major tourist attraction where the environment is hardened or modified to minimise impacts.	Accessible (vehicles, boats & trekking) to all visitors, all year round. Nature Guide – 1 guide to 10 pax (max)	Areas set aside for tourism development. Including road & trail networks. Facilities must be compatible with special qualities of the environment.	Picnic, canoeing, birdwatching, wildlife viewing, team building, etc.

Note:

a. Rangers = employed by Yayasan Sabah
b. Guides = Licensed tourist guides (by Ministry of Tourism and Culture - MOTAC), and those that have been granted approval by Yayasan Sabah to conduct guiding activities in MBCA, i.e. two types of approval by YS, Type I (within "tourism" zone) and Type II (inside "wilderness" zone")

10.3. Zoning Guidelines

Table 10.5 provides the necessary guidelines for the management zones in MBCA. It describes the accessibility, permissible development and activities. It must be noted that there shall be no major development inside the core area, i.e. 58,840 ha, except for field stations that may eventually be upgraded into full-fledged research stations.

Box 10.1: Development Guidelines

Listed below are some of the appropriate guidelines that must be observed for development in MBCA.

1. There shall be no major development inside the core area (i.e. inside MBCA – 58,840 ha) and Buffer Zone 1, except for the establishment of field stations, trails for accessibility, and potentially one Tourism Development Zone (TDZ) in Buffer Zone 1;
2. All TDZs to be established at locations identified and approved by MBMC, and need to have a full blown masterplan with approved EIA before commencement of any activity on the ground;
3. All infrastructure development (i.e. specifically for buildings) must conform (and be certified where appropriate) to the:
   - Malaysia's Green Building Index (GBI);
   - 100% Carbon-neutral (as far as possible);
   - Powered by Renewable Energy (RE) (e.g. mini or micro hydro, solar or combination – hybrid), except where it is impossible to optimise such resources.
4. Facilities for tourism must conform to:
   - Green Globe certification standards (or equivalent) – (http://greenglobe.com); and
   - Global Sustainable Tourism Council (GSTC) – GST Criteria (http://gstcouncil.org).

As for the tourism development zones (TDZs), based on discussions and workshops held, there are 4 key areas plus one at the main entry to MBCA. The basis of identifying these TDZs are based on the following points:

- From the Wildlife Resource Inventory 2013, all the proposed sites were the main access and entry points for encroachment that leads to illegal activities such as poaching of wildlife, harvesting of *Gaharu*, graffiti; and
- To complement the presence of the proposed field stations that will be placed in Buffer Zone 1.

The development of tourism in the TDZs must adhere to the concept of sustainable tourism development (**Box 10.2**), in order that a balance linkages between the environment, socio-culture and economic can be achieved.

Box 10.2: Concept of Sustainable Tourism Development

The concept of sustainable tourism was introduced after the Rio Earth Summit in 1992, alongside with the mainstream sustainable development. Sustainable tourism development guidelines and management practices are applicable to all forms of tourism in all types of destinations, including mass tourism and the various niche tourism segments. Sustainability principles refer to the environmental, economic, and socio-cultural aspects of tourism development, and a suitable balance must be established between these three dimensions to guarantee its long-term sustainability.

Thus, sustainable tourism should (based on the three pillars of environment, socio-culture and economic):

a. Make optimal use of **environmental** resources that constitute a key element in tourism development, maintaining essential ecological processes and helping to conserve natural heritage and biodiversity.
b. Respect the **socio-cultural** authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance.
C. Ensure viable, long-term **economic** operations, providing socio-economic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities and social services to host communities, and contributing to poverty alleviation.

For recreational activities, all visitors are to be accompanied by Local Nature Tourist Guides that are registered with Maliau Basin Guides and Porters Association, except for facilities that are meant to be

"self-guided". The ratios for nature tourist guide to visitors are as below:

- Tourism development zones (TDZs) = 1 nature tourist guide to 10 pax; and
- Core area = 1 nature tourist guide to 6 pax; and 2 rangers for every group.

There are several key legislations relevant to the development or initiatives within MBCA, including its buffer zones. These are illustrated in **Box 10.3** to guide readers. The *Environmental Protection Enactment 1997* and *Environmental Protection (Prescribed Activities) Order 2005* are the two crucial instrument to mitigate adverse negative impacts from development, through the process of environmental impact assessment (EIA).

Box 10.3: Key Legislation and Guideline applicable to MBCA

Below are some of the relevant legislations and guidelines that are applicable in developing the large facilities in MBCA.

a. Legislation
National
Renewable Energy Act 2011 (Act 725) – Part II, IV and V;
Tourism Industry Act 1992 (Act 482) – Part IVA for registration of accommodation premises;
Innkeepers Act 1952 (Act 248);

State
Cultural Heritage (Conservation) Enactment 1997. MBCA is listed under the Enactment;
Environmental Protection Enactment 2002.
Environmental Protection (Prescribed Activities) Order 2005. Prescribed activities listed in the Schedule, i.e. resorts and recreational development covering an area of 10.0 hectares and more
Relevant district authorities, i.e. Pejabat Daerah Tongod and Pejabat Daerah Nabawan

b. Guideline
International
Ceballos-Lascurain, H. (1996). *Tourism, ecotourism and protected areas. The state of nature-based tourism around the world and guidelines for its development*. Gland: IUCN;
Global Sustainable Tourism Council (GSTC) – GST Criteria for hotels and destination (refer to additional notes in box);
Lindberg, K. and Hawkins, D.E. (eds.) (1993). *Ecotourism: A guide for planners and managers. Vol. 1*. Vermont: The Ecotourism Society;
Lindberg, K., Wood, M.E. and Engeldrum, D. (eds.) (1998). *Ecotourism: A guide for planners and managers. Vol. 2*. Vermont: The Ecotourism Society

National
MoCAT (1996). *The National Ecotourism Plan*. Kuala Lumpur: Ministry of Culture, Arts and Tourism. 6 parts report.
MoCAT (1997). *Pelan Ekopelancongan Kebangsaan, Garis Panduan 4: Taman Negara, Hutan Simpan dan Hutan Lain*. Kuala Lumpur: Ministry of Culture, Arts and Tourism.

CHAPTER 11 MANAGEMENT PROGRAMMES AND ACTIONS

11.1. Introduction

The chapter provides the background of the programme and outputs, compiled from outcomes of several workshops, discussions (internal and external). The implementation period will be between 2014 till 2023, with a mid-term review to be conducted in 2018.

11.2. Themes and Policies

The formulation of the themes and programmes has changed from the normal management, where it would have been strategies, etc. The concept has been discussed in workshops and MBMC meetings for inputs and eventually acceptance by all stakeholders. The earlier management has addressed several strategies for the development of MBCA; this plan will continue to take on board some of the activities (e.g. including establishment of field stations, provision of EEP, etc.).

11.2.1. Themes

Several themes have been formulated for this plan (refer to **Table 11.1**) to suit current needs and aspirations of MBCA. A complete list of the themes is to be found in **Appendix K**, with the programme and outputs designed for implementation during the lifespan of this management plan.

There are 11 themes, with 10 being on programmes and outputs that are to be implemented for specific purposes, while the 11th theme (i.e. others) is meant as cross-cutting programme that should be incorporated into the earlier themes (where relevant).

Table 11.1: Themes and Programmes for MBCA, 2014-2023

Theme	Programme	Note
1. Infrastructure Development	1.1 Operation	This is for the development of new infrastructure and maintenance of existing structures. This was discussed in the Dec 2012 workshop. Establishment of the Carpentry workshop and Recreation Club.
	1.2 Tourism development	Introducing 5 tourism development zones (TDZs). This will be based on a proper resource survey and identification of the sites. In the last MP there was no proper tourism plan developed, except for a draft copy for tourism development (2006). Development of tourism facilities in TDZs will be privatised.

Theme	Programme	Note
2. Capacity Building – Human Capital	2.1 Recruitment	This was highlighted in the December 2012 and July 2013 workshop. Addition of two new positions, i.e. Research Coordinator and Conservation Marketing manager. Detailed training programme for staffs and local community.
	2.2 Training	
3. Research	3.1 Biodiversity	More data collection is needed and a more intensified research programme is needed.
4. Resource Conservation & management	4.1 Boundary	Highlighted in the December 2012 workshop, this is important, as it will affect the World Heritage site nomination. Demarcation of boundaries of Buffer Zone 1 and 2.
	4.2 Zoning	Changes were made on the boundaries of Buffer Zone 1.
	4.3 Natural resource inventory	Continuation for research works in the existing research plots and possibilities of development of new ones. This will also be the benchmark for a once in every 5 years major expedition to gather information from different parts of the basin. In the 1st MP a research prospectus was to be develop to guide the research in Maliau.
5. Environmental Education	5.1 Environmental education	Discussed in the December 2012 workshop. In the 1st MP an integrated EE program was suggested and to include if possible all teachers in Sabah through a rainforest EE course. New EE modules for day-trippers to be introduced. Business plan to be formulated.
6. Recreational Tourism	6.1 Facilities (activity)	This was mentioned in the December 2012 workshop, i.e. to upgrade the existing facilities and to develop new ones in the identified tourism zones/sites. Privatisation on certain facilities to responsible developers.
	6.2 Event	This is a new concept to be introduced to showcase Maliau as the place for events and at the same time instilling awareness to the mass public about Maliau. Known as Wildlife Conservation Day (WCD (4th Dec).
7. Sustainable Income Generation	7.1 Direct income	Previously known as sustainable financing strategy, this was discussed in the December 2012 workshop. Revision to user fees (day visitors) and introduction of concession fees.
8. Promotion and Marketing	8.1 Strategy and planning	Introducing the development of a marketing plan that can greatly aid the marketing and promotion on

Theme	Programme	Note
		tourisms services and products offers by MBCA and delivering those aspects straight to
	8.2 Communication	Communication programme through: • Publicity materials • Website • Print media
	8.3 Awareness raising	Formulating new approach for the mass-communication personnel to promote awareness by organising fam trip for: • Media • Tours agencies • Stakeholders and Rightholders.
	8.4 Merchandising	Improve merchandising programme by introducing: • Products development in providing wide ranges of products that are unique for MBCA • Outlets development by sourcing potential new outlets outside of MBCA to increase promotion of MBCA merchandise. Currently, MBCA merchandise products owned by the MBCA have not yet been promoted outside of Maliau.
	8.5 Electronic reservation and payment	Newly introduced method for credit card payment service inside MBCA, instead of cash. Website to provide reservation queries for rooms availability and rates to ease booking process.
9. Initiatives	9.1 Protected area training centre	New initiatives to be introduced in MBCA.
	9.2 Forest rehabilitation	
10. Monitoring	10.1 Biodiversity	Monitoring of Biodiversity in MBCA using the previous method in distribution of flora and fauna, and tree phenology. Introduction of simple yet standardised monitoring routines for certain keystone habitats and species (e.g. large mammals and iconic wildlife).
	10.2 Climate change	Reintroduce of the AWS into field station.
	10.3 Research	Introducing online data storage and analysis for research using "View World". This software is design for mobile phone and can be edited in PC.
	10.4 Recreation/ ecotourism	Addition of few approach in assessing the quality of services and experience by visitors in MBCA which are: • Using of visitors counter to record and gain clear information of visitors' patterns and movement within MBCA.

Theme	Programme	Note
		• Visitors impact management monitoring • Hospitality monitoring • Facilities monitoring
	10.5 Security	Strengthens enforcement party by providing training (SMART) for Rangers, Honorary Wildlife Warden and Honorary Forest Ranger. Introducing the usage of drones to gives real-time aerial monitoring across MBCA boundaries and less accessible areas. Monitoring of fire hotspots within MBCA using GIS generated maps.
11. Others	11.1 Going Green	Cross-cutting initiatives to be maintained and introduced in MBCA for all its facilities.
	11.2 Development	
	11.3 Operational	

Table 11.2 shows the matrix of the themes in relation to the objectives of MBCA, indicating its primary and secondary relationships. The matrix indicates that all the themes are relevant to the objectives.

Table 11.2: Matrix on relationship between the themes and objectives of MBCA

Objectives	Themes									
	1	2	3	4	5	6	7	8	9	10
a. Protection of biological diversity	✓	✓✓	-	✓✓	✓	-	✓	-	-	✓✓
b. Promotion of research	✓	✓✓	✓✓	✓✓	-	-	✓	-	✓	✓
c. Promotion of education & training	-	✓✓	✓	-	✓✓	✓	✓	✓	-	-
d. Promotion of appropriate recreation	✓✓	-	✓	-	-	✓✓	-	✓✓	-	✓
e. Integration of the objectives with other development	✓	-	-	✓	-	-	-	✓	✓	✓

Legend:
✓✓ = Primary
✓ = Secondary

11.2.2. Policies

While every attempt to maintain the policies for each thematic strategy due to its relevancy, certain minor changes were made to accommodate on changes in landuse, buffer zones and its activities. The policies that will guide each of the themes are as illustrated in **Table 11.3**.

Table 11.3: Guiding Policies for the themes

Theme 1: Infrastructure development No major development be permitted inside the core area except for the establishment of field stations, overnight facilities and wilderness trails to facilitate research and compatible recreational activities. In addition, identified tourism zone development must be approved by the MBMC and to obtain approval from relevant agencies (on EIA) as required by prevailing state law. It is essential that all activities in Buffer Zone II be addressed by MBMC and a compatible approach must be made, so as not to have adverse effects on biodiversity.
Theme 2: Capacity building – Human capital If the long-term conservation of the MBCA is to be achieved, adaptive management systems are needed that are able both to overcome challenges and to use opportunities creatively an effectively. These systems should bring smoothly together key elements of operational planning, budgetary accountability, clear line authority, performance monitoring, staff incentives and knowledge management arrangements. Institutional change, decentralisation, staff training and other measures will be needed to ensure that those capacity is developed and maintained. *Source*: YS (2003: 90)
Theme 3: Research Managing MBCA means **to save, study, teach about and use sustainably the components of biodiversity that occur within it, with the aim of preserving in perpetuity the natural conditions prevailing in MBCA**. Both pure and commercial forms of research are desirable. These are the principal policy that moves research work in Maliau. *Source*: YS (2003: 105) In addition, an "open door" policy on research will also be adopted.
Theme 4: Resource conservation and management MBCA belongs to the foremost rank of Malaysian conservation areas, alongside Taman Negara in Pahang, Kelantan and Terengganu, Mulu National Park in Sarawak and Kinabalu Park and Danum Valley Conservation Area in Sabah, all of which have the maximum possible priority for national and global biodiversity conservation. Consistent with state and national law and policy, and with Malaysia's international commitments, every effort will be made, therefore, to preserve in perpetuity the natural conditions prevailing within the MBCA. *Source*: YS (2003: 13)
Theme 5: Environmental education The ecosystems of the MBCA are knowledge resources that can be used to generate various kinds of sustainable benefit flows to Sabah, Malaysia and the world. **Education** will be used to help create new generations sensitised to the wonders of nature while harvesting revenues from those able to pay for learning experiences. In all cases, preference will be given to activities that involve minimal risk to the MBCA while yielding maximum benefits – including financial benefits – for conservation. *Source*: YS (2003: 17)
Theme 6: Recreational tourism The ecosystems of the MBCA are knowledge resources that can be used to generate various kinds of sustainable benefit flows to Sabah, Malaysia and the world. Tourism will be used to harvest revenues from visitors eager to learn about rain forest ecosystems In all cases, strong preference will be given to activities that involve minimal risk to the MBCA while yielding maximum benefits – including financial benefits – for conservation. *Source*: YS (2003: 95)
Theme 7: Sustainable income generation New techniques, technologies and international markets mean that the conservation sector is now capable of achieving and sustaining a primary economic role without necessarily conflicting conservation aims. Investments will be directed to this end, in full awareness that the diversity and novelty of a financing strategy based on sustainable use of biodiversity will require innovation, experiment and deliberate diversification of business activities and income streams. *Source*: YS (2003:122)

Theme 8: Promotion and marketing The ecosystems of the MBCA are knowledge resources that can be used to generate various kinds of sustainable benefit flows to Sabah, Malaysia and the world. Public awareness will be promoted by systematic marketing and outreach, using materials in all media developed using rain forest knowledge resources, some of them distributed for free and some at a profit. *Source*: YS (2003: 95)
Theme 9: Initiatives To create values for MBCA, certain initiatives are to be implemented so that it will be able to bring it to higher level.
Theme 10: Monitoring Monitoring will act as a feedback on the ecosystem health and to determine on the effectiveness of the conservation efforts in MBCA.

11.3. Strategies and Implementation

The strategies to be implemented in this management plan will be based on several themes that had been discussed and presented in workshops and the MBMC meetings.

11.3.1. Theme 1: Infrastructure Development

Table 11.4 shows the identified infrastructure development in MBCA. There are two programmes under this theme, i.e. operation and tourism development. As for the operational programme, three outputs have been identified based on urgency and necessity. The objectives of the operational programmes are:

- To provide facilities for rangers/foresters to conduct effective management of resources in MBCA, including monitoring;
- To provide supporting services in maintaining the facilities in MBCA; and
- To provide better quality of life among staffs and long-term researchers in MBCA with recreational activities that will also be optimised for socialising.

Table 11.4: Outputs, Tasks and Implementation for Theme 1

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Theme 1: INFRASTRUCTURE DEVELOPMENT												
1.1 Operation	1.1.1 Field Stations	MBCA		✓	✓	✓	✓	✓	✓			
	1.1.2 Carpentry Workshop			✓								
	1.1.3 Recreation Club			✓								
1.2 Tourism development	1.2.1 Maliau tourism zone (TZ1)	CEMD										
	1.2.2 Inarad tourism zone (TZ2)											
	1.2.3 Kuamut tourism zone (TZ3)											
	1.2.4 Tibow tourism zone (TZ4)											
	1.2.5 Pinangah tourism zone (TZ5)											

The establishment of new field stations (**Figure 11.1**) are needed to intensify monitoring and enforcement activities along the boundary of Maliau. Based on the findings from the Wildlife and Resource Inventory in June 2013, it was found that continuous threats from encroachments were recorded, i.e. poaching of wildlife and illegal harvesting of *Gaharu*. Establishing these field stations will be prioritised to ensure that adequate protection can be rendered and control encroachment (**Table 11.5**).

Table 11.5: Existing and Proposed Field Stations in MBCA

Field Station	Altitude (m)	Zone	Upgrade	New
A. Existing Field Stations				
1. Belian	305.0	Buffer Zone 1	-	-
2. Agathis	610.0		✓	-
3. Nepenthes (formerly Camel Trophy)	1,067.0	Core	✓	-
4. Ginseng	914.0		-	-
5. Dacrydium (Strike Ridge)	1,295.0		✓	-
6. Rafflesia	762.0		✓	-
7. Lobah	762.0		✓	-
8. Seraya	762.0		✓	-
9. Eucalyptus	1,067.0		✓	-
B. Proposed Field Stations (PFS)				
1. PFS 1 – Calamus FS	1,143.0	Core	-	✓
2. PFS 2 – (Camp 11)	914.0		-	✓
3. PFS 3 – (near to Camp 8 at Tibow)	530.0	Buffer Zone 2	-	✓
4. PFS 4 – (near to Camp 5 at Pinangah)	305.0		-	✓
5. PFS 5 – (near to Camp 4 at Inarad)	229.0	Buffer Zone 1	-	✓
6. PFS 6 – (near to Camp 2 at Kuamut)	305.0	Buffer Zone 2	-	✓

In order to establish a full-fledged research station, the following processes need to be undertaken by initially establishing the appropriate location and commence to establish the "field stations":

- Identify and establish temporary base camp for rangers, with following requirement:
  - ✓ Adequate water supply from available source;
  - ✓ Easy accessibility;
  - ✓ Good coverage for radio communication;
  - ✓ High ground (to avoid flood);
  - ✓ Avoiding path of large mammals;
  - ✓ Safe from falling branches or trees;
- To conduct basic resource inventory by rangers, and to establish trail networks;
- Conduct full resource inventory (scientific expedition) of the area, and identify potential research plots;

- Identify potential area for tourism development (i.e. for Maliau Entrance, Inarad, Kuamut, Tibow and Pinangah); and
- Prepare development plan for field stations.

The carpentry workshop is needed, as currently no such facilities exist in Maliau. Establishment of the recreation club is to separate the activities among the visitors and the staff/researchers, as to avoid conflicts in the future.

Tourism has become a major sector of economic activity since the latter part of the twentieth century and all indications are that it will continue growing in the years to come. With this growth, a diversification of tourism products and destinations is taking place, with increased demand for nature-related tourism, including ecotourism, visitation to protected areas, rural-based tourism, and the like. In the case of MBCA, tourism can help its sustainable management, as a market-based alternative catering to the growing number of discriminating travellers trying to find, understand and enjoy a natural environment. Tourism provides conservation with an economic justification, is a means of building support for conservation, and can bring resources to conservation. In addition it can support the protection of natural resources, as local residents can reap the benefits of increased visitors arrival, creating a realisation on the value of MBCA thus wanting to preserve it.

The potential for tourism in MBCA is great, simply because the opportunities of tourism in Sabah are expanding rapidly:

- Several airlines offering flights from multiple destinations, be it within the country or the region;
- Completion of the Sapulut – Kalabakan road by end of 2014;
- New road linking Sapulut to Tongod;
- Under the Sabah Development Corridor (SDC), tourism sector plays an important part, with Maliau Basin identified as one of the project under the Entry Point Project (EPP) on "nature adventure" (EPP3);
- In line with Malaysia's focus of targeting high yield tourists, the number of 4✯ and 5✯ hotels need to be increased (PEMANDU, 2013);
- Tax incentives for hotel development:
    - ✓ Investment Tax Allowance and Pioneer Status for new hotels with a 4✯ and 5✯ rating. Hotels which are 100 per cent foreign-owned will also be eligible for these incentives; and
    - ✓ Ministry of Finance (MoF) revised the equity conditions for eligibility of tax incentives and gradually liberalised foreign equity for 3✯ rating.

However, it must also be noted that biodiversity is threatened as never before, as the protected areas that harbour so much of our biodiversity are exposed to the pressures of unsustainable development (Newsome, Moore & Dowling, 2002).

Given the risk of damage and destruction to the site, a precautionary approach need to be undertaken in order to protect the biodiversity of MBCA. The development of MBCA for tourism requires a careful balance between providing adequate visitor experiences and services, protecting the ecological and cultural values of the area and ensuring the long-term sustainability of the site.

Thus, development of tourism infrastructures (refer to **Figure 10.2**) must conform to the sustainable tourism development guidelines (**Boxes 10.1** and **10.2**), and to the national legislation for *Renewable Energy Act 2011* (Act 725) – Part II, IV and V; *Tourism Industry Act 1992* (Act 482) – Part IVA for registration of accommodation premises; *Innkeepers Act 1952* (Act 248), also to the State legislation on *Cultural Heritage (Conservation) Enactment 1997*, *Environmental Protection Enactment 2002*, *Environmental Protection (Prescribed Activities) Order 2005* (as listed in **Box 9.3**) Prescribed activities listed in the Schedule are those related to the development of tourism facilities, i.e. resorts and recreational development covering an area of 10.0 ha or more.

The process to be undertaken in identifying and development of the TDZ is as shown below:

- Approximate allocated site by resource manager identified via large-scale resources inventory and agreed by Management Committee. The proposed site descriptions:
  - ✓ Total area (hectares) allocated;
  - ✓ Site descriptions
  - ✓ Status of flora & fauna;
  - ✓ Tourism attractions;
  - ✓ Accessibility;
  - ✓ Others;
- Tourism Masterplan to be developed for the tourism zone areas;
- EIA for the tourism zone to be conducted and approved in accordance to Prescribed Activities as per schedule in the *Environmental Protection (Prescribed Activities) Order 2005*; and
- Development can be conducted in phases or sub-zonings for different purposes.

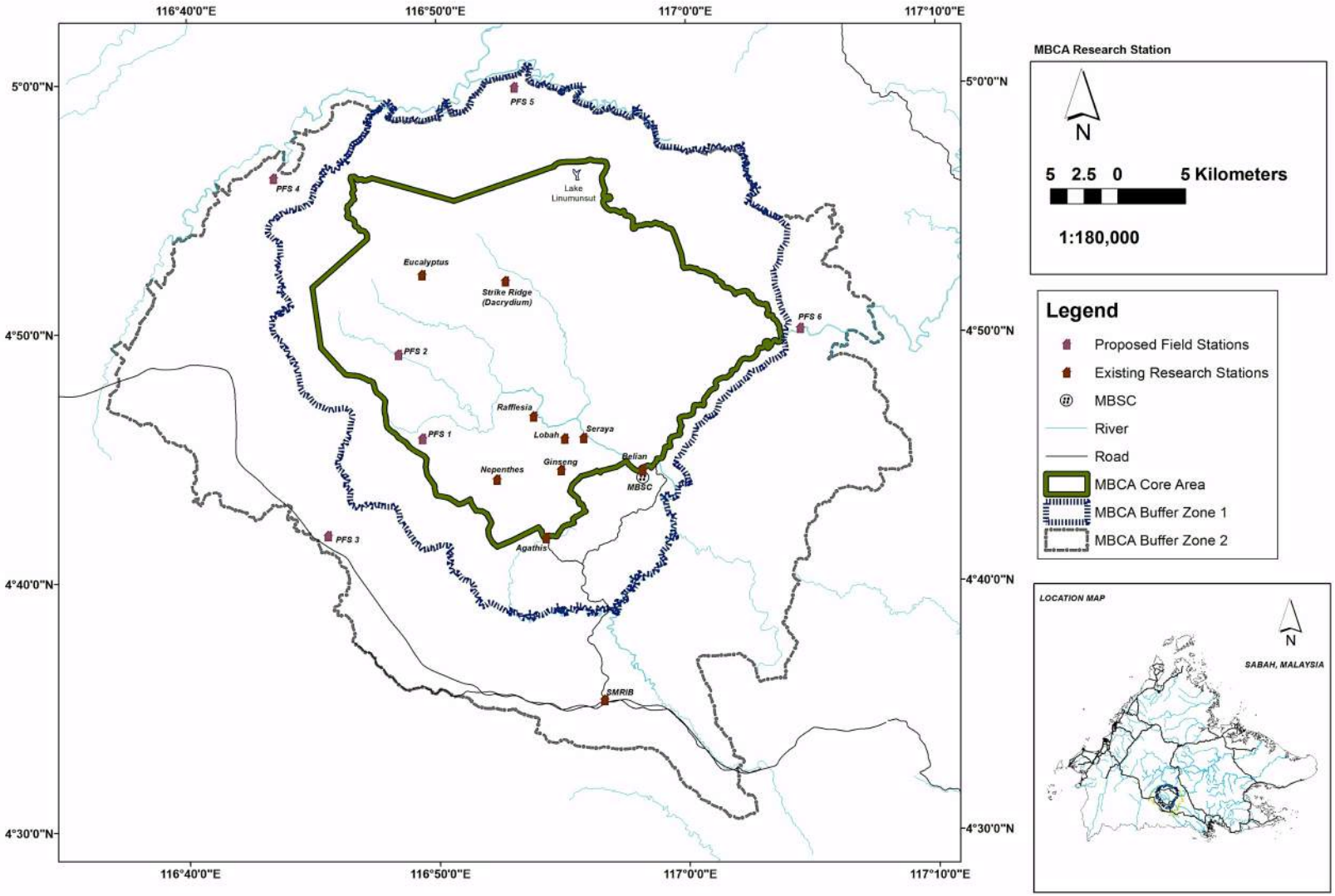


Figure 11.1: Proposed Locations of Field Stations

Eventually, as it was mentioned that tourism will be undertaken by the private sector, proper selection of investors need to be conducted to review its business strengths, experiences, roles it play for the environment, etc. All interested investors are to submit their business plan to MBMC, including:

- Background;
- Experiences;
- Financial strengths and projections;
- Project brief (numbers of room, configuration, sizes, restaurants, multi-purpose hall, etc.);
- Will it be in conformation to Green Building Index;
- Renewable energy usage & waste management system;
- Marketing plan.
- MBMC to review the plan, if it is compatible to the management plan and its guidelines; and
- MBMC to provide "concession rates" for facilities (to refer **section 11.3.7**).

11.3.2. Theme 2: Capacity Building – Human Capital

In the inception workshop for MBCA management plan review in Dec 2012, capacity development was one of the issues identified as important in order to move forward. This is important to be implemented as some of the staffs in Maliau lack the basic skills to deliver their assigned tasks. The development of the training program in MBCA must be planned appropriately and it must follow a process of identifying what are the gaps in the existing human resources. This is to make sure that only specific targeted training program be implemented. However, such training should not be done as a one off program, it has to be a continuous training and it can also be packaged into a specialised course and promoted as field courses for foreign groups or students, and other government agencies or to NGOs.

Table 11.6 details out the human capital for MBCA with two programmes (i.e. recruitment and training). The recruitment for the research coordinator and conservation marketing manager is to address the gaps on:

- Lack of organised and structured program developed for research activities in MBCA;
- The absence of a structured plan for marketing the resources in MBCA to the potential donors, the needs to create awareness and opportunities about MBCA; and
- The potential of raising funds to support environmental education, forest restoration and research activities in MBCA.

Specifically, the research coordinator will administer and operate the research projects permitted at MBCA, whereas the conservation-marketing manager will administer and operate the marketing and business plan for MBCA.

Table 11.6: Outputs, Tasks and Implementation for Theme 2

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
THEME 2: CAPACITY BUILDING – HUMAN CAPITAL												
2.1 Recruitment	2.1.1 Management											
	a. Research Coordinator	CEMD		✓								
	b. Conservation Marketing Manager		✓									
2.2 Training	2.2.1 Communication and Media											
	a. Adobe Photoshop, Desktop publishing, Web development & Audio-video editing	CEMD	✓	✓	✓	✓			✓			
	2.2.2 Hospitality											
	a. Frontliners	CEMD	✓		✓		✓		✓			
	b. Foods and Beverages (F & B)		✓		✓		✓		✓			
	c. Housekeeping		✓		✓		✓		✓			
	2.2.3 Enforcement											
	a. Honorary Forest Rangers (HFR)	CEMD	✓		✓			✓				
	b. SMART training		✓		✓		✓		✓			
	2.2.4 Guides and Porters											
	a. Local Nature Tourist Guides	MBCA		✓					✓			
	b. Porters			✓					✓			
	c. Maliau Basin Guides & Porters Association			✓								
	2.2.5 Technical and Field courses											
	a. Technical courses											
	Map reading and Navigation	CEMD		✓		✓		✓				
	GPS and Basic GIS			✓		✓		✓				
	Camera trappings			✓		✓		✓				
	Single Rope Technique (SRT & Tree climbing			✓				✓				
	Photography			✓				✓				
	b. Field courses											
	Phenology	CEMD		✓				✓				
	Specimens – collection and storage			✓				✓				
	Birdwatching & survey technique			✓				✓				
	Mammals – identification & survey			✓				✓				
	2.2.6 Safety											
	a. First Aid (Basic & Intermediate)	CEMD	✓	✓	✓	✓	✓			✓		
	b. Search and Rescue (SAR)			✓					✓			
	c. Occupational Safety & Health (OSH)			✓		✓		✓				

As an obligation to the Convention of Biological Diversity (CBD) under its AICHI Targets: *Goal C: Improve the status of biodiversity safeguarding ecosystem, species and genetic diversity*, several targets are relevant to human capital:

- Target #11 - By 2020, at least 17 percent of terrestrial and inland water, and 10 percent of coastal and marine areas, especially areas of particular

importance for biodiversity and ecosystem services, are **conserved through effectively and equitably managed**, ecologically representative and well connected system of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape.

- Target #12 - 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.

In order to implement Goal C, it is essential that the staffs be trained appropriately so to equip them to implement appropriate measure to manage, enforce and monitor the resources in MBCA, as its long-term security is crucial. Thus, it must again be emphasised that the functions of the staff in MBCA are to carry out protection and management of the area. Among others, it includes:

- Patrolling – boundary surveillance and marking against encroachment;
- Enforcement – anti-poaching activities;
- Public awareness and environmental education;
- Rendering information and services for visitors;
- Maintenance – trails, infrastructure and other facilities;
- Monitoring – flora, fauna & climate data; and
- Assisting researchers.

11.3.3. Theme 3: Research

Table 11.7 outlines the development of a well-structured and planned research program in Maliau. Research is part of the management objectives of MBCA, i.e. the promotion of research into all aspects of the composition and functioning of the Reserve's ecosystem including comparative studies of disturbance and recovery processes following logging of nearby areas.

The results of the research programmes and projects initiated and instituted would hopefully provide information that can act as a feedback mechanism for the improvement in managing MBCA. The result could also be readily used for servicing the educational and eco-tourism sectors. It is also part of the contribution from MBCA towards several national and global initiatives.

The revision of the draft research management plan (YS, 2006a) and the establishment of long term research plots would directly and indirectly contribute to the management objectives:

- Research;
- Assist resource manager in providing clear direction on research activities in MBCA;
- Provide long-term management of resources and its potential contributions and benefits to the overall landscape ecosystem; and

- Collate information on the potential impacts from the outcomes of activities around/within the buffer zones.

Issues or threats as mentioned in **Section 8.3.2** need to be addressed in the revised Research Management Plan.

Table 11.7: Outputs, Tasks and Implementation for Theme 3

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
THEME 3: RESEARCH												
3.1 Biodiversity	3.1.1 Research Management Plan	CEMD		✓								
	3.1.2 Long-term Research Plots	MBCA		✓	✓	✓	✓					

The concept of adopting the "open door" policy has been discussed during the MBMC meeting (meeting #13 & 14), and it was agreed upon, so as not to restrict the kinds of research to be conducted in MBCA.

Potential partnership or collaboration with Universiti Malaysia Sabah (UMS) (http://www.ums.edu.my/v5/index.php/en.html) and those from the South East Asia Rainforest Research Programme (SEARRP) of Royal Society (http://www.searrp.org/) and that of Centre for International Forestry Research (CIFOR) (http://www.cifor.org/) are to be encouraged, together with any other institutions. The role of Sabah Biodiversity Centre (SaBC) (http://www.sabah.gov.my/sabc/) is also to be considered in facilitating research activities in MBCA, as permits are to be obtained from the Centre.

11.3.4. Theme 4: Resource Conservation and Management Development

Three programmes has been identified under this theme, namely on boundary, zoning and natural resource inventory (refer to **Table 11.8**). The resource conservation will cover the aspects of boundary, zoning and natural resource inventory.

It is essential to undertake the boundary demarcation and zoning appropriately as MBCA is being prepared for nomination as a World Heritage site. It should be well marked on the ground. The precise area of MBCA (i.e. the core area, buffer zones 1 & 2) is clearly not well defined from the data collated from GIS analyses. As the state government of Sabah has endorsed the nomination of Maliau Basin (together with Danum Valley and Imbak Canyon) as a World Heritage site, to be known as DaMal Rainforest Complex, it is now essential that such output (boundary demarcation) be completed for record. The preparation of the nomination dossier has been completed, and will be submitted to the Department of National Heritage, the focal point for country's World Heritage nomination.

Apart from that, for the purpose of monitoring and enforcement, the zoning divides the land into areas based on its sensitivity and conservation values. It is a planning technique for sub-dividing the area into units that focus upon management objectives and the natural resource inventory exercise is essential to collate latest information from a large scale survey that will assist resource manager to plan and develop the area. This programme, i.e. zoning, has been well described in **Chapter 10** of this report.

Table 11.8: Outputs, Tasks and Implementation for Theme 4

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
THEME 4: RESOURCE CONSERVATION AND MANAGEMENT												
4.1 Boundary	4.1.1 Demarcation	CEMD		✓	✓							
4.2 Zoning	4.2.1 Management zoning		✓									
	4.2.2 Zoning guidelines & rules		✓									
4.3 Natural resource inventory	4.3.1 Site specific	MBCA	✓	✓	✓	✓						
	4.3.2 Large-scale expedition	CEMD					✓					

With regards to natural resource inventory, there are two outputs related to it. One is the continuous inventory of several sites for the preparation of the field stations, and that of the site allocation for the tourism development zones (TDZs). The second output is the large-scale expedition to be held once every 5 years to assess the biodiversity of MBCA. It is to be conducted with partners from Sabah Wildlife Department, Sabah Forestry Department, Sabah Parks, Universiti Malaysia Sabah, etc.

11.3.5. Theme 5: Environmental Education

This is a continuous and ongoing programme, fulfilling the objective set for MBCA. **Table 11.9** details out the program implementation for environmental education (EE) program in MBCA. Basically EE is a "*learning process in which individuals and groups acquire awareness, knowledge and skills about the total environment, resulting in attitudinal and behavioural changes, thus, contributing towards environmental conservation and sustainable environmental management*" (MTCE, 2009: 6).

The basic guiding principles of EE programme for MBCA is underpinned by a number of key principles. These are:

- A duty to care to protect biodiversity and maintain essential ecological processes;
- EE must be integrated with social and economic goals and accorded equal priority;

- EE is a key tool for raising awareness and effecting behavioural change to move towards sustainability;
- EE must involve everyone; and
- EE must be lifelong, holistic and practical.

The EE programme in MBCA was discussed in **section 9.4.4(a)**, whereby the objectives of EEP in MBCA will complement the objective of Sabah Environmental Education Policy (SEEP). Implementation of the EE program in MBCA must be guided by the policy as outlines in the CEMD Strategic Plan 2011-2020 and Sabah Environmental Education Policy (SEEP).

Table 11.9: Outputs, Tasks and Implementation for Theme 5

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
THEME 5: ENVIRONMENTAL EDUCATION												
5.1 Environmental Education	5.1.1 New modules	MBCA	✓									
	5.1.2 Business plan	CEMD		✓								
	5.1.3 EE programme (IKEA)	MBCA	✓	✓	✓							

Several national and state initiatives related to EE can also be used to guide the EE programme implementation; these are the Eco-School Initiative, a national initiative driven by WWF-Malaysia, Sabah Environmental Education Network (SEEN) and Program Sekolah Rakan Alam Sekitar (SERASI). Also the Sabah Nature Club (SNC) can continue to play its roles in MBCA towards promoting the EE programme. Looking forward there are potentials to promote the EE programme in and around the Security Gate area once the main road linking Sapulut to Kalabakan is fully completed by end of 2014. A half-day EE programme can be introduced in and around the security gate area to cater for potential day trippers commuting the Sapulut-Kalabakn road.

11.3.6. Theme 6: Recreational Tourism

Tourism opportunities in Sabah are expanding rapidly, based on several airlines offering flights from multiple destinations, be it within the country or the region, and with the near completion of the Sapulut – Kalabakan road by end of 2014 it will definitely be an advantage for MBCA. As identified under the Sabah Development Corridor (IDS, 2007), tourism sector plays an important part, with Maliau Basin identified as one of the project under the Entry Point Project (EPP) on "nature adventure".

With that, a proper development planning has to be put in place to make MBCA as the destination for eco-tourism in the region (**Table 11.10**). It is high time now for the replacement and upgrading for several of the tourism facilities in MBCA and

development of new and attractive ones to accommodate the growing numbers of visitors in the future.

Table 11.10: Outputs, Tasks and Implementation for Theme 6

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
THEME 6: RECREATIONAL TOURISM												
6.1 Facilities (Activity)	6.1.1 Trails & Shelters (trekking)	MBCA	✓	✓	✓			✓	✓			
	6.1.2 Hides (birdwatching & wildlife)			✓	✓	✓						
	6.1.3 Viewing towers (wildlife & scenery)			✓	✓	✓						
	6.1.4 Interpretation trail (self-guided)			✓	✓	✓						
	6.1.5 Cycling track			✓	✓	✓						
	6.1.6 Ziptrek	CEMD			✓							
6.2 Event	6.2.1 Wildlife Conservation Day (WCD)	MBCA			✓	✓	✓	✓	✓			

Sponsorships of developing and maintaining of facilities can be considered to support to reduce the overall capital and maintenance cost. In addition, privatisation should be considered to develop facilities such as Ziptrek. A proper and thorough survey is needed to plan on the appropriate location for the Ziptrek, so as not to be a hindrance or disturbance to wildlife movements or its habitats.

Creating awareness to attract visitors through an event is proposed, and one that can be associated with MBCA is hosting of the "Wildlife Conservation Day (WCD)" that falls on December 4th every year.

11.3.7. Theme 7: Sustainable Income Generation

The sustainable income generation for MBCA has been addressed in the earlier management plan, though with some successes, there is room for improvement. It is essential that a consistent income generation be made available, and to put values into MBCA through direct incomes. While indirect income has been discussed during several workshops, to date there is nothing concrete available. However, there are possible opportunities for indirect incomes in the years to come, and that can be taken into account during the mid-term review of this management plan.

Table 11.11 details out the sustainable income generation plan for MBCA. "Sustainable Income" is about much more than simply obtaining money. It is about planning for the organisation's future by adapting to changing funding environments. Sustainability requires effective planning and financial management as well as knowledge of what income opportunities are available and the ability to diversify into these where possible. It also involves building organisational skills and capacity. In an ideal world a "sustainable organisation" basically will:

- Plan 3, even 5 years in advance and knows the amounts and types of funding it will need to sustain itself;
- Avoids relying on any one funder by diversifying income so that it can sustain itself when particular income streams dry up;
- Develops its knowledge and skills so that it can recognise and take advantages of opportunities to diversify when they occur; and
- Uses the right income source to drive developments at the right time.

Table 11.11: Outputs, Tasks and Implementation for Theme 7

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
THEME 7: SUSTAINABLE INCOME GENERATION												
7.1 Direct	7.1.1 User fees	CEMD	✓									
	7.1.2 Concession fees		✓									
	7.1.3 Trust fund		✓									

Currently, there are several sources of income generated from MBCA (i.e. user fees, conservation fee, F&B, lodging, etc.). Under this programme, a new direct income is to be introduced in MBCA and the current user fees structure (**Table 11.12**) is to be revised, and concession fee (**Table 11.13**) is to be introduced in which groups or individuals that provide certain services to visitors are levied a fee for the permission to operate within MBCA, its buffer zones (including the tourism zones).

Table 11.12: The proposed new fee structures for visitors (additional)

Descriptions	MyKad		Non-MyKad	
	Children	Adult	Children	Adult
a. Entrance fee				
• Entry (day trip)	1.00	5.00	3.00	10.00
b. User fee				
• Sky-bridge	3.00	10.00	5.00	15.00
• ZipTrek	5.00	15.00	10.00	30.00
• Camera (DSLR/Handycam)	10.00	10.00	20.00	20.00
• Bicycle rental	10.00	40.00	20.00	60.00
• Parking (per car/night)	-	10.00	-	10.00

Table 11.13: Proposed concession fees for MBCA

Facilities	Unit	Rate (RM per month)
1. Designated Tourism Zones		
a. Accommodation		
• 5-star boutique resort	Room/chalet	1,500.00
• 3-star hotel	Room	800.00
• Dormitory/hostel	Bed	300.00
b. Food & Beverages (F & B)		
• Restaurant (more than 100 pax)	Unit	5,000.00
• Restaurant (50 – 100 pax)	Unit	3,000.00
• Restaurant (below 50 pax)	Unit	150.00
c. Other outlets		
• Souvenir	Unit	100.00
• Outfitter (outdoor gear)	Unit	100.00
• Petrol kiosk	Unit	3 cents per litre
d. Others		
• Transport (Security Gate – MBSC)	Vehicle	300.00
• Telco tower	Tower	500.00
2. Others		
a. Accommodation		
• 5-star boutique resort	Room/chalet	1,000.00
• 3-star hotel	Room	600.00
• Dormitory/hostel	Bed	200.00
b. Food & Beverages (F & B)		
• Restaurant (more than 100 pax)	Unit	3,000.00
• Restaurant (50 – 100 pax)	Unit	1,000.00
• Restaurant (below 50 pax)	Unit	150.00
c. Other outlets		
• Souvenir	Unit	100.00
• Outfitter (outdoor gear)	Unit	100.00
• Petrol kiosk	Unit	3 cents per litre
d. Others		
• Transport (Security Gate – MBSC)	Vehicle	200.00
• Telco tower	Tower	500.00

There are also several other opportunities that may be utilised to generate sustainable income for MBCA due to the:

- Potential increase in numbers of visitors:
- Greater awareness by public on existence of MBCA via internet, media, travel guidebook, etc.;
- Timely with "Visit Malaysia Year 2014", and greater promotion by the government;
- Completion of the sealed road between Sapulut – Kalabakan by end of 2014. It is now just about 20.0 km from main entrance of MBCA;
- Creation of "day visit" charges;
- Introduction of "concession charges" for facilities to potential operators (concessionaires);
- Royalty from "branding" of MBCA logo; and
- Merchandise, e.g. T-shirts, postcards, etc.

However, it must also be stressed out that certain core funding for financing of operational costs and maintenance be made available by Yayasan Sabah, and other running cost come from public funds for the management and conservation of MBCA.

Recommendations:-

a. Meals to be based on "trekking" and "non-trekking" for all visitors to MBCA;
b. An additional rate for "day visitor" be introduced (refer to **Table 11.12**). The quantum were based on recommendations by MBMC during its 14th MBMC meeting held on December 16th, 2013;
c. Concession fees to be introduced (refer to **Table 11.13**); and
d. A clear structure on the administration of the Conservation Trust Fund be formulated.

11.3.8. Theme 8: Promotion and Marketing

Table 11.14 below outlines the promotion and marketing strategy needed to better promote MBCA using various possible sources like communications, print media, website, and the internet. All these various mechanism will have a different target groups and impacts generated. There are 5 programmes under this theme, with several outputs. A paper prepared by Germanis (2013) outlines several potential recommendations that can be incorporated into the programmes. The paper also presented the target audiences, i.e. tourists, researchers, funders, students and the public.

Table 11.14: Outputs, Tasks and Implementation for Theme 8

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
THEME 8: PROMOTION AND MARKETING												
8.1 Strategy and Planning	8.1.1 Marketing plan (including workplan)	CEMD		✓								
8.2 Communication	8.3.1 Publicity materials	MBCA		✓								
	8.3.2 Website	CEMD	✓	✓								
	8.3.3 Print media		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8.3 Awareness raising	8.4.1 Fam trip for media			✓		✓		✓		✓		✓
	8.4.2 Fam trip for tourism agencies			✓		✓		✓		✓		✓
	8.4.3 Outreach to targeted groups			✓		✓		✓		✓		✓
8.4 Merchandising	8.5.1 Products development		✓	✓								
	8.5.2 Outlets development			✓	✓							
8.5 Electronic reservation & payment	8.6.1 Electronic reservation mechanism			✓								
	8.6.2 Electronic payment			✓								

Marketing and promotion are useful for a variety of purposes as it can attract new visitors and users, while retaining existing visitors and users, it can be used to attract or retain donors & sponsors, volunteers, stakeholders and rightholders and it can be

used to generate interest in taking activities in MBCA, be it for recreational or educational purposes.

A new programme to market the merchandise from MBCA will be introduced in which a product development strategy is needed to better expand and enhance the merchandise sales. In addition to that, outlets establishment in various locations identified as to be the hotspots for tourist will also be introduced to better market and promote the products coming form MBCA.

Apart from that, to ease visitors and lessen the paper work for the staff, a new system for electronic reservation and payment will be introduced, this will definitely improve the current system, which sometimes is inefficient and may hamper some potential tourist or visitors from coming to MBCA.

11.3.9. Theme 9: Initiatives

A new theme being introduced is on initiatives to be undertaken under this management plan. **Table 11.15** outlines the programme under initiatives in which two very important and relevant programme to MBCA programme are identified. Development of the PA programme in MBCA is timely, as MBCA has been providing access for protected areas training, and this need to be promoted and upscaled. The facilities available are of great qualities, and these qualities and the experiences of many members in Sabah can be shared nationally and internationally. The programme is one of the initiatives identified that can be elevated to regional level, with partnerships from several key organisations from around ASEAN and Europe, i.e. ASEAN Centre for Biodiversity (http://www.aseanbiodiversity.org) and the International Union for Conservation of Nature (IUCN) (http://www.iucn.org). There is also potential to partner with the Centre for International Forestry Research (CIFOR) (http://www.cifor.org).

Table 11.15: Outputs, Tasks and Implementation for Theme 9

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
THEME 9: INITIATIVES												
9.1 Protected area training centre	9.1.1 Development of PA programme	CEMD		✓	✓							
9.2 Forest rehabilitation	9.2.1 Forest restoration document		✓	✓								
	9.2.2 Business plan			✓								

As for forest rehabilitation, much has been discussed in **section 9.4.4(a**), whereby the surrounding area of MBCA has during the last decade undergone a severe degradation due to large scale logging activity – particularly the lowland and hill dipterocarp forests. The core area has been left untouched as well as a large part of the forest on elevated grounds. The northern part of Buffer Zone 1 is the most

severely degraded area, this area are also visible through SPOT pan-chromatic data on Google Earth. Thus, it is crucial that a proper and intensive forest restoration activity is to be conducted at the identified sites to basically rejuvenate the degraded area so that biodiversity could prevail.

Priority will be to rehabilitate the newly reclassified Class I (protection) forest that has been incorporated as Maliau Buffer Zone (i.e. Buffer Zone 1). A detail study is needed to identify the scale needed to restore the degraded forest, based on the objectives that will be determined by the manager.

11.3.10. Theme 10: Monitoring

Monitoring and review is an essential part of the management plan, with each successive review of the plan, building on the results of the monitoring of the previous or existing plan – what has and has not been achieved – as well as reflecting changes in MBCA and changes in the policy context. **Table 11.16** shows the section on monitoring and its frequencies for various programmes to be implemented in MBCA. The main goal for the monitoring programmes is to monitor the changes on the environment, the surrounding and within MBCA and sharing of information and knowledge for present and future resource management. In brief, monitoring is the process of collecting data to describe condition and, when collected over time, change.

Table 11.16: Outputs, Tasks and Implementation for Theme 10

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
THEME 10: MONITORING												
10.1 Biodiversity	10.1.1 Distribution & changes of flora & fauna	MBCA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.1.2 Tree phenology						✓					✓
10.2 Climate change	10.2.2 Rainfall data (AWS)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.2.3 Landscape changes	CEMD					✓					✓
10.3 Research	10.3.1 Research information data		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10.4 Recreation / Ecotourism	10.4.1 Visitors arrivals	MBCA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.4.2 Hospitality			✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.4.3 Visitors impact management			✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.4.4 Facilities (set-up, upgrade & maintenance)			✓	✓	✓	✓	✓	✓	✓	✓	✓
10.5 Security	10.5.1 Enforcement		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.5.2 Fire				✓							

Previously there was no clear monitoring programme established in MBCA, which often intertwined with researches conducted by local and international partners. However, it was stated in the 1st MBCA Management Plan (YS, 2003) that the monitoring programme in MBCA aims to:

- Detect change in indicators of local ecosystem health and threat;
- Contribute to the detection of change in global environmental conditions.

Thus it is high time that a proper and integrated monitoring programme is established in MBCA for better resource management and protection. Several of the monitoring programmes have been established by CEMD, and it can be improvised to enhance its quality on data collection.

As the case on review, it is essential that a mid-term review of the management plan be conducted in 2018, to look at:

- Progress of implementation on outputs as mentioned in the management plan, i.e. the extent to which the targets in the strategic management plan are achieved; and
- The effectiveness of the strategic planagement plan to demonstrate that the objectives are achieved.

11.3.11. Other Key Issues and Responses

Table 11.17 outlines the initiatives for other cross cutting programmes to be implemented in MBCA. Other smaller initiatives but are equally important and currently being practiced in MBCA are:

- 3R – Reduce, Reuse & Recycle;
- Composting of rubbish (food waste); and
- "Leave no litter" policy, where visitors take out all rubbish with them and disposed at designated areas.

Table 11.17: Outputs, Tasks and Implementation for Other Cross-cutting Programme

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
A. OTHERS												
A1 Going Green	A1.1 Waste management	MBCA	✓	✓								
	A1.2 Renewable energy (RE)			✓	✓							
A2 Climate Change	A2.1 Automatic Weather Station (AWS)		✓	✓	✓							
A3 Operational	A3.1 Safety		✓									
	A3.2 Data Management System	CEMD	✓	✓	✓							

All these will need to be intensified and upgraded to cater for the growing number of visitors. The timeline allocated in **Table 11.17** are meant for the purpose of upgrading existing facilities to accommodate the outputs mentioned.

a. Going Green

With the expected increase in the number of visitors coming in to MBCA in due time, it is necessary that a proper going green initiatives be implemented and enforced in MBCA to reduce the unnecessary operational cost. The development

of RE is to be considered, in combination of solar (or hybrid system). It is much needed to ensure that long-term support for staffs and researchers at the remote field stations are provided with continuous power supply, as this will encourage them to stay longer to conduct their jobs or activities.

b. Development

With the development of new field stations, it is necessary that the Automatic Weather Station (AWS) be installed for data collections, research and monitoring purposes. The AWS should be installed at all new field stations and at the main entrance (at Maliau Tourism Zone, next to Information Building). This is to make sure that the data collected from the AWS will be collected every day as in this places it will be manned all the time.

There will at least be 5 parameters (minimum, but can be expanded to 7 parameters if necessary). The parameters are:

- Air temperature;
- Relative humidity;
- Precipitation (Rainfall);
- Wind speed (Anemometer) & direction (Wind vane); and
- Atmospheric pressure.

The two additional parameters (optional) that can be included are:

- Solar radiation (Pyranometer); and
- Soil temperature & moisture.

c. Operational

The safety of staffs, researchers and visitors are paramount and adequate measures must be taken to ensure that accidents are minimised. The presence of the Occupational Safety and Health (OSH) protocols and committee are most welcoming.

BIBLIOGRAPHY

BIBLIOGRAPHY

Adams, J.S. and Victurine, R. (2011). *Permanent Conservation Trust: A study of the Long-term Benefits of Conservation Endowments*. New York: Wildlife Conservation Society.

Ancrenaz, M., Hearn, A.J., Ross, J., Sollmann, R. and Wilting, A. (2012). *Handbook for Wildlife Monitoring using Camera-traps*. Kota Kinabalu: BBEC II Secretariat, Natural Resources Office.

Appleton, M.R., Texon, G.I. and Uriarte, M.T. (2003). *Competence Standards for Protected Area Jobs in South East Asia*. Los Banos: ASEAN Regional Centre for Biodiversity Conservation.

ASM (Academy of Sciences Malaysia) (2008). *Eucalyptus Camp Memories: An Expedition to the Maliau basin, Sabah*. Kuala Lumpur: Academy of Sciences Malaysia.

Baptist, J.J., Lojiwin, R.F. and Murang, L. (2000). *Socio-economy Survey of the Indigenous Communities from the Sook, Nabawan and Kalabakan Districts Surrounding the Maliau Basin*. Technical Assistant Report No. 10, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Biun, A. and Lakim, M. (2002). *Diversity and Abundance of Birds Community at Pakis Camp, Maliau Basin, Sabah*. Technical Assistant Report No. 12, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Boo, E. (1990). *Ecotourism: The Potentials and Pitfalls*. Vols. 1 & 2. Washington, D.C.: World Wildlife Fund.

Borrini-Feyerabend, G., Dudley, N., Jaeger, T., Lassen, B., Pathak Broome, N., Phillips, A. and Sandwith, T. (2013). *Governance of Protected Areas: From understanding to actions*. Best Practice Protected Area Guidelines Series No. 20. Gland: IUCN.

CBD (Convention on Biological Diversity) (2004). *Guidelines on Biodiversity and Tourism Development*. Quebec: The Secretariat of the Convention on Biological Diversity.

Ceballos-Lascurain, H. (1996). *Tourism, Ecotourism and Protected Areas. The State of Nature-based Tourism around the World and Guidelines for its Development*. Gland: IUCN.

Clark, C.M. (1997). *Nepenthes of Borneo*. Kota Kinabalu: Natural History Publications (Borneo).

Clark, R.N., Burgess, R.L. and Hendee, J.C. (1972). "The Development of Anti-litter Behaviour in a Forest Campground". *Journal of Applied Behaviour Analysis*. **5**(1): 1-5.

Clark, R.N. and Stankey, G.H. (1979). *The Recreation Opportunity Spectrum: A Framework for Planning, Management and Research*. General Technical Report PNW-98. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.

Conservation Finance Alliance (CFA). (2008). *Rapid Review of Conservation Trust Funds*, 2nd edition. Prepared for the CFA Working Group on Environmental Funds by Barry Spergel and Philippe Taieb.

Cranbrook, Earl of (1986). "A Review of Fossil and Prehistoric Remains of Rhinoceroses of Borneo". *Sabah Museum and Archives Journal*, **1**(1): 50-110.

Das, I. (2012). *Snakes of South-East Asia*. Oxford: John Beaufoy Publishing.

de Groot, R.S. (1983). "Tourism and Conservation in the Galapagos Islands". *Biological Conservation*. **26**(4): 291-300.

Dubgaard, A. (2002). *Cost-benefit Analysis of the Maliau Basin Conservation Plan*. Technical Assistance Report No. 51, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Dudley, N. (Editor) (2008). *Guidelines for Applying Protected Area Management Categories*. Gland, Switzerland: IUCN.

Eagles, P.F.J. (1999). "Nature-based Tourism in Terrestrial Protected Area". In Stolton, S. and Dudley, N. (Eds.) *Partnerships for Protection: New Strategies for Planning and Management for Protected Areas*. London: Earthscan, pp. 144-152.

EPU (2007). *A Report on the National Workshop on Conservation Financing*. Putrajaya: Economic Planning Unit (EPU) in cooperation with DANIDA.

Fraisse, M.C. (2013). *Background, discussion, and options for a forest carbon project linked to the Maliau Basin Conservation Area*. A report prepared for NEPCon, Aarhaus, Denmark.

GEF (1998). *Evaluation of Experience with Conservation Trust Funds*. Washington, DC: Global Environmental Facility

Germanis, K. (2013). *MBCA: Online Communications and Marketing Recommendations*. A report prepared for NEPCon, Aarhaus, Denmark.

GoS (Government of Sabah) (1998). "Forest (Maliau Basin Conservation Area) Rules 1998". *Warta Kerajaan Tambahan Kedua*. **Jil. LIII, No. S1** (pp. 4-7). Dated 2nd April, 1998. Kota Kinabalu: Jabatan Cetak Kerajaan.

_____(2012). "Forest (Maliau Basin Conservation Area) (Amendment) Rules 2012". *Warta Kerajaan Tambahan Kedua*. **Jil. LXVII, No. S4** (pp. 27-28). Dated 22nd November, 2012. Kota Kinabalu: Jabatan Cetak Kerajaan.

Graefe, A.R., Kuss, F.R. and Vaske, J.J. (1990). *Visitor Impact Management in Planning Framework*. Washington, D.C.: National Parks Association.

Greer, T. (2002). *Protected Area Management and Land Use Planning – Maliau Basin Conservation Area*. Technical Assistance Report No. 36, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Hansen, C. B. (2000). *Eco-tourism Planning and Management*. Technical Assistance Report No. 11, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Hazebroek, H.P., Adlin, T.Z. and Sinun, W. (2004). *Maliau Basin: Sabah's Lost World*. Kota Kinabalu: Natural History Publication (Borneo) Sdn. Bhd.

Helgarth, S.F. (1975). *Trail Deterioration in the Selway-Bitterroot Wilderness Reserve*. Note INT-193, Ogden, UT: US Department of Agriculture, Forest Service, Intermountain Forest and Research Experiment Station.

Ibrahim, K. (2002). *Pre-feasibility Study for the provision of Environmentally Friendly Energy Supply for the Maliau Basin Field Studies Centre*. Technical Assistance Report No. 31, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Ibrahim Komoo, Mazlan Othman, Ikram M. Said & Latiff, A. (eds.) (2010). *Maliau Basin: Physical Environment and Biological Diversity of the Northern Rim*. Kuala Lumpur: Academy of Sciences Malaysia & Yayasan Sabah Group.

IDS (Institute for Development Studies) (2007). *Sabah Development Corridor: Socio-economic Blueprint 2008-2025*. Kota Kinabalu: Institute for Development Studies (Sabah).

Inger, R.F. and Stuebing, R.B. (2005). *Frogs of Borneo*, 2nd edition. Kota Kinabalu: Natural History Publications (Borneo).

ITTO (International Tropical Timber Organisation) (2002). *ITTO Guidelines for the Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests*. ITTO Policy Development Series No. 13. Yokohama: ITTO.

Jim, C.Y. (1989). "Visitor Management in Recreation Areas". *Environmental Conservation*. **16**(1): 19-32, 40.

Jubenville, A. and Twight, B.W. (1993). *Outdoor Recreation Management: Theory and Application*. 3rd edition. State College, PA: Venture Publishing Inc.

Jubenville, A., Twight, B.W. and Becker, R.H. (1987). *Outdoor Recreation Management: Theory and Application*. State College, PA: Venture Publishing Inc.

Juul-Nielsen, H. (2000). *A Survey on Larger Mammals Species in the Maliau Basin, Sabah, Malaysia*. Technical Assistant Report No. 8, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Juul, H. (2001). *Survey on the Extent of Illegal Encroachment of the Maliau Basin Conservation Area*. Technical Assistant Report No. 17, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Kajala, L., Almik, A., Dahl, R., Dikšaitė, L, Erkkonen, J., Fredman, P., Jensen, F. Søndergaard, Karoles, K., Sievänen, T., Skov-Petersen, H., Vistad, O. I. and Wallsten, P. (2007). *Visitor*

Monitoring in Nature Areas – a manual based on experiences from the Nordic and Baltic countries. Stockholm: The Swedish Environmental Protection Agency.

Keenleyside, K., Dudley, N., Cairns, S., Hall, C. and Stolton, S. (2012). *Ecological Restoration for Protected Areas: Principles, Guidelines and Best Practices*. Gland: IUCN.

Kenchington, R.A. (1989). "Tourism in the Galapagos Islands: The Dilemma of Conservation". *Environmental Conservation*. **16**(3): 227-232, 236.

Knudson, D.M., Cable, T.T. and Beck, L. (1995). *Interpretation of Cultural and Natural Resources*. State College, PA: Venture Publishing Inc.

Kopylova, S.L. and Danilina, N.R. (Editors) (2011). *Protected Area Staff Training: Guidelines for Planning and Management.* Gland: IUCN.

Lakim, M., Biun, M. and Moeller, H.S. (2006). "Diversity and Abudance of Bird Communities in Maliau Basin Conservation Area, Sabah, Malaysia". *Sabah Parks Nature Journal*, **7**: 1-44.

Lamb, D. and Gilmour, D. (2003). *Rehabilitation and Restoration of Degraded Forests*. Gland: IUCN

Lamb, A. and Wong, W.W. (1989). "Phase I Botanical Diary with Particular Attention to Fruit Trees, Orchids, Herbaceous Flora". In Marsh *op cit*., pp. 76-103.

Lee, Y.F. (2003). *Preferred Checklist of Sabah Trees*. 3rd edition. Kota Kinabalu: Natural History Publications (Borneo).

Lindberg, K. and Hawkins, D.E. (eds.) (1993). *Ecotourism: A Guide for Planners andManagers.* Vol. 1. Vermont: The Ecotourism Society

Lindberg, K., Wood, M.E. and Engeldrum, D. (eds.) (1998). *Ecotourism: A Guide for Planners and Managers.* Vol. 2. Vermont: The Ecotourism Society

Machlis, G.E. and Tichnell, D.L. (1985). *The State of the World's Park: An International Assessment for Resource Management*. Boulder, CO: Westview Press Inc.

Maestre, F.T., Quero, J.L. and Gotelli, N.J. (2012). "Plant Species Richness and Ecosystem Multifunctionality in Global Drylands'. *Science*. **335** (6065): 214–218.

Malim, T.P. (2002). *General Wildlife Survey and Wildlife Management Recommendations for Maliau Basin Conservation Area, Tawau, Sabah*. Technical Assistance Report No. 44, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Manning, R.E. (1979). "Strategies for Managing Recreational Use of National Parks". *Parks*. **4**(1): 13-15.

Marsh, C.W. (ed.) (1989). *Expedition to Maliau Basin, Sabah, April-May 1988, Final Report*. Kota Kinabalu: Yayasan Sabah and World Wide Fund for Nature Malaysia.

Mather, A.S. and Chapman, K. (1995). *Environmental Resources*. Harlow: Longman Scientific & Technical.

Mathieson, A. and Wall, G. (1982). *Tourism: Economic, Physical and Social Impacts*. Harlow: Longman Scientific & Technical.

McArthur, S. (1994). "Acknowledging a Symbiotic Relationship – Better Heritage Management via Better Visitor Experience". *Australian Parks and Recreation*. **30**(3): 12-17.

MEGTW (Ministry of Energy, Green Technology and Water). (2008). *National Renewable Energy Policy and Action Plan*. Putrajaya: Ministry of Energy, Green Technology and Water.

_____(2009). *National Green Technology Policy*. Putrajaya: Ministry of Energy, Green Technology and Water.

MoCAT (1996). *The National Ecotourism Plan*. Kuala Lumpur: Ministry of Culture, Arts and Tourism. 6 parts report.

_____ (1997). *Pelan Ekopelancongan Kebangsaan, Garis Panduan 4: Taman Negara, Hutan Simpan dan Hutan Lain*. Kuala Lumpur: Ministry of Culture, Arts and Tourism.

Mohamad, S.W. and Darmaraj, M.R. (2009). *A General Guide to Camera-trapping Large Mammals in Tropical Rainforests, with particular reference to Tigers*. Petaling Jaya: WWF-Malaysia. (also in Bahasa Malaysia).

Mohamed, M., Sinun, W., Anton, A., Dalimin, M.N. and Ahmad, A.H. (eds.) (1998). *Maliau Basin Scientific Expedition*. Kota Kinabalu: Universiti Malaysia Sabah.

MoNRE (Ministry of Natural Resources and Environment) (2010). *National Policy on Climate Change*. Putrajaya: Ministry of Natural Resources and Environment.

_____ (2011). *Malaysia: Second National Communication to the UNFCCC*. Putrajaya: Ministry of Natural Resources and Environment.

_____ (2012). *National Water Resources Policy*. Putrajaya: Ministry of Natural Resources and Environment Malaysia.

Moore, A.W. (1981). "Tour Guides as a Factor in National Park Management". *Parks*. **6**(1): 12-15.

Moreno-Mateos, D., Power, M. E., Comín, F. A., & Yockteng, R. (2012). "Structural and functional loss in restored wetland ecosystems". *PLoS biology*, 10(1), e1001247. Public Library of Science. doi:10.1371/journal.pbio.1001247

MoSTE (Ministry of Science, Technology and the Environment) (1998a). *National Policy on Biological Diversity*. Kuala Lumpur: Ministry of Science, Technology and the Environment.

_____ (1998b). *First National Report to the Conference of Parties of the Convention of Biological Activities*. Kuala Lumpur: Ministry of Science, Technology and the Environment.

_____ (2002). *National Policy on the Environment*. Kuala Lumpur: Ministry of Science, Technology and the Environment.

MoSTI (Ministry of Science, Technology and Innovation) (2005). *Biotechnology for Wealth Creation and Social Well-being: The Way Forward*. Putrajaya: Ministry of Science, Technology and Innovation.

MTCE (Ministry of Tourism, Culture and Environment) (2009). *Sabah Environmental Education Policy*. Kota Kinabalu: MTCE.

Myers, N. (1988). "Threatened Biotas: 'Hot-spots' in Tropical Forest". *The Environmentalist*, **8**(3): 187-208.

_____ (1990). "The Biodiversity Challenge: Expanded Hot-spots Analysis". *The Environmentalist*, **10**(4): 243-256.

Natural Resource Office (2010a). *Sabah Land Utilisation Policy, 2010-2020*. Kota Kinabalu: Natural Resource Office.

_____(2010b). *Sabah Land Utilisation Policy, 2010-2020*. Technical Report. Kota Kinabalu: Natural Resource Office.

Nawir, A.A., Murniati and Rumboko, L. (Eds.) (2007). *Forest Rehabilitation in Indonesia: Where to after more than three decades*?. Jakarta: Center for International Forestry Research (CIFOR).

Nellemann, C. and Corcoran, E. (eds.) (2010). *Dead Planet, Living Planet – Biodiversity and Ecosystem Restoration for Sustainable Development*. A Rapid Response Assessment. GRID-Arendal: United Nations Environmental Programme.

Newson, D., Moore, S.A. and Dowling, R.K. (2002). *Natural Area Tourism: Ecology, Impacts and Management*. Clevedon: Channel View Publications.

Newton, A.C. and Tejedor, N. (Eds.). (2011). *Principles and Practice of Forest Landscape Restoration: Case studies from the drylands of Latin America*. Gland, Switzerland: IUCN.

Olsen, M.M. (2002). *The Banteng in Sabah: Habitat, Distribution and Conservation*. Technical Assistant Report No. 32, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Payne, J., Francis, C.M. & Phillipps, K. (1985). *A Field Guide to the Mammals of Borneo*. Kota Kinabalu: Sabah Society.

Peh, K.S.H. (2010). "Invasise species in Southeast Asia: the knowledge so far". *Biodiversity Conservation*, 19: 1083-1099.

PEMANDU (2013). Economic Transformation Programme: Annual Report 2012. Putrajaya: Performance Management and Delivery Unit (PEMANDU), Prime Minister's Department.

Phillipps, Q. & Phillipps, K. (2011). *Field Guide to the Birds of Borneo*. 2nd edition. Oxford: Beaufoy Books.

Pigram, J. (1983). *Outdoor Recreation and Resource Management*. Beckenham, Kent: Croom Helm Ltd.

Porodong, P., Lunkapis, G.J. and Sabri, F. (2011). "A Brief Note on Conservation, Swidden Agriculture and Indigenous Community Living in the Periphery of Imbak Canyon Conservation Area". In Latiff, A. and Sinun, W. (eds.) *Imbak Canyon Conservation Area, Sabah: Geology, Biodiversity and Socio-economic Environment*. Kuala Lumpur: Academy of Sciences Malaysia, pp. 337-346.

Rey Benayas, J. M., Newton, A. C., Diaz, A., Bullock, J. M., & Benayas, J. M. R. (2009). "Enhancement of biodiversity and ecosystem services by ecological restoration: a meta-analysis". *Science*, **325**(5944): 1121-4.

Saw, L.G. and Marsh, C.W. (1989). "Vegetation Classification and Mapping". In Marsh *op cit*., pp. 117-125.

Saw, L.G., Chua, L.S.L. and Abdul Rahim, N. (eds.) (2009). *Malaysia: National Strategy for Plant Conservation*. Putrajaya: Ministry of Natural Resources and Environment & Forest Research Institute Malaysia.

SFD (Sabah Forestry Department) (2009). *Strategic Plan of Actions (Sabah): The Heart of Borneo Initiative*. Sandakan: Sabah Forestry Department.

_____ (2013a). *Annual Report 2012*. Sandakan: Sabah Forestry Department.

_____ (2013b). *Strategic Plan of Action (Sabah): The Heart of Borneo Initiative (2014-2020)*. Sandakan: Sabah Forestry Department.

Sharpe, G.W. (1976). *Interpreting the Environment*. New York: John Wiley & Sons.

_____and Gensler, G.L. (1978). "Interpretation as a Management Tool". *Journal of Interpretation*. **3**(2): 3-9.

Smith, J.B., Schellnhuber, M. and Mirza, M.O. (2001). *Vulnerability to Climate Change and Reasons for Concerns: A Synthesis*. IPCC Third Assessment Report (TAR) of Working Group II (WG2).

Stankey, G.H., McCool, S.F. and Stoles, G.L. (1984). "Limits of Acceptable Change: A New Framework for Managing the Bob Marshall Wilderness". *Western Wildlands*. **10**(3): 33-37.

Stankey, G.H., Cole, D.N., Lucas, R.C., Peterson, M.E. and Frissell, S.S. (1985). *The Limits of Acceptable Change (LAC) System for Wilderness Planning*. USDA Forest Service General Technical Report Int-176. Ogden, Utah: Intermountain Forest and Range Experiment Station.

SWD (Sabah Wildlife Department) (2011a). *Elephant Action Plan, 2012-2016*. Kota Kinabalu: Sabah Wildlife Department.

_____ (2011b). *Rhinoceros Action Plan, 2012-2016*. Kota Kinabalu: Sabah Wildlife Department.

_____ (2011c). *Orangutan Action Plan, 2012-2016*. Kota Kinabalu: Sabah Wildlife Department.

Thomas, L. and Middleton, J., (2003). *Guidelines for Management Planning of Protected Areas*. Gland: IUCN.

Tongkul, F. (2002). *Structural Geology of Maliau basin and Surrounding Areas*. Technical Assistant Report No. 33, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED

Traeholt, C. (2001a). *Progress Report No. 1 for Zoology Input*. Technical Assistant Report No. 15, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

_____ (2001b). *Maliau Basin Conservation Project Zoological Survey*. Technical Assistant Report No. 28, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

_____ (2002). *Final Report of the Maliau Basin Conservation Project: Zoological Survey*. Technical Assistance Report, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Tunison, J.T., Loh, R.K. and Leialoha, J. (1995). Fire effects in the submontane seasonal zone Hawaii Volcanoes National Park. Coperative National Park Resources Study Unit, Technical Report No. 97, Cooperative Agreement CA 8007-8002-9004. Honolulu: University of Hawaii Press. http://www.botany.hawaii.edu/faculty/duffy/techr/097.pdf

Wikramanayake, E., Dinerstein, E., Loucks, C., Olson, D., Morrison, J., Lamoreux, J., McKnight, M. and Hedao, P. (2001). *Terrestrial Ecoregions of the Indo-Pacific: A Conservation Assessment*. Washington (DC): Island Press.

Webb, C. and Ali, S. (2002). *Plants and Vegetation of the Maliau Basin Conservation Area, Final Report*. Technical Assistant Report No. 43, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

Wilson, D.E. and Reeder, D.M. (editors). *Mammal Species of the World. A Taxonomic and Geographic Reference* (3rd ed). Vol. 1 & 2. Baltimore, Maryland: Johns Hopkins University Press.

Wong, K.M. (2001). "The Lost World: Maliau Basin, a Malaysian Heritage". *Malaysian Naturalist*, **54**(3): 26-31,

Wong, A. and Guntavid, J.P. (2000). *Socio-economic Study on Local Communities of Tongod District, Surrounding the Maliau Basin Conservation Area*. Technical Assistant Report No. 9, Management of Maliau Basin Conservation Area Project. Kota Kinabalu: Yayasan Sabah-DANCED.

WWF (2009). *Guide to Conservation Finance: Sustainable Financing for the Planet*. Washington, DC: Word Wildlife Fund.

Yap, K.S., Wan Azli, W.H., Tangang, F., Juneng, L., Samathuria, M.K. and Subramaniam, K. (2012). *Malaysia Climate Change Scenarios*. ASM Series on Climate Change. Kuala Lumpur: Academy of Sciences Malaysia.

YS (Yayasan Sabah). (2002). *Infapro Enrichment Planting Manual, August 2002*. Kota Kinabalu: Yayasan Sabah Group.

_____(2003). *Maliau Basin Conservation Area, Sabah: Strategic Management Plan 2003-2012*. Kota Kinabalu: Yayasan Sabah Group

_____(2006a). *Maliau Basin Conservation Area: Research Management Plan 2006-2012 (Draft)*. Kota Kinabalu: Yayasan Sabah Group.

_____(2006b). *Maliau Basin Conservation Area: Sustainable Tourism Development Plan (Draft)*. Kota Kinabalu: Yayasan Sabah Group.

Yeap, C.A., Sebastian, A.C. and Davison, G.W.H. (2005). *A Handbook of Important Bird Areas in Malaysia*. Kuala Lumpur: Malaysian Nature Society.

APPENDICES

Appendix A: The Forest (Maliau Basin Conservation Area) Rules, 1998

THE FOREST ENACTMENT 1968

THE FOREST (MALIAU BASIN CONSERVATION AREA) RULES, 1998

In exercise of the powers conferred upon him under section 42 of the Forest Enactment 1968, the Chief Minister hereby makes the following rules:

Citation, commencement and application.

1. (1) These rules may be cited as the Forest (Maliau Basin Conservation Area) Rules 1998 and shall be deemed to have come into operation on 31st December, 1997.

(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 91/88C (hereinafter called "The Reserve").

Management Committee.

2. (1) There shall be established the Maliau Basin Conservation Management Committee (hereinafter called "the Management Committee") to advise the Director on the conservation and protection of the Reserve as a permanent tropical rain forest for the purpose of scientific research, recreation and protection of ecology, environment and climatic condition

(2) The membership of the Management Committee shall consist of the following:

(a) the Director of Forest Department or his representative;

(b) a representative of the Sabah Foundation;

(c) a representative of the University Malaysia Sabah;

(d) a representative of the Ministry of Tourism and Environmental Development;

(e) a representative of the Department of Wildlife;

(f) a representative of Sabah Parks;

(g) a representative of the Sabah Museums;

(h) a representative of the National University of Malaysia;

(i) a representative of the Forest Research Institute of Malaysia;

(j) a representative of the Agriculture University of Malaysia; and

(k) a representative of the University Malaysia Sarawak.

(3) The Chairman of the Management Committee shall be appointed by the Chief Minister of Sabah on rotation among the following:

(a) the Director of Forest or his representative;

(b) the representative of Sabah Foundation;

(c the representative of the Ministry of Tourism and Environmental Development; and

(d) the representative of University Malaysia Sabah;

Provided that notwithstanding the above provision, the Chief Minister may in his absolute discretion appoint such person as he may deem fit to be the Chairman.

(4) The Chairman shall hold office for a term of two years from the date of his appointment.

(5) The Secretary shall be appointed by the Management Committee from among persons serving the Sabah Foundation for such period as may be determined by the Management Committee.

(6) The Management Committee shall be the powers to determine its own procedure.

Role of Management Committee.

3. The role of the Management Committee shall be to plan, facilitate, monitor and evaluate the following objectives for the Reserve:

(i) the protection in perpetuity of as much as possible of the biological diversity, expressed at genetic, individual, sub-species, habitat and ecosystem levels of organisation;

(ii) the promotion of research into all aspects of the composition and functioning of the Reserve's ecosystem including comparative studies of disturbance and recovery processes following logging of nearby areas;

(iii) the promotion of education and training in conservation, natural history, ecology, forestry and related sciences;

(iv) the promotion of the Reserve for appropriate recreation and nature tourism, provided such activities do not significantly compromise the management objectives stated above; and

(v) the integration of the objectives for the Reserve with other planned development in surrounding areas so as to create a model forest management area that combines conservation, forestry and nature tourism activities on a sustainable long-term basis.

Powers and functions of the Management Committee.

4. The Management Committee shall have the following functions and powers:

(i) to invite other organisations including overseas organisations into the Management Committee on an *ad hoc* basis;

(ii) to forge relationship with local or overseas organisations for the purpose of research, conservation and education;

(iii) to advise on any proposal for development within the Reserve;

(iv) to assess, accept and reject any proposed research to be carried out within the Reserve;

(v) to address appropriately the findings of research in the national interest; and

(vi) to advise on guidelines of the role of collaborators.

Day-to-day Management. Enactment No. 2 of 1968.

5. Without prejudice to the duties and powers of the Director and other forest officers under the Forest Enactment 1968, the day-to-day management of the Reserve shall be carried out by the Sabah Foundation, which in consultation with the Management Committee, may determine the procedure for the following matters:

(a) the matrix of the management organisation;

(b) the control and regulation of entry of persons into the Reserve including the regulation of the period during which persons may remain therein and the conditions under which they may do so;

(c) the establishment of such research centres, jungle lodges, observatory towers, cabins and other similar structures as may be deemed necessary to carry out the purposes of the Reserve; and

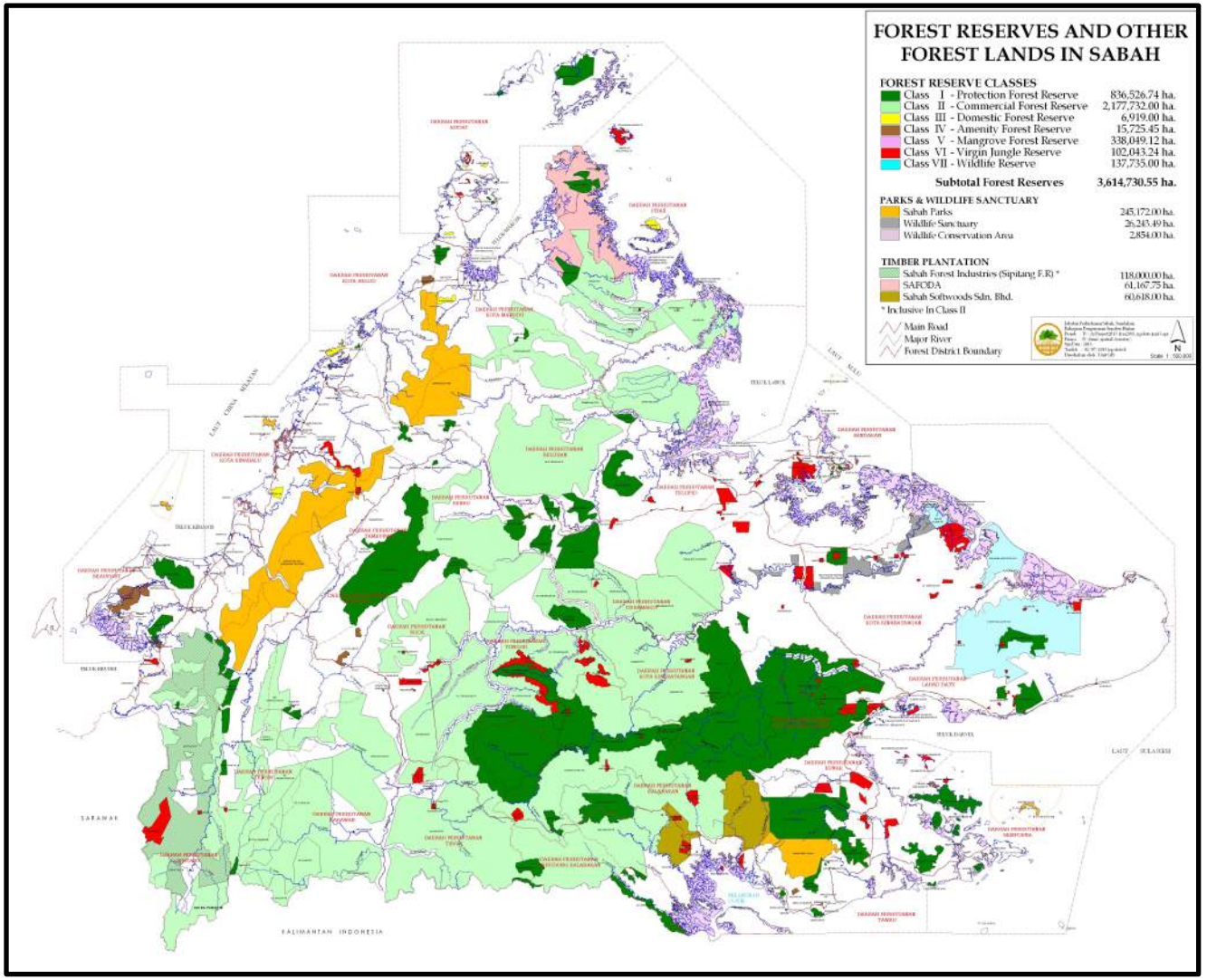
(d) such other matters as may be necessary for the more effectually carrying out its functions and duties in connection with the day-to-day management of the Reserve.

Made at Kota Kinabalu, this 16th day of March, 1998.

DATUK YONG TECK LEE
Chief Minister of Sabah.

Source: GoS (1998: 4-5)

Appendix B: Protected Areas in Sabah (July 2013)



Appendix C: Activities Summaries Review

Description of Programme & Activity	Yes	No		Notes
1. DEVELOPMENT AND INFRASTRUCTURE				
1.1 Maliau Basin Studies Centre (MBSC)				Completed- officially opened on 29th Jan, 2011
1.1.1 Phase 1 construction (site preparation, etc.)	✓	-	-	Completed
1.1.2 Phase 2 construction (building works, etc.)	✓	-	-	Completed
1.1.3 Maintenance of MBSC facilities	✓	-	-	On-going
1.2 Solar Power	-	x	-	Other alternative power supply to be explored: • Micro-hydro (Feasibility study to be carried out by appointed consultant to identify the suitable site for the micro-hydro) • Maliau Security Gate, MBSC, Agathis, Ginseng & Seraya – potential for micro-hydro dev. • MBSC cost estimates – RM2.5 million • Research Stations – Approx. RM75k - RM100k per station • Funding from IKEA to construct micro-hydro station for the research stations, starting with Agathis Camp • In progress
1.2.1 Funding application from MESITA	-	x	-	
1.2.2 Installations	-	x	-	
1.3 Visitor Reception & Information Building (VRIB)	✓	-	-	Completed- officially opened on 17/April/2007
1.4 Road (Security Gate and VRIB to MBSC)				
1.4.1 Construction	✓	-	-	YS allocates annual budget to maintain road • Approval from the Government to upgrade the road roughly totalling (RM107 million) under Sabah Development Corridor. The work was originally to commence in 2009 (road route plan, and road design completed) but the fund payment was deferred to 2014. • Part of fund (RM50 million) was approved for early disbursement in 2013.
1.4.2 Maintenance	✓	-	-	On-going. Suitable amount of funding is needed to consistently maintain the road network. Major repair done in 2009 with a of cost RM3.6 million.
1.5 Access to Maliau Falls				
1.5.1 Trail survey, preparation and construction	✓	-	-	Completed, with regular maintenance but there's no upgrading work done
1.5.2 Suspension bridge	✓	-	-	Completed, with regular maintenance but there's no

					upgrading work done
	1.5.3 Construct day-shelters	✓	-	-	Completed, with regular maintenance but there's no upgrading work done
	1.5.4 Steps and other trail easing installations	✓	-	-	Completed, with regular maintenance but there's no upgrading work done
	1.5.5 Camp construction near Maliau Falls				
	1.5.6 Maintenance of access facilities	✓	-	-	Completed, with regular maintenance but there's no upgrading work done
1.6 Agathis-Camel Trophy trail		-	x	-	
	1.6.1 Up-grade trail	✓	-	-	
	1.6.2 Suspension bridge at Agathis end of trail	✓	-	-	
	1.6.3 Bridge at Camel Trophy end of trail	✓	-	-	
	1.6.4 Replace trail easing installations	✓	-	-	
	1.6.5 Construct day shelters	✓	-	-	
1.7 Other trails					
	1.7.1 Camel Trophy-Rafflesia (up-grade)	-	x	-	Needs regular maintenance
	1.7.2 Rafflesia-Bambangan (up-grade)	-	x	-	Needs regular maintenance
	1.7.3 Agathis-Ginseng (up-grade)	✓	-	-	Regular maintenance
	1.7.4 Kuamut Riverine trail (up-grade)	-	x	-	Confluence/ riverine trail
	1.7.5 Rafflesia to Strike Ridge (up-grade)	-	x	-	
	1.7.6 Strike Ridge to Gunung Lotung (up-grade)	-	x	-	
	1.7.7 Ginseng to Bambangan (up-grade)	-	x	-	
1.8 Nature Trails					
	1.8.1 Maliau Basin Studies Centre	✓	-	-	Via Knowledge Trail, Belian Trail & Lagoon Trail
	1.8.2 Agathis	✓	-	-	Agathis Nature Trail
	1.8.3 Heath forest	?			
1.9 Other camps					
	1.9.1 Camel Trophy (up-grade)	✓	-	-	Will need to be upgraded to better accommodate large influx of visitors and to build a separate quarters for staff.
	1.9.2 Camel Trophy (repair tree platform)	✓	-	-	Needs regular maintenance and additional safety line
	1.9.3 Agathis (up-grade)	✓	-	-	To be relocated due to elephant attack.
	1.9.4 Agathis (field laboratory)	-	x	-	to be constructed at a new site (proposed)
	1.9.5 Belian (construct)	✓	-	-	Camping ground development
	1.9.6 Ginseng (move or up-grade)	✓	-	-	Upgraded
	1.9.7 Rafflesia (up-grade)	✓	-	-	Suspension bridge to be develop
	1.9.8 Bambangan (move or up-grade)	✓	-	-	This camp was closed as there's too much issue on the waste management, and there's no supply of water.
	1.9.9 Strike Ridge (up-grade)	✓	-	-	Up grading work to be conducted
	1.9.10 Camp maintenance	✓	-	-	This will be subject to funding availability
1.10 Ranger posts					
	1.10.1 Sg. Kuamut 1 (construction)	-	x	-	To be developed once the areas have been identified. A wildlife survey will be conducted prior to the development of the ranger post to determine the suitable location for the post. The ranger post will be used to monitor illegal activities.
	1.10.2 Sg. Kuamut 2 (construction)	-	x	-	To be developed once the areas have been identified. A wildlife survey will be conducted prior to the development of the ranger post to determine the suitable spot for the post. The ranger post will be used to monitor illegal activities.

	1.10.3 Lake Linumunsut (construction)	-	x	-	To be constructed in the next management plan
1.11 Other items					
	1.11.1 Tree platform (MBSC)	✓	-	-	
	1.11.2 Canopy walkway (across river from MBSC)	✓	-	-	
	1.11.3 Fire / observation tower (Km 5 or 'W' Point)	✓	-	-	
	1.11.4 Observation platform (Jalan Babi)	-	x	-	
	1.11.5 Suspension bridge over Sg. Maliau at MBSC	✓	-	-	
2. HUMAN RESOURCE DEVELOPMENT & TRAINING					
2.1 Basic capacity-building courses					Have signed MoU with WWF-Malaysia on 28 Jan 2011 for Capacity Building in Protected Areas Management. But a proper/formal form of training program on forest protection is still needed to increase the self-confidence of the rangers. The formal training could also be for higher level education such as diploma or degree at local university.
	2.1.1 Orientation (refresher)	✓	-	-	
	2.1.2 Orientation (new staff)	✓	-	-	Conducted either in YS KK office or in Maliau
	2.1.3 Team building	✓	-	-	Refresher course is needed for some of the senior staff in Maliau especially the rangers.
	2.1.4 English language	-	x	-	No such training was conducted, but the staff learned and pick up the language from on the job training as they are always exposed to visitors and researchers from outside which normally only converse in English. Need to conduct regular training on English language to improve the staff command of the language.
	2.1.5 Interpersonal communication skills	-	x	-	
	2.1.6 Report & proposal writing	-	x	-	
	2.1.7 Management & organizational skills	-	x	-	
	2.1.8 Clerical and accounting skills	-	x	-	
	2.1.9 Computer skills	-	x	-	
2.2 Field capacity courses					
	2.2.1 Search, rescue & first aid skills	-	x	-	
	2.2.2 Mapping, orienteering & survey skills	✓	-	-	Refresher course is needed.
	2.2.3 Advanced patient management skills	-	x	-	
	2.2.4 Fighting forest fires	-	x	-	
2.3 Visitor management & education courses					
	2.3.1 Interpretation & guiding	✓	-	-	Conducted and some staff attended the course, refresher course is needed.
	2.3.2 Hospitality skills for field and rest house	-	x	-	
	2.3.3 Environmental education & outreach	✓	-	-	Conducted by the Sabah Nature Club.
2.4 Technical courses					
	2.4.1 Faunal inventory & survey techniques	-	x	-	
	2.4.2 Floral inventory & survey techniques	-	x	-	
	2.4.3 Techniques of phenology	-	x	-	
	2.4.4 Tree identification	✓	-	-	Refresher course is needed
	2.4.5 Herbarium & curation techniques	-	x	-	
	2.4.6 Data management	✓	-	-	Refresher course is needed.

	2.4.7 Library management	-	x	-	
2.5 Safety and maintenance courses					
	2.5.1 Risk assessment	✓	-	-	
	2.5.2 Use of equipment	-	x	-	
	2.5.3 Maintaining trails	-	x	-	
	2.5.4 Maintaining buildings	-	x	-	
	2.5.5 Maintaining signs	-	x	-	
	2.5.6 Store inventory maintenance	-	x	-	
	2.5.7 Safety in free emergencies	-	x	-	
	2.5.8 Vehicle maintenance	-	x	-	
2.6 Specialised courses		-	x	-	
	2.6.1 Photography	✓	-	-	
	2.6.2 Swimming	✓	-	-	
	2.6.3 Nursery skills	-	x	-	
	2.6.4 Gardening & landscaping	-	x	-	
	2.6.5 Tree climbing	✓	-	-	
	2.6.6 Fire fighting leadership	-	x	-	
	2.6.7 Study tours	✓	-	-	
	2.6.8 Honorary Wildlife Warden	✓	-	-	
3. PUBLIC AWARENESS AND ENVIRONMENTAL EDUCATION					
3.1 Web-site development					Website for Maliau is hosted via the Yayasan Sabah (YS) website. It's also featured in Borneo Forest Heritage website. Online reservation and booking to be incorporated into the existing website design to ease reservation and bookings processes. Monitoring on tour companies website which display information on Maliau must be conducted to control the information that they publish in their website.
	3.1.1 optimize web-site design and search engines	✓	-	-	Information on Maliau is always updated in the Facebook page and not in the website itself. The website design needs to be changed to better showcase Maliau. In addition to that, there are companies that are helping to promote Maliau via their own website.
	3.1.2 e-commerce enable				
	3.1.3 Establish order-fulfilment capacity				
	3.1.4 Develop internet sales				
	3.1.5 *Friends of Maliau* home page & e-newsletter				
3.2 Local outreach					
	3.2.1 Annual sports activities	✓	-	-	
	3.2.2 Use of MBSC for local teachers	✓	-	-	
	3.2.3 Use of MBSC for local students	✓	-	-	
	3.2.4 Visit to MBSC & DVFC by community leaders	✓	-	-	
	3.2.5 Other local outreach activities	✓	-	-	
3.3 Materials production and sale					
	3.3.1 Prepare teachers` env. Ed. Pack	✓	-	-	
	3.3.2 Prepare materials for MBSC display / use	✓	-	-	
	3.3.3 Prepare materials for VRIB display / use	✓	-	-	
	3.3.4 Sale of educational merchandize	✓	-	-	More merchandise of unique values to Maliau to be produced.
3.4 Nature trails: signs and booklet					
	3.4.1 MBSC nature trail	✓	-	-	
	3.4.2 Agathis nature trail	✓	-	-	
	3.4.3 Heath forest nature trail	✓	-	-	
3.5 Special events					
	3.5.1 Official opening (MBSC)	-	-	-	Officially opened on 29th Jan, 2011

	3.5.2 Official opening (VRIB)	✓	-	-	Officially opened on 24th Apr, 2007
	3.5.3 Submission of World Heritage Site Application			✓	In progress
	3.5.4 World Heritage Site listing ceremony			✓	Nomination process in progress
3.6 Ongoing activities					
	3.6.1 Ongoing media & VIP visits, mobile exhibitions	✓	-	-	
	3.6.2 Ongoing book, booklet, poster, etc. production	✓	-	-	
4. RESEARCH AND ENVIRONMENTAL MONITORING					
4.1 Research coordination					
	4.1.1 Advisory Research Committee	?	-	-	
	4.1.2 Research Prospectus (MBSC & DVFC)	✓	-	-	
	4.1.3 Appoint Research Coordinator	-	x	-	
4.2 Research / field activities		✓	-	-	Limited resources, laboratory equipment's not sufficient, there's no grid system for research plots established, lack of GIS equipment's. Funding for research internally from YS is also insufficient to support the existing research programs
4.3 Laboratory and equipment					
	4.3.1 Field equipment	✓	-	-	
	4.3.2 Laboratory equipment	✓	-	-	
	4.3.3 Maintain laboratory	✓	-	-	
4.4 Environmental monitoring					
	4.4.1 Environmental monitoring reviewed	✓	-	-	
	4.4.2 Weather (quarterly downloads)	✓	-	-	At different elevations the weather data (rainfall) is set up since 2000 at Maliau Gate, Studies centre and Agathis Camp. Data collection of the rain will be taken on the next day is on the previous day it is raining and it must be taken before 8am)
	4.4.3 Weather (annual reports)	✓	-	-	
	4.4.4 Phenology (fruiting, flowering, leaf-flushing)	✓	-	-	Phenology plot established since 2005 at Belian Camp, Agathis Camp, Maliau Gate and Fig Plot (Belian Camp) The data from the plots will be collected on the 15th day of the month every month.
	4.4.5 Changing wildlife abundance			✓	Random observation
	4.4.6 Selected indicator species	✓	x		
	4.4.7 Selected species of concerns	✓			
	4.4.8 Continuation of camera-trapping programme		x		
	4.4.9 Transect routes	?			
4.5 Encroachment monitoring					
	4.5.1 Encroachment monitoring reviewed		x		
	4.5.2 Boundaries & boundary penetration	✓			
	4.5.3 Internal signs of intrusion	?			
4.6 Fire risk monitoring					
	4.6.1 Fire risk monitoring programme designed		x		
	4.6.2 Weather indicators		x		
	4.6.3 Microclimate indicator		x		
	4.6.4 Human induced fire	✓			
4.7 Data, information & knowledge management					
	4.7.1 Database protocols & architecture designed	✓			
	4.7.2 Climate database maintained	✓			
	4.7.3 water level database maintained	✓			
	4.7.4 Plant /fungi species list maintained	✓			
	4.7.5 Vertebrate / invertebrate species list	✓			

	maintained				
	4.7.6 Phenology database maintained	✓			
	4.7.7 Wildlife abundance database maintained	✓			
	4.7.8 Indicator species maintained		x		
	4.7.9 Species of concerns database maintained		x		
	4.7.10 Camera trap photo-library maintained	✓			
	4.7.11 Transect database maintained	?			
	4.7.12 Scientific report	?			
4.8 Library management					
	4.8.1 Existing holdings housed at MBSC	✓			
	4.8.2 On-line catalogue (integrated with DVFC)		x		
	4.8.3 Books purchased or donated	✓			
	4.8.4 Journal subscriptions renewed	?			
5. BUFFER ZONE MANAGEMENT PLANNING					
5.1 Landscape connectedness					
	5.1.1 FMUs join Management Committees	✓			
	5.1.2 Workshop on biodiversity reservoirs[a]				
	5.1.3 Workshop on large-scale 'wildlife corridors'[a]				
	5.1.4 Workshop on improving RIL techniques[a]				
	5.1.5 Workshop on promoting forest recovery[a]				
	5.1.6 Workshop on biodiversity in land use[a]				
	5.1.7 Workshop on maliau-lmbak valley links				
	5.1.8 Workshop on biodiversity-friendly forestry[a]				
5.2 Fire management planning[b]					
	5.2.1 Assess condition of residual forest stands		x		
	5.2.2 Assess logging roads and fire breaks	✓			
	5.2.3 Assess need for ecological remediation		x		
	5.2.4 Assess scope for community involvement	✓			
	5.2.5 Workshops on institutional cooperation	✓			
	5.2.6 Specify replanting programme (fire)		x		
	5.2.7 Implement replanting programme (fire)		x		
	5.2.8 Specify equipment and supplies		x		
	5.2.9 Acquire equipment and supplies		x		
	5.2.10 Specify fire training programme	✓			
	5.2.11 Implement fire training programme		x		
5.3 Tourism development					
	5.3.1 Tourism plan for Security Gate area		x		Included as one of the projects under Sabah Development Corridor (SDC)
	5.3.2 Trails to view points in and around the VJR		x		
	5.3.3 Visitor Reception & Information Building Construction	✓			Partly funded by SHELL (known as Shell Maliau Basin Reception & Information Building – SMBRIB). The building also house the souvenir shop, Maliau café, exhibition hall and an office.
	5.3.4 Souvenir Shop and Restaurant at Gate House	✓	-	-	
	5.3.5 Tourism plan for Inarad and Linumunsut	-	x	-	Included as one of the projects under Sabah Development Corridor (SDC)
	5.3.6 Tourism plan for Tibow resettlement area[c]	-	x	-	
5.4 Replanting					
	5.4.1 Specify replanting (biodiversity)[b]				
	5.4.2 Implement replanting (biodiversity)[b]				
	5.4.3 Negotiate community forestry agreements				
	5.4.4 Identify and protect critical habitat areas[b]				
	5.4.5 Assess and map potential access routes[b]				

6. TOURISM WITHIN CONSERVATION AREA				
6.1 Establish fee rates	✓	-	-	
6.2 Establish discounts arrangements	✓	-	-	
6.3 Establish local porterage chargers	✓	-	-	SOP for porter and guide developed
6.4 Establish agree access terms with tour operators	✓	-	-	
6.5 Design booking system for basin facilities	✓	-	-	Credit card facility established and streamlining of the booking system was done.
6.6 Waste management system				Policy to be in place soon: - Targeting zero waste policy - Bring-&-Bring out policy - Separation of household waste - Composting
6.7 Low-impact design for satellites camps				
6.8 Prepare for tourist use at Camel Trophy camp	✓	-	-	Received the MS ISO 9001:2008 – for Visitor's Management
6.9 Prepare for tourist use at Bambangan camp	✓	-	-	
6.10 Prepare for tourist use at Ginseng camp	✓	-	-	
6.11 Recruit resident naturalists	-	x	-	
6.12 Recruit assistant resident naturalists	-	x	-	
6.13 Maintain all buildings	✓	-	-	
6.14 Maintain all trails and roads	✓	-	-	
7. SUSTAINABLE FINANCING				
7.1 Prepare comprehensive business plan				
7.2 Organise investment strategy				
7.3 Bioprospecting development				
7.4 Grants & partnerships				
7.5 International marketing				
7.6 Prepare e-commerce enabled website				
7.7 Establish a trust fund and protocols				
8. PLANNING AND REPORTING				
8.1 Review 10-year Strategic Plan	✓	-	-	Ongoing
8.2 Prepare annual Work Plans	✓	-	-	
8.3 Prepare Annual Reports	✓	-	-	Not up-to-date
9. MISCELLANEOUS				
9.1 Scientific seminar	✓			
9.2 Lake Linumunsut Report		x		

Appendix D: Research Activities Summaries

1. General Information

Listed below are the basic informations on research activities in MBCA.

- Research applications (2000 – 2013) : 117
- Not approved : 2
- Completed : 69 (PhD = 9, MSc = 25, BSc = 13, Post-Doc = 16, Others = 6)
- In progress : 43
- Have yet to commence : 33
- Collaborative projects : SAFE, UMS

2. Numbers of Researcher[1], 2000-2013

Breakdown on numbers of researchers, and their countries of registration.

Country	Post-Doc	PhD	MSc	BSc	Others	Total
i. Australia	1	2	0	0	0	**3**
ii. USA	1	5	0	0	0	**6**
iii. Sweden	0	1	0	0	2	**3**
iv. United Kingdom	13	17	18	1	0	**49**
v. Denmark	0	0	3	1	0	**4**
vi. Germany	0	1	0	0	0	**1**
vii. Japan	6	1	0	0	0	**7**
viii. Singapore	1	1	0	0	0	**1**
ix. Switzerland	0	1				**1**
x. Malaysia	5	6	16	9	4	**40**
Total	**27**	**34**	**37**	**11**	**6**	**115**

Note:

[1] = Countries where researchers are registered

3. Fields of Study

Listed below are the fields of study applied by researchers, totalling **115**.

- Forest ecology = 27
- Botany = 10
- Entomology = 28
- Hydrology = 2
- Pedology = 2
- Zoology = 18
- Ichthyology = 4
- Arachnology = 1
- Frugivory = 1
- Biodiversity = 2
- Geomorphology = 1
- Carbon study = 1
- Economy = 1
- Ornithology = 5
- Mycology = 2
- Sociology = 4
- Herpetology = 5
- Limnology = 1

Appendix E: Gaps that need to be addressed

1. Development & Infrastructures	• Access road: Consistent maintenance required suitable amount of funding; • Jungle trails: Regularly maintained but no upgrades; • Jungle trails: Nepenthes (formerly known as Camel Trophy) - Rafflesia camps and Kuamut Trail need to be upgraded; • Closing of Bambangan Camp due to bad cleanliness and no water supply; • Ranger posts (monitoring illegal activities) to be station at Kuamut River and Lake Linumunsut but need wildlife survey first and required funding; • Research stations to be powered with sustainable energy – micro hydro; • Research stations to be implemented with waste management practice; and • Recreation facilities for visitors' activities.
2. Human resource development & training	• High staffs turnover, and replacement of resigned staff/vacant position is not being carried out; • Lack of resources (staff) – staffs have to do multi-taskings and in need of more staffing; • International communication skill is not fully fulfilled; • Team work training required refresher training; • Need evaluation of courses' practicality due to too many courses; • English language course, interpersonal communication skills, report & proposal writing, management & organizational skills, clerical & accounting skills, computer skills, search, rescue & first aid skills, advanced patient management skills, fighting forest fires, hospitality management, faunal inventory & survey techniques has not been implemented yet; • Lack of adequate skills to conduct critical management activities; • Formal forest protection training for particular ranger – most rangers does not have academic qualification to further their study (Diploma, Degree, Master); • Occupational Safety and Health (OSH):- ✓ Need to establish a Safety and Health Policy, ✓ Establish OSH Committee, ✓ To develop a written work procedures or SOP for OSH, ✓ Set-up of appropriate safety signage's, ✓ Personal Protective Equipment (PPE) tools to be provided, ✓ Need OSH training at MBCA and dedicated staff for regular OSH monitoring. ✓ Need official training for incident investigation.
3. Public awareness & environmental education	• Lack of training for effective implementation; • Graphic designer; • Need more tools for marketing; • Lack of skill in terms of graphic designing by staff; • Website development to be reviewed/update, to enable e-commerce; • www.maliaubasin.org is offline only through facebook and www.borneoforestheritage.org.my via YS; and • MBCA info is being highlighted by other companies such as tour companies.
4. Research & environmental monitoring	• Intensive study on natural resources and other baseline data is needed; • Future and existing monitoring programs should only be conducted upon request by the management; • Reporting from field data collected: staff needs the skills to report on the findings from the monitoring activities; • Skilled researchers and staff is needed to conduct and continuously monitor on research program;

	• Lack of research platform to assist and facilitate Maliau as a research site; • Lack of proper database system; • Lack of funds to conduct research activities; • Need analysis of baseline data – indicators on microclimate, bio-indicator and water monitoring; • Lack of local researchers/student:- ✓ Access road to MBCA is bad; ✓ Cost to stay in MBCA is expensive; ✓ Slow internet connectivity; ✓ No recreation; ✓ Lacking laboratory equipment; ✓ High cost of running research in MBCA; ✓ No studies on climate change; and ✓ Scientific reports should be presented in journals.
5. Buffer zone management planning	• Need to demarcate MBCA – increase buffer zone as Class 1 Protected Area is expensive; • Lack of Equipment – e.g. transport for boundary survey, patrol and maintenance; • Lack of funding to support ground work; • Limited number of staff; • Size of area for monitoring is big; • Research stations not sufficient; and • Sensitive areas have not been identified. **Threats:** • Easy access from old existing logging roads and rivers; and the new highway development (Kalabakan-Tawau road)
6. Tourism within conservation area	• No major construction within the basin, only in Kuamut River and Lake Linumunsut; • Appointing tour operators may lead to selected company monopolising businesses; • To review the tourism marketing plan; • To review policies on marketing strategies, and budget allocations; • Facilities and capacity to support tourism; • Capacity building for staff; • Booking and visitor management; • Monitoring, assessment and evaluation of the tourism products and activities; • Accessibility; • Standard Operating Procedures (SOP) for tour operators; • Fees to be reviewed; and • Establishment of tourism unit.
7. Sustainable financing	• Professional help to assist MBCA for sustainable financing and business plan; and • Identify long term financial planning for Maliau and identify new sources of revenue. **Opportunities:** • Ecotourism • EE activities • Carbon Trading • PES
8. Planning & reporting	• Need proper record of reports for training/courses attended by staffs – for evaluation; and • Evaluation of the training programs conducted needs to be done to assess its effectiveness.
9. Protection and conservation	• Sensitive area has not been identified; and • Required *Polis Bantuan* (Auxiliary Police) for surveillance and security.
10. Miscellaneous	• Green house crisis; • Economic crisis; • Pressure getting natural resources;

	• Land issue – oil palm plantation; • Communication; • Finding the right location for the new ranger field posts; and • Development of Lake Linumunsut, sustainability of the development and how attractive would it be for tourism.

Appendix F: AICHI Targets and Relevancy

Strategic Goals	Targets	Relevancy to MBCA
Goal A: Address the underlying causes of biodiversity loss by maintaining biodiversity across government and society.	**T1:** By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	Marketing, awareness program, EE and tourism activities
	T2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	MBCA Management Plan to detail out how resource management in Maliau is undertaken in line with the relevant state policies and regulations.
	T3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimise or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio-economic conditions.	Not applicable
	T4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	Not applicable
Goal B: Reduce the direct pressures on biodiversity and promote sustainable use.	**T5:** By 2020 the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	Creation of buffer zones, gazzetment of new corridors connecting Maliau to Imbak & Danum
	T6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystem and the impacts of fisheries on stocks, species and ecosystem are within safe ecological limits.	Not applicable
	T7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	Not applicable
	T8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	Consistent water quality monitoring in selected rivers in Maliau to assess the pollution level due to land use activities from outside of Maliau
	T9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	Regular monitoring of invasive species
	T10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystem impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	Not applicable

Goal C: Improve the status of biodiversity by safeguarding ecosystem, species and genetic diversity	**T11:** By 2020, at least 17 percent of terrestrial and inland water, and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected system of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape.	The addition of Class I (of existing Buffer 1) to the core areas have certainly provided a substantial increased in protected area to MBCA.
	T12: 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	Regular monitoring of the known threatened species and enforcement to prevent illegal hunting or collection of the threatened species
	T13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	Not applicable
Goal D: Enhance the benefits to all from biodiversity and ecosystem services	**T14:** By 2020, ecosystem that provide essential services, including services related to water, and contribute to health, livelihoods and well being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and the vulnerable.	Buffer zone establishment to strengthen the core area capacity to regulate water. Local communities rights to use the forest area for subsistence is to be recognised and applied in the management of the buffer zone area.
	T15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystem, thereby contributing to climate change mitigation and adaptation and to combating desertification.	Buffer zone areas which has been affected by previous logging activities is to be restored.
	T16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation is in force and operational, consistent with national legislation.	The forthcoming gazettement of the ABS Regulation will be applicable to MBCA.
Goal E : Enhance implementation through participatory planning, knowledge management and capacity building	**T17:** By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	Not applicable
	T18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the convention with the full and effective participation of indigenous and local communities, at all relevant levels.	The Sabah Biodiversity Centre (SaBC) in Sabah, is in the process of finalizing Access and Benefit Sharing (ABS) Regulations to augment the Sabah Biodiversity Enactment 2000. As per its mandate, SaBC is exploring ways to implement the forthcoming ABS Regulations in the context of genetic resources and traditional knowledge owned by indigenous and local communities in ways that also support local governance of biodiversity and the customary sustainable uses of natural resources. This proposal is to support Sabah, and Malaysia more generally, to develop a framework for ABS using an integrated and community-based approach in which Maliau can support via its community engagement/consultation work.

	T19: By 2020, knowledge on the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	
	T20: By 2020, at the latest, the mobilisation of financial resources for effectively implementing the Strategic Plan 2011-2020 from all sources and in accordance with the consolidated and agreed process in the Strategy for Resources Mobilisation should increase substantially from the current levels. This target will be subject to changes contingent to resources needs assessments to be developed and reported by Parties.	Not applicable

Appendix G: List of Trees

Item	Family/Scientific Name	Descriptions	IUCN Red List	CITES	WCE
Anacardiaceae		Shrubs and trees			
1.	*Buchanania arborescens*		-	-	-
2.	*Buchanania sessifolia*		-	-	-
3.	*Buchanania sessiliflora*		-	-	-
4.	*Buchanania sp.*		-	-	-
5.	*Campnosperma auriculata*		-	-	-
6.	*Campnosperma squanatum*		-	-	-
7.	*Gluta aptera*		-	-	-
8.	*Gluta laxiflora*		-	-	-
9.	*Gluta sabahana*		-	-	-
10.	*Gluta speciosa*		-	-	-
11.	*Gluta wallichii*		-	-	-
12.	*Koordersiodendron pinnatum*		-	-	-
13.	*Mangifera bullata*		Data deficient	-	-
14.	*Mangifera foetida*		LC	-	-
15.	*Mangifera griffithii*		-	-	-
16.	*Mangifera pajang*		VU	-	-
17.	*Mangifera parvifolia*		LC	-	-
18.	*Mangifera rigida*		-	-	-
19.	*Mangifera swintonioides*		-	-	-
20.	*Mangifera sp.*		-	-	-
21.	*Melanochylla auriculata*		-	-	-
22.	*Melanochylla bullata*		-	-	-
23.	*Melanorrhoea wallichii*		-	-	-
24.	*Parishia insignis*		-	-	-
25.	*Parishia sp.*		-	-	-
26.	*Pygea sp.*		-	-	-
Anisophylleaceae		Leechwood family: includes trees			
27.	*Anisophyllea corneri*		LC	-	-
28.	*Carallia bracteata*		-	-	-
Annonaceae		Kenanga family: trees lianas and shrubs			
29.	*Artabotrys roseus*		-	-	-
30.	*Artabotrys suaveolens*		-	-	-
31.	*Artabotrys sp.*		-	-	-
32.	*Cyathostemma excelsa*		-	-	-
33.	*Dasymachalon clusiflorum*		-	-	-
34.	*Goniothalamus sp.*		-	-	-
35.	*Polyalthia glauca*		-	-	-
36.	*Uvaria sp.*		VU	-	-
Apocynaceae		Periwinkle family: trees lianas & shrubs			
37.	*Alstonia angustifolia*		LC	-	-
38.	*Alstonia angustiloba*		-	-	-
39.	*Alyxia pilosa*		-	-	-
40.	*Alyxia sp.*		-	-	-
41.	*Anodendron gradilis*		-	-	-
42.	*Chilocarpus beccarianus*		-	-	-
43.	*Kopsia sp.*		-	-	-
44.	*Tabernaemontana pauciflora*		-	-	-
45.	*Tabernaemontana sp.*		-	-	-
46.	*Urceola laevis*		-	-	-
47.	*Urnularia lanceolata*		-	-	-
48.	*Willughbeia coriacea*		-	-	-
49.	*Willughbeia sp.*		-	-	-
Aquifoliaceae		Holly family: shrubs, trees and rarely climbers			
50.	*Ilex clemensiae*		-	-	-
51.	*Ilex cymosa B1*		-	-	-
52.	*Ilex wallichii*		-	-	-

Araucariaceae		Conifers: flowerless seed plants			
53.	*Agathis borneensis*		-	-	-
54.	*Agathis kinabaleunsis*		-	-	-
55.	*Agathis sp.*		-	-	-
Bignoniaceae		Bignonia family: trees & woody climbers			
56.	*Oroxylon sp.*		-	-	-
Bombacaceae		Durian family: mainly trees			
57.	*Durio acutifolius*		VU	-	-
58.	*Durio grandiflorus*		VU	-	-
59.	*Durio grandifolius*		-	-	-
60.	*Durio graveolens*		-	-	-
61.	*Durio griffithii*		-	-	-
62.	*Durio cf. Kinabaluensis*		-	-	-
63.	*Durio kutejensis*		VU	-	-
64.	*Durio lanceolata*		-	-	-
65.	*Durio oxleyanus*		-	-	-
66.	*Durio sp.*		-	-	-
67.	*Neesia strigosa*		-	-	-
68.	*Neesia synandra*		-	-	-
Boraginaceae		Heliotrope family: trees, shrubs, climbers & herbs			
69.	*Pteleocarpa lamponga*		-	-	-
Burseraceae		Kedondong family: mostly trees, rarely climbers			
70.	*Canarium decumanum*		-	-	-
71.	*Canarium denticulatum*		-	-	-
72.	*Canarium kinabaluensis*		-	-	-
73.	*Canarium littorale*		LC	-	-
74.	*Odontophyllum*		-	-	-
75.	*Canarium patentinervium*		LC	-	-
76.	*Canarium rostratum*		-	-	-
77.	*Canarium sp.*		-	-	-
78.	*Dacryodes cf. rugosa var. virgata*		-	-	-
79.	*Dacryodes incurvata*		-	-	-
80.	*Dacryodes laxa*		LC	-	-
81.	*Dacryodes longifolia*		-	-	-
82.	*Dacryodes nigosa*		-	-	-
83.	*Dacryodes rostrata*		LC	-	-
84.	*Dacryodes rubiginosa*		-	-	-
85.	*Dacryodes rugosa*		-	-	-
86.	*Dacrodes rugosa var. rugosa*		-	-	-
87.	*Dacryodes sp.*		-	-	-
88.	*Santiria grandiflora*		-	-	-
89.	*Santiria laevigata*		LC	-	-
90.	*Santiria cf. oblongifolia*		-	-	-
91.	*Santiria sp.*		-	-	-
Casuarinaceae		Casuarina family: trees			
92.	*Gymnostoma nobilis*		-	-	-
93.	*Gymnostoma sumatrana*		-	-	-
94.	*Gymnostoma sp.*		-	-	-
Celastraceae		Spindle-tree family: trees, lianas & shrubs			
95.	*Bhesa paniculata*		LC	-	-
96.	*Cassine kochinchinensis*		-	-	-
97.	*Euonymus castaneifolius*		-	-	-
98.	*Laphopetalum beccarianum*		-	-	-
99.	*Laphopetalum multinervium*		-	-	-
100.	*Laphopetalum subobovatum*		-	-	-
101.	*Microtropis kinabaluensis*		-	-	-
102.	*Microtropis platyphylla*		-	-	-
103.	*Microtropis cf. sabahensis*		-	-	-
104.	*Microtropis sp.*		-	-	-
Clusiaceae		Mangosteen family, includes trees; often classified under Guttiferae			
105.	*Calophyllum bursicolum*		-	-	-
106.	*Calophyllum coeletryi*		-	-	-
107.	*Calophyllum cordata*		-	-	-
108.	*Calophyllum depressinervosum*		-	-	-

109.	*Calophyllum gracilipes*		-	-	-
110.	*Calophyllum griseum*		-	-	-
111.	*Calophyllum nodosum*		-	-	-
112.	*Calophyllum soulattri*		LC	-	-
113.	*Calophyllum teysmannii*		-	-	-
114.	*Calophyllum wallichianum var. Incrassatum*		-	-	-
115.	*Calophyllum sp.*		-	-	-
116.	*Garcinia benthamiana*		-	-	-
117.	*Garcinia cf. celebica*		-	-	-
118.	*Garcinia desrousseauxii*		-	-	-
119.	*Garcinia forbesii*		-	-	-
120.	*Garcinia gaudichandii*		-	-	-
121.	*Garcinia mangostana*		-	-	-
122.	*Garcinia cf. mangostana*		-	-	-
123.	*Garcinia miquelii*		-	-	-
124.	*Garcinia multinervia*		-	-	-
125.	*Garcinia parvifolia*		-	-	-
126.	*Garcinia ramiflora*		-	-	-
127.	*Garcinia sp.*		-	-	-
128.	*Mesua borneensis*		-	-	-
129.	*Mesua macrantha*		-	-	-
Chrysobalanaceae		Trees & shrubs			
130.	*Atuna excels*		-	-	-
131.	*Atuna sp.*		-	-	-
132.	*Parastemon urophyllus*		-	-	-
133.	*Parinari kunstlerii*		-	-	-
134.	*Parinari oblongifolia*		-	-	-
135.	*Parinari sp.*		-	-	-
Combretaceae		Terminalia family: trees, shrubs & woody climbers			
136.	*Terminalia foetidissima*		-	-	-
137.	*Terminalia sp.*		-	-	-
Cornaceae		Dogwood family: trees			
138.	*Mastixia rostrata*		-	-	-
Crypteroniaceae		Bekoi family: mainly trees			
139.	*Axinandra coriacea*		-	-	-
140.	*Crypteronia griffthii*		-	-	-
Ctenolophonaceae					
141.	*Ctenolophone parvifolius*		-	-	-
Cunoniaceae		Shrubs & trees			
142.	*Weinmannia blumei*		-	-	-
143.	*Weinmannia borneensis*		-	-	-
Datiscaceae		Herbs to large trees			
144.	*Octomeles sumatrana*		-	-	-
Dilleniaceae		Simpoh family: trees, climbers & herbs			
145.	*Dillenia borneensis*		-	-	-
146.	*Dillenia e.rcelsa*		-	-	-
147.	*Dillenia sp.*		-	-	-
148.	*Ietracera akara*		-	-	-
149.	*Tetracera kortlialsii*		-	-	-
150.	*Tetracera scandens*		-	-	-
Dipterocarpaceae		Meranti family: mainly large trees			
151.	*Anisoptera sp.*		-	-	-
152.	*Dipterocarpus acutangulus*		-	-	-
153.	*Dipterocarpus applanatus*		CE	-	-
154.	*Dipterocarpus caudiferus*		-	-	-
155.	*Dipterocarpus confertus*		-	-	-
156.	*Dipterocarpus crinitus*		EN	-	-
157.	*Dipterocarpus gracilis*		CE	-	-
158.	*Dipterocarpus lowii*		CE	-	-
159.	*Dipterocarpus stellatus*		-	-	-
160.	*Dispterocarpus sp.*		-	-	-
161.	*Dryobalanops lanceolata*		EN	-	-
162.	*Dryobalanos sp.*		-	-	-
163.	*Hopea aequalis*		CE	-	-
164.	*Hopea beccariana*		CE	-	-
165.	*Hopea bracteata*		-	-	-

166.	*Hopea ferruginea*		CE	-	-
167.	*Hopea cf. ferruginea*		-	-	-
168.	*Hopea nervosa*		CE	-	-
169.	*Hopea sangal*		CE	-	-
170.	*Hopea sp.*		-	-	-
171.	*Parashorea malaanonan*		CE	-	-
172.	*Parashorea tomentella*		-	-	-
173.	*Shorea acuminatissima*		CE	-	-
174.	*Shorea agamii*		-	-	-
175.	*Shorea almon*		CE	-	-
176.	*Shorea andulensis*		EN	-	-
177.	*Shorea angustifolia*		-	-	-
178.	*Shorea argentifolia*		EN	-	-
179.	*Shorea asahi*		-	-	-
180.	*Shorea atrinervosa*		-	-	-
181.	*Shorea bracteolata*		EN	-	-
182.	*Shorea confusa*		-	-	-
183.	*Shorea coriacea*		-	-	-
184.	*Shorea faguetiana*		EN	-	-
185.	*Shorea fallax*		-	-	-
186.	*Shorea ferruginea*		-	-	-
187.	*Shorea cf. flemmichii*		-	-	-
188.	*Shorea foxworthyii*		-	-	-
189.	*Shorea gibbosa*		CE	-	-
190.	*Shorea glaucescens*		-	-	-
191.	*Shorea gratissima*		EN	-	-
192.	*Shorea hopeifolia*		CE	-	-
193.	*Shorea johorensis*		CE	-	-
194.	*Shorea laevis*		LC	-	-
195.	*Shorea leprosula*		EN	-	-
196.	*Shorea leptoclados*		-	-	-
197.	*Shorea leptoderma*		CE	-	-
198.	*Shorea macrophylla*		VU	-	-
199.	*Shorea macroptera*		-	-	-
200.	*Shorea mecistopteryx*		-	-	-
201.	*Shorea multiflora*		LC	-	-
202.	*Shorea obscura*		EN	-	-
203.	*Shorea oleosa*		-	-	-
204.	*Shorea cf. oleuca*		-	-	-
205.	*Shorea ovalis*		-	-	-
206.	*Shorea parvifolia*		-	-	-
207.	*Shorea parvistipulata*		-	-	-
208.	*Shorea patoiensis*		-	-	-
209.	*Shorea pauciflora*		EN	-	-
210.	*Shorea pilosa*		-	-	-
211.	*Shorea pinanga*		-	-	-
212.	*Shorea platycarpa*		CE	-	-
213.	*Shorea platyclados*		EN	-	-
214.	*Shorea smithiana*		CE	-	-
215.	*Shorea superb*		-	-	-
216.	*Shorea venulosa*		-	-	-
217.	*Shorea waltonii*		-	-	-
218.	*Shorea sp.*		-	-	-
219.	*Vatica albiramis*		-	-	-
220.	*Vatica dulitensis*		-	-	-
221.	*Vatica oblongifolia*		-	-	-
222.	*Vatica rassak*		LC	-	-
223.	*Vatica sp.*		-	-	-
224.	*Vatica umbonata*		LC	-	-
Ebenaceae		Ebony family: trees, shrubs			
225.	*Diospyros buxifolia*		-	-	-
226.	*Diospyros cauliflora*		-	-	-
227.	*Diospyros curraniopsis*		-	-	-
228.	*Diospyros densa*		-	-	-
229.	*Diospyros elliptifolia*		-	-	-
230.	*Diospyros fusiformis*		-	-	-
231.	*Diospyros korineii*		-	-	-

232.	*Diospyros laevigata*		LC	-	-
233.	*Diospyros lanceifolia*		-	-	-
234.	*Diospyros macrophylla*		-	-	-
235.	*Diospyros cf. macrophylla*		-	-	-
236.	*Diospyros nitida*		-	-	-
237.	*Diospyros penibukanensis*		-	-	-
238.	*Diospyros sumatrana*		-	-	-
239.	*Diospyros sp.*		-	III	-
Ericaceae		Heather family: includes small trees & epiphytes			
240.	*Diplycosia barbigera*		-	-	-
241.	*Diplycosia chrysothrix*		-	-	-
242.	*Diplycosia heterophylla*		-	-	-
243.	*Diplycosia heterophylla var. latifolia*		-	-	-
244.	*Diplycosia cf. microphylla*		-	-	-
245.	*Diplycosia memecyloides*		-	-	-
246.	*Diplycosia punctulata*		-	-	-
247.	*Diplycosia sp.*		-	-	-
248.	*Gaultheria sp.*		-	-	-
249.	*Rhododendron bogobonum*		-	-	2
250.	*Rhododendron borneense*		-	-	2
251.	*Rhododendron borneense ssp. villosum*		-	-	2
252.	*Rhododendron burtii*		-	-	2
253.	*Rhododendron cf. malayanum*		-	-	2
254.	*Rhododendron cf. wrayii*		-	-	2
255.	*Rhododendron crassifolium*		-	-	2
256.	*Rhododendron cuneifolium*		-	-	2
257.	*Rhododendron durionifolium*		-	-	2
258.	*Rhododendron durionifolium ssp. sabahense*		-	-	2
259.	*Rhododendron fallacinum*		-	-	2
260.	*Rhododendron javanicum*		-	-	2
261.	*Rhododendron javanicum ssp. Brookeanum var. brookeanum*		-	-	2
262.	*Rhododendron javanicum ssp. Brookeanum var. gracile*		-	-	2
263.	*Rhododendron javanicum ssp. cockburnii*		-	-	2
264.	*Rhododendron longiflorum*		-	-	2
265.	*Rhododendron longiflorum var. longiflorum*		-	-	2
266.	*Rhododendron longiflorum var. subcordatum*		-	-	2
267.	*Rhododendron micromalayanum*		-	-	2
268.	*Rhododendron nervulosum*		-	-	2
269.	*Rhododendron praetervisum*		-	-	2
270.	*Rhododendron stapfianum*		-	-	2
271.	*Rhododendron suaveolens*		-	-	2
272.	*Rhododendron sp.*		-	-	2
273.	*Vaccinium bancanum*		-	-	-
274.	*Vaccinium cercidifolium*		-	-	-
275.	*Vaccinium claoxylon*		-	-	-
276.	*Vaccinium clementis*		-	-	-
277.	*Vaccinium coriaceum*		-	-	-
278.	*Vaccinium pachydermum*		-	-	-
279.	*Vaccinium phillyreoides*		-	-	-
280.	*Vaccinium sp.*		-	-	-
Erythroxylaceae					
281.	*Erythroxylum cuneatum*		-	-	-
Euphorbiaceae		Rubber tree family			
282.	*Agrostistachys borneensis*		-	-	-
283.	*Agrostistachys leptostachys*		-	-	-
284.	*Agrostistachys sp.*		-	-	-
285.	*Agrostistachys longifolia*		-	-	-

286.	*Antidesma grandistipulata*		-	-	-
287.	*Antidesma leucopodum*		-	-	-
288.	*Antidesma lucida*		-	-	-
289.	*Antidesma neurocarpum*		-	-	-
290.	*Antidesma tomentosum var. tomentosum*		-	-	-
291.	*Antidesma venenosum*		-	-	-
292.	*Antidesma sp.*		-	-	-
293.	*Aporusa acuminatissima*		-	-	-
294.	*Aporusa aurea*		-	-	-
295.	*Aporusa confusa*		-	-	-
296.	*Aporusa elmeri*		-	-	-
297.	*Aporusa falcifera*		-	-	-
298.	*Aporusa grandistipulata*		-	-	-
299.	*Aporusa lucida*		-	-	-
300.	*Aporusa lunata*		-	-	-
301.	*Aporusa nitida*		-	-	-
302.	*Aporusa subcaudata*		-	-	-
303.	*Aporusa sp.*		-	-	-
304.	*Baccaurea javanica*		-	-	-
305.	*Baccaurea lanceolata*		-	-	-
306.	*Baccaurea macrocarpa*		-	-	-
307.	*Baccaurea macrophylla*		-	-	-
308.	*Baccaurea cf. macrophylla*		-	-	-
309.	*Baccaurea minor*		-	-	-
310.	*Baccaurea stipulata*		-	-	-
311.	*Baccaurea sumatrana*		-	-	-
312.	*Baccaurea tetandra*		-	-	-
313.	*Baccaurea trigonocarpa*		-	-	-
314.	*Baccaurea sp.*		-	-	-
315.	*Blumeodendron kurzii*		-	-	-
316.	*Blumeodendron tokbrai*		-	-	-
317.	*Chaetocarpus castanocarpus*		-	-	-
318.	*Cleistanthus baramicus*		-	-	-
319.	*Cleistanthus megacarpus*		-	-	-
320.	*Cleistanthus myrianthus*		-	-	-
321.	*Cleistanthus cf. myrianthus*		-	-	-
322.	*Cleistanthus cf. oblongatus*		-	-	-
323.	*Cleistanthus sumatranus*		-	-	-
324.	*Cleistanthus sp.*		-	-	-
325.	*Croton oblongifolius*		-	-	-
326.	*Croton argyratus*		-	-	-
327.	*Croton rheophyticus*		-	-	-
328.	*Croton sp.*		-	-	-
329.	*Diospyros macrophylla*		-	-	-
330.	*Drypetes gracilipes*		-	-	-
331.	*Drypetes kikir*		-	-	-
332.	*Drypetes longifolia*		-	-	-
333.	*Drypetes macrostigma*		-	-	-
334.	*Drypetes subcubica*		-	-	-
335.	*Drypetes sp.*		-	-	-
336.	*Endospermum malaccensis*		-	-	-
337.	*Endospermum peltatum*		-	-	-
338.	*Galearia fulva*		-	-	-
339.	*Glochidion calospermum*		-	-	-
340.	*Glochidion elmeri*		-	-	-
341.	*Glochidion hypoleucum*		-	-	-
342.	*Glochidion lutescens*		-	-	-
343.	*Glochidion rubrum*		-	-	-
344.	*Glochidion wallichianum*		-	-	-
345.	*Glochidion sp.*		-	-	-
346.	*Kolidodepas laevigatum*		-	-	-
347.	*Macaranga cf. pruinosa*		-	-	-
348.	*Macaranga gigantea*		-	-	-
349.	*Macaranga hypoleuca*		-	-	-
350.	*Macaranga lakeyi*		-	-	-

351.	*Macaranga lowii*		-	-	-
352.	*Macaranga macrostachys*		-	-	-
353.	*Macaranga pearsonii*		-	-	-
354.	*Macaranga penangensis*		-	-	-
355.	*Macaranga puberula*		-	-	-
356.	*Macaranga recurvata*		-	-	-
357.	*Macaranga winkleri*		-	-	-
358.	*Macaranga wrayi*		-	-	-
359.	*Mallotus caudatus*		-	-	-
360.	*Mallotus griffithianus*		-	-	-
361.	*Mallotus korthalsii*		-	-	-
362.	*Mallotus muticus*		-	-	-
363.	*Mallotus oblongifolius*		-	-	-
364.	*Mallotus penangensis*		-	-	-
365.	*Mallotus stercularis*		-	-	-
366.	*Mallotus stipularis*		-	-	-
367.	*Mallotus wrayi*		-	-	-
368.	*Mallotus sp.*		-	-	-
369.	*Melanolepis multiglandulosa*		-	-	-
370.	*Melanolepis sp.*		-	-	-
371.	*Moultonianthus leembruggianus*		-	-	-
372.	*Neoscortechinia forbesii*		-	-	-
373.	*Omphalea sargentii*		-	-	-
374.	*Omphalea sp.*		-	-	-
375.	*Oraphalia sp.*		-	-	-
376.	*Pimelodendron griffithianum*		-	-	-
377.	*Ptychopyxsis arborea*		-	-	-
378.	*Ptychopyxsis bacciformis*		-	-	-
379.	*Sauropus sp.*		-	-	-
380.	*Spathiostemon javensis*		-	-	-
381.	*Spathiostemon sp.*		-	-	-
382.	*Suregada glomerulata*		-	-	-
383.	*Trigonopleura malayana*		-	-	-
384.	*Trigonostemon sp.*		-	-	-
Fagaceae		Oak family: trees			
385.	*Castanopsis cf. psilophylla*		-	-	-
386.	*Castanopsis hypophoenica*		-	-	-
387.	*Castanopsis motleyana*		-	-	-
388.	*Castanopsis sp.*		-	-	-
389.	*Lithocarpus canteyanus*		-	-	-
390.	*Lithocarpus caudatifolius*		-	-	-
391.	*Lithocarpus clementianus*		-	-	-
392.	*Lithocarpus confertus*		-	-	-
393.	*Lithocarpus ewyckii*		-	-	-
394.	*Lithocarpus gracilis*		-	-	-
395.	*Lithocarpus hallieri*		-	-	-
396.	*Lithocarpus hatusimae*		-	-	-
397.	*Lithocarpus havilandii*		-	-	-
398.	*Lithocarpus leptogyne*		-	-	-
399.	*Lithocarpus lucidus*		-	-	-
400.	*Lithocarpus meijeri*		-	-	-
401.	*Lithocarpus nieuwenhuisii*		-	-	-
402.	*Lithocarpus pasuk*		-	-	-
403.	*Lithocarpus revolutus*		-	-	-
404.	*Lithocarpus sp.*		-	-	-
405.	*Quercus argentata*		-	-	-
406.	*Quercus lowii*		-	-	-
407.	*Quercus sumatrana*		-	-	-
408.	*Quercus treubiana*		-	-	-
409.	*Quercus valdinervosa*		-	-	-
410.	*Trigonobalanus verticillatus*		-	-	-
Flacourtiaceae		Rukam family: includes trees			
411.	*Casearia rugulosa*		-	-	-
412.	*Caseria sp.*		-	-	-
413.	*Flacourtia rukum*		-	-	-
414.	*Homalium sp.*		-	-	-

415.	*Hydnocarpus anomala*		-	-	-
416.	*Hydnocarpus borneensis*		-	-	-
417.	*Hydnocarpus polypetala*		-	-	-
418.	*Hydnocarpus sp.*		-	-	-
419.	*Hydnocarpus sumatrana*		-	-	-
420.	*Hydnocarpus woodi*		-	-	-
421.	*Pangium edule*		-	-	-
422.	*Ryparosa cf. baccaureiodes*		-	-	-
423.	*Ryparosa hullettii*		-	-	-
424.	*Ryparosa acuminate*		-	-	-
425.	*Ryparosa hulletii*		-	-	-
426.	*Ryparosa sp.*		-	-	-
Hypericacaeae		St. John`s Wort family: includes trees; often classified under Guttiferae			
427.	*Cratoxylum arborescens*		LC	-	-
428.	*Cratoxylum cochinchinense*		LC	-	-
429.	*Cratoxylum formosum*		LC	-	-
430.	*Cratoxylum sp.*		-	-	-
431.	*Cratoxylum sumatranum*		-	-	-
432.	*Calophyllum sp.*		-	-	-
Icacinaceae		Mainly trees and shrubs			
433.	*Iodes philippinensis*		-	-	-
434.	*Iodes sp.*		-	-	-
435.	*Stemonurus cf. grandiflorus*		-	-	-
436.	*Stemonurus grandifolius*		-	-	-
437.	*Stemonurus malaccensis*		-	-	-
438.	*Stemonurus secundiflorus var. lanceolatus*		-	-	-
Ixonanthaceae		Trees and shrubs			
439.	*Ixonanthes reticulate*		-	-	-
Juglandaceae		Walnut family: mainly trees			
440.	*Engelhardia serrata*		-	-	-
Lauraceae		Laurel family: mainly trees			
441.	*Actinodaphne borneensis*		-	-	-
442.	*Actinodaphne cf. oleifolia*		-	-	-
443.	*Actinodaphne diversifolia*		-	-	-
444.	*Actinodaphne pruinosa*		LC	-	-
445.	*Actinodaphne sp.*		-	-	-
446.	*Alseodaphne insignis*		-	-	-
447.	*Alseodaphne oblanceolata*		-	-	-
448.	*Alseodaphne rubiginosa*		-	-	-
449.	*Alseodaphne sp.*		-	-	-
450.	*Beilschmiedia assamica*		-	-	-
451.	*Beilschmiedia glabra*		-	-	-
452.	*Beilschmiedia micrantha*		-	-	-
453.	*Beilschmiedia tawaensis*		-	-	-
454.	*Beilschmiedia sp.*		-	-	-
455.	*Caryodanopsis tokensis*		-	-	-
456.	*Cinnamomum griffithii*		-	-	-
457.	*Cinnamomum racemosa*		-	-	-
458.	*Cinnamomum racemosum*		-	-	-
459.	*Cryptocarya cagayanensis*		-	-	-
460.	*Cryptocarya pulchrianervia*		-	-	-
461.	*Cryptocarya sp.*		-	-	-
462.	*Dehaasia caesia*		-	-	-
463.	*Dehaasia incrassata*		-	-	-
464.	*Dehaasia sp.*		-	-	-
465.	*Endiandra macrophylla*		-	-	-
466.	*Endiandra sp.*		-	-	-
467.	*Eusideroxylon zwageri*		VU	-	-
468.	*Litsea cf. accedens*		-	-	-
469.	*Lindera caesa var. rufa*		-	-	-
470.	*Litsea brachystachya*		-	-	-
471.	*Litsea calicarpa*		-	-	-
472.	*Litsea crassifolia*		-	-	-
473.	*Litsea elliptica*		-	-	-
474.	*Litsea ellipticacea*		-	-	-

475.	*Litsia fulva*		-	-	-
476.	*Litsea lancifolia*		-	-	-
477.	*Litsea adorifera*		-	-	-
478.	*Litsea oppositifolia*		-	-	-
479.	*Litsea resinosa*		-	-	-
480.	*Litsea sessilis*		-	-	-
481.	*Litsea sp.*		-	-	-
482.	*Neolitsea cassia*		-	-	-
483.	*Neolitsea sp.*		-	-	-
484.	*Nothaphoebe sarawakensis*		-	-	-
485.	*Nothaphoebe sp.*		-	-	-
486.	*Persea bancana*		-	-	-
487.	*Phoebe macrophylla*		-	-	-
488.	*Phoebe sp.*		-	-	-
Lecythidaceae		Brazil Nut family: includes trees			
489.	*Barringtonia lanceolata*		-	-	-
490.	*Barringtonia sarcostachys*		-	-	-
Leeaceae		Shrubs, trees and climbers			
491.	*Leea aculeata*		-	-	-
492.	*Leea indica*		-	-	-
493.	*Leea sp.*		-	-	-
Leguminosae or Fabaceae		Bean family: includes trees			
494.	*Albizia singularis*		-	-	-
495.	*Albizia splendens*		-	-	-
496.	*Archidendron cf. borneense*		-	-	-
497.	*Archidendron clypearia var. casai*		-	-	-
498.	*Bauhinia diptera*		-	-	-
499.	*Bauhinia kockiana*		LC	-	-
500.	*Bauhinia sp.*		-	-	-
501.	*Caesalpinia latisiliqua*		-	-	-
502.	*Caesalpinia sappan*		LC	-	-
503.	*Calleria sp.*		-	-	-
504.	*Crudia ornata*		-	-	-
505.	*Crudia reticulata*		-	-	-
506.	*Cynometra sp.*		-	-	-
507.	*Derris sp.*		-	-	-
508.	*Dialium indum*		-	-	-
509.	*Dialium kunstleri*		-	-	-
510.	*Dialium platysepalum*		-	-	-
511.	*Dialium sp.*		-	-	-
512.	*Entada sp.*		-	-	-
513.	*Fordia sp.*		-	-	-
514.	*Fordia splendidissima*		-	-	-
515.	*Koompassia excelsa*		CD	-	-
516.	*Koompassia malaccensis*		CD	-	-
517.	*Millettia cf. vasta*		-	-	-
518.	*Mucuna biplicata*		-	-	-
519.	*Mucuna sp.*		-	-	-
520.	*Parkia javanica*		-	-	-
521.	*Parkia jiringa*		-	-	-
522.	*Parkia speciosa*		-	-	-
523.	*Peltophorum racemosum*		-	-	-
524.	*Pahnera kockiana*		-	-	-
525.	*Saraca sp.*		-	-	-
526.	*Sindora irpicina*		-	-	-
527.	*Sindora sp.*		-	-	-
528.	*Sindora velutina*		-	-	-
529.	*Spatholobus gyrocarpus*		LC	-	-
530.	*Spatholobus latibractea*		-	-	-
531.	*Spatholobus macropterus*		-	-	-
532.	*Spatholobus sp.*		-	-	-
Loganiaceae		Strychnine family: includes trees			
533.	*Fagraea blumii*		-	-	-
534.	*Fagraea involucrata*		-	-	-
535.	*Fagraea kuminii*		-	-	-
536.	*Fagraea macroscypha*		-	-	-

537.	*Fagraea racemosa*		-	-	-
538.	*Fagraea spicata*		-	-	-
539.	*Fagraea splendens*		-	-	-
540.	*Fagraea sp.*		-	-	-
541.	*Mitrasacme sp.*		-	-	-
542.	*Strychnos ignatii*		-	-	-
Magnoliaceae		Chempaka family: includes trees			
543.	*Magnolia candollii*		-	-	-
544.	*Magnolia candollii var. candollei*		-	-	-
545.	*Magnolia drymifolia*		-	-	-
546.	*Magnolia gigantifolia*		-	-	-
547.	*Magnolia sp.*		-	III	-
548.	*Michelia sp.*		-	-	-
549.	*Talauma craibiana*		-	-	-
550.	*Talauma gitingensis*		-	-	-
Melastomataceae		Sendudok family: trees, climbers, shrubs, epiphytes and herbs			
551.	*Allomorphia sp.*		-	-	-
552.	*Anerincleistus echinatus*		-	-	-
553.	*Anerincleistus macrophylla*		-	-	-
554.	*Anerincleistus setulosus*		-	-	-
555.	*Anerincleistus sp.*		-	-	-
556.	*Astronia sp.*		-	-	-
557.	*Blastus cogniauxii*		-	-	-
558.	*Blastus sp.*		-	-	-
559.	*Creaghiella purpurea*		-	-	-
560.	*Creaghiella setosa*		-	-	-
561.	*Diplectria glabra*		-	-	-
562.	*Diplectria sp.*		-	-	-
563.	*Dissochaeta beccariana*		-	-	-
564.	*Dissochaeta punctulata*		-	-	-
565.	*Dissochaeta rubiginosa*		-	-	-
566.	*Dissochaeta sp.*		-	-	-
567.	*Driessenia microthrix*		-	-	-
568.	*Driessenia sp.*		-	-	-
569.	*Kibessia galeata*		-	-	-
570.	*Kibessia korthalsia*		-	-	-
571.	*Medinilla crassifolia*		-	-	-
572.	*Medinilla cf. quadrifolia*		-	-	-
573.	*Medinilla macrophylla*		-	-	-
574.	*Medinilla polyanthum*		-	-	-
575.	*Medinilla cf. laxiflora*		-	-	-
576.	*Medinilla suberosa*		-	-	-
577.	*Medinilla succulenta*		-	-	-
578.	*Medinilla tawaoensis*		-	-	-
579.	*Medinilla sp.*		-	-	-
580.	*Melastoma anomala*		-	-	-
581.	*Melastoma beccarianum*		-	-	-
582.	*Melastoma laevifolia*		-	-	-
583.	*Melastoma malabathricum*		-	-	-
584.	*Melastoma neccarianum*		-	-	-
585.	*Melastoma oxypora*		-	-	-
586.	*Melastoma stenophylla*		-	-	-
587.	*Melastoma sp.*		-	-	-
588.	*Melastomata cledimia*		-	-	-
589.	*Melastomata sonnerila*		-	-	-
590.	*Memecylon appendiculatum*		-	-	-
591.	*Memecylon beccarianum*		-	-	-
592.	*Memecylon borneensis*		-	-	-
593.	*Memecylon costatum*		-	-	-
594.	*Memecylon edule*		-	-	-
595.	*Memecylon laevigatum*		-	-	-
596.	*Memecylon paniculatum*		-	-	-
597.	*Memecylon sp.*		-	-	-
598.	*Ochthocharis sp.*		-	-	-
599.	*Oxyspora sp.*		-	-	-

600.	*Pachycentria constricta*		-	-	-
601.	*Pachycentria pulverulenta*		-	-	-
602.	*Pachycentria sp.*		-	-	-
603.	*Phyllagathis sp.*		-	-	-
604.	*Pternandra coerulescens*		-	-	-
605.	*Pternandra cf. rostrata*		-	-	-
606.	*Pternandra sp.*		-	-	-
607.	*Sonerila borneensis*		-	-	-
608.	*Sonerila crassiusscule*		-	-	-
609.	*Sonerila kinabaluensis*		-	-	-
610.	*Sonerila sp.*		-	-	-
611.	*Sonerila maculata*		-	-	-
612.	*Sonerila nervulosa*		-	-	-
Meliaceae		Sentol family: mainly trees			
613.	*Aglaia affinis*		-	-	-
614.	*Aglaia brachybotrys*		-	-	-
615.	*Aglaia cassenaria*		-	-	-
616.	*Aglaia crassinaria*		-	-	-
617.	*Aglaia elliptica*		LC	-	-
618.	*Aglaia forbesii*		NT	-	-
619.	*Aglaia gamopelata*		-	-	-
620.	*Aglaia ganggo*		-	-	-
621.	*Aglaia cf. glabrata*		-	-	-
622.	*Aglaia luzoniensis*		NT	-	-
623.	*Aglaia odoratissima*		LC	-	-
624.	*Aglaia oligophylla*		NT	-	-
625.	*Aglaia palembanica*		NT	-	-
626.	*Aglaia polyantha*		-	-	-
627.	*Aglaia rivularis*		VU	-	-
628.	*Aglaia rufa*		-	-	-
629.	*Aglaia rufinervis*		NT	-	-
630.	*Aglaia tomentosa*		LC	-	-
631.	*Aglaia trichostemon*		-	-	-
632.	*Aglaia sp.*		-	-	-
633.	*Amoora sp.*		-	-	-
634.	*Aphanamixis borneensis*		-	-	-
635.	*Chisocheton beccarianum*		-	-	-
636.	*Chisocheton divergens*		-	-	-
637.	*Chisocheton patens*		-	-	-
638.	*Chisocheton sarawakensis*		-	-	-
639.	*Chisocheton sp.*		-	-	-
640.	*Dysoxylon sp.*		-	-	-
641.	*Dysoxylon cf. acutangula*		-	-	-
642.	*Dysoxylum cyrtobotryum*		-	-	-
643.	*Dysoxylum nigulosum*		-	-	-
644.	*Dysoxylum pachyrhache*		-	-	-
645.	*Dysoxylum rugulosum*		-	-	-
646.	*Disoxylum sp.*		-	-	-
647.	*Reinwarditiodendron humile*		-	-	-
648.	*Sandoricum koetjape*		-	-	-
649.	*Walsura pinnata*		-	-	-
650.	*Walsura sp.*		-	-	-
Moraceae		Mulberry family: trees, climbers, shrubs, epiphytes and herbs			
651.	*Antiaris toxicaria*		-	-	-
652.	*Artocarpus anisophyllus*		-	-	-
653.	*Artocarpus dadah*		-	-	-
654.	*Artocarpus elasticus*		-	-	-
655.	*Artocarpus kemando*		-	-	-
656.	*Artocarpus lanceifolius*		-	-	-
657.	*Artocarpus nitidus*		-	-	-
658.	*Artocarpus sp.*		-	-	-
659.	*Ficus aff. Endospermifolia*		-	-	-
660.	*Ficus annulata*		-	-	-
661.	*Ficus auraliacea var. parvifolia*		-	-	-
662.	*Ficus bennendijkii*		-	-	-
663.	*Ficus caulocarpa*		-	-	-

664.	*Ficus cereicarpa*		-	-	-
665.	*Ficus cucurbitina*		-	-	-
666.	*Ficus cuspida*		-	-	-
667.	*Ficus delosyce*		-	-	-
668.	*Ficus deltoids*		-	-	-
669.	*Ficus depressa*		-	-	-
670.	*Ficus fistulosa*		-	-	-
671.	*Ficus lepicarpa var. levibracteata*		-	-	-
672.	*Ficus leptocalama*		-	-	-
673.	*Ficus megaleia var. subuncinata*		-	-	-
674.	*Ficus obscura Blume*		-	-	-
675.	*Ficus obscura var. obscura*		-	-	-
676.	*Ficus oleafolia var. memecylifolia*		-	-	-
677.	*Ficus sp.*		-	-	-
678.	*Ficus sundaica*		-	-	-
679.	*Ficus uncinata*		-	-	-
Myristicaceae		Nutmeg family: includes trees			
680.	*Gymnacranthera forbesii*		-	-	-
681.	*Horsfielda borneensis*		-	-	-
682.	*Horsfielda grandis*		-	-	-
683.	*Horsfielda polyspherula var. maxima*		-	-	-
684.	*Horsfielda sp.*		-	-	-
685.	*Kibara sp.*		-	-	-
686.	*Knema cf. latericia*		-	-	-
687.	*Knema cf. latericia var. olbifolia*		-	-	-
688.	*Knema cinerea*		-	-	-
689.	*Knema conferta*		LC	-	-
690.	*Knema curtisii*		-	-	-
691.	*Knema elmeri*		LC	-	-
692.	*Knema galeata*		-	-	-
693.	*Knema kinabaluensis*		CD	-	-
694.	*Knema latericia*		-	-	-
695.	*Knema latericia var. albifolia*		-	-	-
696.	*Knema latifolia*		LC	-	-
697.	*Knema laurina*		-	-	-
698.	*Knema lepirifolia*		-	-	-
699.	*Knema oblongata*		-	-	-
700.	*Knema pallens*		-	-	-
701.	*Kenma sp.*		-	-	-
702.	*Myristica cinnamomea*		LC	-	-
703.	*Myristica malaccensis*		-	-	-
Myrsinaceae		Ardisia family: treelets, climbers, shrubs and herbs			
704.	*Ardisia cf. elliptica*		-	-	-
705.	*Ardisia colorata*		-	-	-
706.	*Ardesia forbesii*		-	-	-
707.	*Ardisia lanceolata*		-	-	-
708.	*Ardisia macrophylla*		-	-	-
709.	*Ardisia oxyphylla*		-	-	-
710.	*Ardisia obovatifolia*		-	-	-
711.	*Ardisia potysticta*		-	-	-
712.	*Ardisia ridleyi*		-	-	-
713.	*Ardisia sanguinolenta*		-	-	-
714.	*Ardisia sp.*		-	-	-
715.	*Embelia coriacea*		-	-	-
716.	*Embelia minutifolia*		-	-	-
717.	*Embelia myrtillus*		-	-	-
718.	*Embelia oblongata*		-	-	-
719.	*Embelia sp.*		-	-	-
720.	*Labisia pumila*		-	-	-
721.	*Labisia pumila var. lanceolata*		-	-	-
722.	*Labisia punctata*		-	-	-
723.	*Labisia sp.*		-	-	-

724.	*Maesa macrothyrsa*		-	-	-
725.	*Maesa macrocarpa*		-	-	-
Myrtaceae		Myrtle family: trees and shrubs			
726.	*Eugenia bankense*		-	-	-
727.	*Eugenia barringtoniodes*		-	-	-
728.	*Eugenia cf. ampullaris*		-	-	-
729.	*Eugenia chrysantha*		-	-	-
730.	*Eugenia claviflora var. riparia*		-	-	-
731.	*Eugenia densiflora*		-	-	-
732.	*Eugenia kinabluensis*		-	-	-
733.	*Eugenia perpuncticulata*		-	-	-
734.	*Eugenia rajangense*		-	-	-
735.	*Eugenia rugosa*		-	-	-
736.	*Eugenia sp.*		-	-	-
737.	*Eugenia stapfiana*		LC	-	-
738.	*Eugenia valdevenosa*		-	-	-
739.	*Rhodamnia cinerea*		-	-	-
740.	*Rhodamnia sp.*		-	-	-
741.	*Syzygium alcinae*		-	-	-
742.	*Syzygium ampullarium*		-	-	-
743.	*Syzygium bankensis*		-	-	-
744.	*Syzygium calabatun*		-	-	-
745.	*Syzygium cerasiformis*		-	-	-
746.	*Syzygium chrysantha*		-	-	-
747.	*Syzygium corymbifera*		-	-	-
748.	*Syzygium elliptilimba*		-	-	-
749.	*Syzygium kingii*		-	-	-
750.	*Syzygium myrtillus*		-	-	-
751.	*Syzygium ochneocarpa*		-	-	-
752.	*Syzygium rostrata*		-	-	-
753.	*Syzygium sp.*		-	-	-
754.	*Syzygium tetragonocladum*		-	-	-
755.	*Tristania anomala*		-	-	-
756.	*Tristania cf. grandifolia*		-	-	-
757.	*Tristania grandifolia*		-	-	-
758.	*Tristania sp.*		-	-	-
759.	*Tristaniopsis cf. grandiflora*		-	-	-
760.	*Tristaniopsis clementis*		-	-	-
761.	*Tristaniopsis merguensis*		-	-	-
762.	*Tristania obovata*		-	-	-
763.	*Tristaniopsis sp.*		-	-	-
764.	*Tristaniopsis whitiana*		-	-	-
Ochnaceae		Trees and shrubs			
765.	*Euthemis leucocarpa*		-	-	-
766.	*Euthemis minor*		LC	-	-
767.	*Euthemis sp.*		-	-	-
768.	*Gomphia borneensis*		-	-	-
769.	*Gomphia serrata*		LC	-	-
770.	*Gomphia sp.*		-	-	-
771.	*Neckia serrata*		-	-	-
Olacaceae		Petaling family: trees, climbers and shrubs			
772.	*Ochanostachys amentacea*		Data deficient	-	-
773.	*Ochanostachys sp.*		-	-	-
774.	*Scorodocarpus borneensis*		-	-	-
Oleaceae		Olive family: trees, climbers and shrubs			
775.	*Chionanthus beccarianus*		-	-	-
776.	*Chionanthus crispus*		-	-	-
777.	*Chionanthus curvicarpus*		-	-	-
778.	*Chionanthus laxiflorus*		-	-	-
779.	*Chionanthus sp.*		-	-	-
780.	*Jasminum sp.*		-	-	-
Oxalidaceae		Belimbing family: includes trees			
781.	*Sarcotheca diversifolia*		-	-	-
Palmae or Arecaceae		Palms			
782.	*Areca kinabaluensis*		-	-	-
783.	*Areca minuta*		-	-	-

784.	*Areca sp.*		-	-	-
785.	*Arenga undulatifolia*		-	-	II
786.	*Borassodendron sp.*		-	-	-
787.	*Calamus blumei*		-	-	-
788.	*Calamus ceasius*		-	-	-
789.	*Calamus conirostris*		-	-	-
790.	*Calamus convallium*		-	-	-
791.	*Calamus diepenhorstii*		-	-	-
792.	*Calamus flabelloides*		-	-	-
793.	*Calamus cf. Gonospermus*		-	-	-
794.	*Calamus hepburnii*		-	-	-
795.	*Calamus javensis*		-	-	-
796.	*Calamus laevigatus*		-	-	-
797.	*Calamus marginatus*		-	-	-
798.	*Calamus muricatus*		-	-	-
799.	*Calamus ornatus*		-	-	-
800.	*Calamus oxleyanus*		-	-	-
801.	*Calamus pandanosmus*		-	-	-
802.	*Calamus paspalanthus*		-	-	-
803.	*Calamus praetermissus*		-	-	-
804.	*Calamus sarawakensis*		-	-	-
805.	*Calamus scabrifolius*		-	-	-
806.	*Calamus scipionum*		-	-	-
807.	*Calamus sp.*		-	-	-
808.	*Caryota mitis*		-	-	2
809.	*Ceratolobus concolor*		-	-	2
810.	*Daemonorops didymophylla*		-	-	-
811.	*Daemonorops elongata*		-	-	-
812.	*Daemonorops fissa*		-	-	-
813.	*Daemonorops korthalsii*		-	-	-
814.	*Daemonorops longipes*		-	-	-
815.	*Daemonorops microstachys*		-	-	-
816.	*Daemonorops oxycarpa*		-	-	-
817.	*Daemonorops ruptilis*		-	-	-
818.	*Daemonorops sabut*		-	-	-
819.	*Daemonorops sparsiflora*		-	-	-
820.	*Daemonorops sp.*		-	-	-
821.	*Eugeissona utilis*		-	-	-
822.	*Iguanura cf. Polymorpha*		-	-	-
823.	*Korthalsia concolor*		-	-	-
824.	*Korthalsia echinometra*		-	-	-
825.	*Korthalsia ferox*		-	-	-
826.	*Korthalsia furtadoana*		-	-	-
827.	*Korthalsia jala*		-	-	-
828.	*Khortalsia rigida*		-	-	-
829.	*Korthalsia robusta*		-	-	-
830.	*Korthalsia rostrata*		-	-	-
831.	*Korthalsia sp.*		-	-	-
832.	*Licuala valida*		-	-	-
833.	*Oncosperma horridum*		-	-	-
834.	*Oncosperma sp.*		-	-	-
835.	*Pholidocarpus maiadum*		-	-	-
836.	*Pinanga aristata*		-	-	-
837.	*Pinanga lepidota*		-	-	-
838.	*Pinanga salicifolia*		-	-	-
839.	*Pinanga capitata*		-	-	-
840.	*Plectocomia elongata*		-	-	-
841.	*Plectocomia geminiflora*		-	-	-
842.	*Plectocomia mulleri*		-	-	-
843.	*Plectocomiopsis geminiflora*		-	-	-
844.	*Retispatha dumetosa*		-	-	-
845.	*Salacca cf. Affinis*		-	-	-
846.	*Salacca ramosiana*		-	-	-
Pittosporaceae		Splay-berry family: mainly shrubs and trees			
847.	*Pittosporum ferrugineum*		-	-	-
848.	*Pittosporum resiniferum*		-	-	-
Podocarpaceae		Conifers			

849.	*Dacrycarpus imbricatus var. patulus*		-	-	-
850.	*Dacrydium beccarii*		LC	-	-
851.	*Dacrydium elatum*		LC	-	-
852.	*Dacrydium pectinatum*		LC	-	-
853.	*Dacrydium sp.*		-	-	-
854.	*Dacrydium xanthandrum*		LC		
855.	*Falcatifolium falciforme*		LC	-	-
856.	*Phyllocladus hypophyllus*		LC	-	-
857.	*Podocarpus imbricatus*		-	-	2
858.	*Podocarpus neriifolius*		LC	III	2
859.	*Podocarpus polystachyus*		LC	-	2
860.	*Podocarpus sp.*		-	-	2
Polygalaceae		Trees, shrubs, herbs and climbers			
861.	*Epirixanthes sp.*		-	-	-
862.	*Polygala sp.*		-	-	-
863.	*Xantophylla sp.*		-	-	-
864.	*Xanthophyllum affine*		-	-	-
865.	*Xanthophyllum amoenum*		-	-	-
866.	*Xanthophyllum beccarianum*		-	-	-
867.	*Xanthophyllum gracile*		-	-	-
868.	*Xanthophyllum havilandii*		-	-	-
869.	*Xanthophyllum palembanicum*		-	-	-
870.	*Xanthophyllum rufum*		-	-	-
871.	*Xanthophyllum sp.*		-	-	-
872.	*Xanthophyllum stipitatum*		-	-	-
873.	*Xanthophyllum velutinum*		-	-	-
874.	*Xanthophyllum vitellinum*		-	-	-
Proteaceae		Silky oak family: trees and shrubs			
875.	*Helecia excelsa*		-	-	-
876.	*Helecia petiolaris*		-	-	-
877.	*Helecia attenuata*		-	-	-
878.	*Helecia robusta*		-	-	-
879.	*Helecia sp.*		-	-	-
880.	*Heleciopsis artocarpoides*		-	-	-
Rhamnaceae		Jujube family: trees, climbers and shrubs			
881.	*Ventilago sp.*		-	-	-
882.	*Zizyphus borneensis*		-	-	-
883.	*Zizyphus calophylla*		-	-	-
884.	*Zizyphus sp.*		-	-	-
Rhizophoraceae		Mangrove family: mainly trees			
885.	*Anisophyllea coneri*		-	-	-
886.	*Carallia brachiata*		-	-	-
Rosaceae		Rose family: trees, shrubs, scramblers and herbs			
887.	*Angelesia cf. splendens*		-	-	-
888.	*Prunus arborea var. densa*		-	-	-
889.	*Prunus arborea var. stipulacea*		-	-	-
890.	*Prunus polystachys*		-	-	-
891.	*Prunus sp.*		-	II	-
892.	*Rubus glomeratus*		-	-	-
893.	*Rubus mollucanus*		-	-	-
894.	*Rubus sp.*		-	-	-
Rubiaceae		Coffee family: trees, climbers, shrubs and herbs			
895.	*Acranthera cf. atropella*		-	-	-
896.	*Acranthera sp.*		-	-	-
897.	*Aidia borneensis*		-	-	-
898.	*Anthocephalus chinensis*		-	-	-
899.	*Antirhea sp.*		-	-	-
900.	*Argostemma boragineum*		-	-	-
901.	*Argostemma sp.*		-	-	-
902.	*Canthium sp.*		-	-	-
903.	*Cephaelis sp.*		-	-	-
904.	*Chassalia sp.*		-	-	-
905.	*Coptosapelta sp.*		-	-	-
906.	*Cowiea sp.*		-	-	-

907.	*Cyanoneuron pubescens*		-	-	-
908.	*Diplospora sp.*		-	-	-
909.	*Discospermum abnorme*		-	-	-
910.	*Gaertnera borneensis*		-	-	-
911.	*Gaertnera sp.*		-	-	-
912.	*Gaertnera vaginans*		-	-	-
913.	*Gaertnera vaginans ssp. Junghuhniana*		-	-	-
914.	*Gardenia tubifera*		-	-	-
915.	*Geophila sp.*		-	-	-
916.	*Hedyotis cf. philippinesis*		-	-	-
917.	*Hedyotis congesta*		-	-	-
918.	*Hedyotis rigida*		-	-	-
919.	*Hedyotis sp.*		-	-	-
920.	*Hedyotis tenelliflora*		-	-	-
921.	*Hydnophytum cf. formicarium*		-	-	-
922.	*Hydnophytum sp.*		-	-	-
923.	*Hypobathrum sp.*		-	-	-
924.	*Ixora blumei*		-	-	-
925.	*Ixora cf. urophylla*		-	-	-
926.	*Ixora congesia*		-	-	-
927.	*Ixora elliptica*		-	-	-
928.	*Ixora fucosa*		-	-	-
929.	*Ixora grandiflora*		-	-	-
930.	*Ixora javanicum*		-	-	-
931.	*Ixora pyrantha*		-	-	-
932.	*Ixora sp.*		-	-	-
933.	*Ixora stenophylla*		-	-	-
934.	*Ixora griffithii*		-	-	-
935.	*Ixora brachyantha*		-	-	-
936.	*Lasianthus borneensis*		-	-	-
937.	*Lasianthus chrysens*		-	-	-
938.	*Lasianthus inaequalis*		-	-	-
939.	*Lasianthus membranaceus*		-	-	-
940.	*Lasianthus polycarpus*		-	-	-
941.	*Lasianthus sp.*		-	-	-
942.	*Lucinaea sp.*		-	-	-
943.	*Morinda ? sp.*		-	-	-
944.	*Motleyia borneensis*		-	-	-
945.	*Mussaenda elmeri*		-	-	-
946.	*Mussaluola sp.*		-	-	-
947.	*Myrmecodia sp.*		-	-	-
948.	*Myrmeconauclea strigosa*		-	-	-
949.	*Nauclea griffithii*		-	-	-
950.	*Nauclea officinalis*		-	-	-
951.	*Nauclea sp.*		-	-	-
952.	*Nauclea subdita*		-	-	-
953.	*Neonauclea excelsioides*		-	-	-
954.	*Neonauclea gigantifolia*		-	-	-
955.	*Neonauclea longipedunculata*		-	-	-
956.	*Neonauclea pseudocalycina*		-	-	-
957.	*Neonauclea sp.*		-	-	-
958.	*Ophiorrhiza sp.*		-	-	-
959.	*Ophiorrhiza winkleri*		-	-	-
960.	*Paederia sp.*		-	-	-
961.	*Pavetta sp.*		-	-	-
962.	*Pleiocarpidia polyneura*		-	-	-
963.	*Pleiocarpidia sp.*		-	-	-
964.	*Porterandia anisophylla*		-	-	-
965.	*Praravinia borneensis*		-	-	-
966.	*Praravinia sericotricha*		-	-	-
967.	*Praravinia sp.*		-	-	-
968.	*Praravinia suberosa*		-	-	-
969.	*Praravinia verruculosa*		-	-	-
970.	*Prismatomeris beccariana*		-	-	-

971.	*Prismatomeris sp.*		-	-	-
972.	*Prismatomeris tetrandra*		-	-	-
973.	*Psychotria aurantiaca*		-	-	-
974.	*Psychotria densifolia*		-	-	-
975.	*Psychotria sarmentosa*		-	-	-
976.	*Psychotria sp.*		-	-	-
977.	*Psychotria polycarpa*		-	-	-
978.	*Psychotria valetonii*		-	-	-
979.	*Psydrax sp.*		-	-	-
980.	*Rennellia borneensis*		-	-	-
981.	*Rennellia sp.*		-	-	-
982.	*Saprosma arborea*		-	-	-
983.	*Schradera korthalsiana*		-	-	-
984.	*Schradera montana*		-	-	-
985.	*Schradera (Lucinaea) nervulosa*		-	-	-
986.	*Steenisia sp.*		-	-	-
987.	*Streblosa sp.*		-	-	-
988.	*Streblus sp.*		-	-	-
989.	*Tarenna cumingiana*		-	-	-
990.	*Tarenna sp.*		-	-	-
991.	*Timonius cf. flavescens*		-	-	-
992.	*Timonius eskerianus*		-	-	-
993.	*Timonius flavescens*		-	-	-
994.	*Timonius sp.*		-	-	-
995.	*Timonius borneensis*		-	-	-
996.	*Uncaria calophylla*		-	-	-
997.	*Uncaria cordata*		-	-	-
998.	*Uncaria gambir*		-	-	-
999.	*Uncaria sp.*		-	-	-
1000.	*Urophyllum arboreum*		-	-	-
1001.	*Urophyllum cf. pleiocapidia*		-	-	-
1002.	*Urophyllum glabrum*		-	-	-
1003.	*Urophyllum griffithianum*		-	-	-
1004.	*Urophyllum hirsutum*		-	-	-
1005.	*Urophyllum sp.*		-	-	-
1006.	*Urophyllum woodii*		-	-	-
1007.	*Wendlandia dasythyrsa*		-	-	-
1008.	*Zeuxantha moultonii*		-	-	-
Rutaceae		Orange family: trees, shrubs and climbers			
1009.	*Clausena excavata*		-	-	-
1010.	*Luvunga samentosa*		-	-	-
1011.	*Luvunga sp.*		-	-	-
1012.	*Maclurodendron porteri*		-	-	-
1013.	*Melicope subunifoliolata*		VU	-	-
1014.	*Tetractomia tetandrum*		-	-	-
1015.	*Tetractomia tetrandra*		-	-	-
Sabiaceae		Trees or climbers			
1016.	*Meliosma sumatrana*		-	-	-
1017.	*Polyosma lantifolia*		-	-	-
Sapindaceae		Soap-nut family: trees, shrubs and climbers			
1018.	*Allophyllus cobbe*		-	-	-
1019.	*Guioa pleuropteris*		-	-	-
1020.	*Guioa pterorhachis*		-	-	-
1021.	*Harpullia sp.*		-	-	-
1022.	*Lansium domesticum*		-	-	-
1023.	*Lepisanthes sp.*		-	-	-
1024.	*Mischocarpus pentapetalus*		-	-	-
1025.	*Mischocarpus sundaicus*		-	-	-
1026.	*Nephelium cf. mutabile*		-	-	-
1027.	*Nephelium cuspidatum var. robustum*		-	-	-
1028.	*Phelium maingayi*		-	-	-
1029.	*Nephelium ramboutan-ake*		-	-	-
1030.	*Nephelium sp.*		-	-	-
1031.	*Nephelium uncinatum*		-	-	-
1032.	*Paranephelium nitidum*		-	-	-

1033.	*Pometia pinnata*		-	-	-
1034.	*Xerospermum noronhianum*		-	-	-
Sapotaceae		Chiku family: includes trees			
1035.	*Ganua kingiana*		-	-	-
1036.	*Ganua sarawakensis*		-	-	-
1037.	*Madhuca cf. sandakenensis*		-	-	-
1038.	*Madhuca kingiana*		-	-	-
1039.	*Madhuca korthalsii*		-	-	-
1040.	*Madhuca mindanaensis*		-	-	-
1041.	*Madhuca sandakanensis*		-	-	-
1042.	*Madhuca sp.*		-	-	-
1043.	*Palaquium beccarianum*		-	-	-
1044.	*Palaquium cf. endertii*		-	-	-
1045.	*Palaquium gutta*		-	-	-
1046.	*Palaquium lieocarpum*		-	-	-
1047.	*Palaquium rostratum*		-	-	-
1048.	*Palaquium sericeum*		-	-	-
1049.	*Palaquium sp.*		-	-	-
1050.	*Palaquium stenophyllum*		-	-	-
1051.	*Payena gigas*		-	-	-
1052.	*Payena microphylla*		-	-	-
1053.	*Pouteria malaccensis*		-	-	-
1054.	*Pouteria sp.*		-	-	-
Saurauiaceae		Trees or shrubs			
1055.	*Saurauia acuminate*		-	-	-
1056.	*Saurauia borneensis*		-	-	-
1057.	*Saurauia cf. ferox*		-	-	-
1058.	*Saurauia sp.*		-	-	-
1059.	*Saurauia strigosa*		-	-	-
Saxifragaceae		Trees, shrubs and herbs			
1060.	*Polyosma cf. cyanea*		-	-	-
1061.	*Polyosma integrifolia*		-	-	-
1062.	*Polyosma latifolia*		-	-	-
1063.	*Polyosma mutabilis*		-	-	-
1064.	*Polyosma sp.*		-	-	-
Simaroubaceae		Tree-of-heaven family: mainly treelets and trees			
1065.	*Eurycoma longifolia*		-	-	-
Sonneratiaceae		Mangrove and inland trees			
1066.	*Duabanga mollucana*		-	-	-
Sterculiaceae		Cacao family: includes trees			
1067.	*Heritiera borneensis*		-	-	-
1068.	*Heritiera elata*		-	-	-
1069.	*Heritiera impressinervia*		-	-	-
1070.	*Heritiera simplicifolia*		-	-	-
1071.	*Heritiera sp.*		-	-	-
1072.	*Heritiera sumatrana*		-	-	-
1073.	*Pterospermum oblongum*		-	-	-
1074.	*Pterospermum sp.*		-	-	-
1075.	*Scaphium affine*		-	-	-
1076.	*Scaphium longipetiolatum*		-	-	-
1077.	*Scaphium macropodum*		LC	-	-
1078.	*Sterculia cordata*		-	-	-
1079.	*Sterculia rubiginosa var. setistipulata*		-	-	-
1080.	*Sterculia sp.*		-	-	-
1081.	*Sterculia stipulata*		-	-	-
Styracaceae		Trees			
1082.	*Bruinsmia styracoides*		-	-	-
Symplocaceae		Alum-tree family			
1083.	*Symplocos anomala*		-	-	-
1084.	*Symplocos henschelii var. henschelii*		-	-	-
1085.	*Symplocos ophirensis ssp. Cumingiana var. cumingiana*		-	-	-
1086.	*Symplocos pendula var. hirtistylis*		-	-	-
1087.	*Symplocos sp.*		-	-	-

Tetrameristaceae		Trees or shrubs			
1088.	*Tetramerista glabra*		-	-	-
Theaceae		Tea family: shrubs or trees			
1089.	*Adinandra clemensiae*		-		
1090.	*Adinandra collina*		-	-	-
1091.	*Adinandra dumosa*		-	-	-
1092.	*Adinandra excelsa*		-	-	-
1093.	*Adinandra miquelianus*		-	-	-
1094.	*Adinandra sp.*		-	-	-
1095.	*Eurya acuminata*		-	-	-
1096.	*Eurya obora*		-	-	-
1097.	*Gordonia sarawakensis*		-	-	-
1098.	*Gordonia sp.*		-	-	-
1099.	*Pyrenaria cf. kunstleri*		-	-	-
1100.	*Pyrenaria parviflora*		-	-	-
1101.	*Pyrenaria tawauensis*		-	-	-
1102.	*Schima brevifolia*		-	-	-
1103.	*Schima monticola*		-	-	-
1104.	*Schima sp.*		-	-	-
1105.	*Schima wallichiana*		-	-	-
1106.	*Schima wallichii ssp. Monticola*		-	-	-
1107.	*Ternstroemia aneura*		-	-	-
1108.	*Ternstroemia cf. microcalyx*		-	-	-
1109.	*Ternstroemia coriacea*		-	-	-
1110.	*Ternstroemia elongata*		-	-	-
1111.	*Ternstroemia sp.*		-	-	-
1112.	*Ternstroemia lowii*		-	-	-
Thymelaeaceae		Daphne family: trees, shrubs, climbers and herbs			
1113.	*Aquilaria malaccensis*		VU	II	-
1114.	*Gonystylus bancanus*		VU	-	-
1115.	*Gonystylus forbesii*		-	-	-
1116.	*Gonystylus sp.*		-	-	-
1117.	*Wikstroemia androsaemifolia*		-	-	-
1118.	*Wikstroemia sp.*		-	-	-
1119.	*Wikstroemia tenuiramis*		-	-	-
Tiliaceae		Jute family: mainly trees and shrubs			
1120.	*Brownlowia peltata*		-		
1121.	*Brownlowia sp.*		-		-
1122.	*Microcos antidesmifolia*		-	-	-
1123.	*Microcos cinamomifolia*		-	-	-
1124.	*Microcos elmeri*		-	-	-
1125.	*Microcos reticulata*		-	-	-
1126.	*Microcos sp.*		-	-	-
1127.	*Pentace laxiflora*		-	-	-
Trigoniaceae		Trees			
1128.	*Trigoniastrum hypoleucum*		-	-	-
Ulmaceae		Elm family: trees and shrubs			
1129.	*Gironniera nervosa*		-	-	-
1130.	*Gironniera subaequalis*		-	-	-
Urticaceae		Nettle family: trees, shrubs, climbers and herbs			
1131.	*Astrothalamus sp.*		-	-	-
1132.	*Elastotema integrifolium*		-	-	-
1133.	*Elastotema sp.*		-	-	-
1134.	*Poikilospermum sp.*		-	-	-
1135.	*Poikilospermum suaveolens*		-	-	-
Verbenaceae		Verbena family: trees, shrubs, climbers and herbs			
1136.	*Callicarpa candicans*		-	-	-
1137.	*Callicarpa longifolia*		-	-	-
1138.	*Callicarpa sp.*		-	-	-
1139.	*Clerodendron sp.*		-	-	-
1140.	*Clerodendrum pygnaeum*		-	-	-
1141.	*Clerodendrum cf. album*		-	-	-
1142.	*Petraeovitex sp.*		-	-	-
1143.	*Petraeovitex ternate*		-	-	-
1144.	*Premna sp.*		-	-	-
1145.	*Teijsmanniodendron glabrum*		-	-	-

1146.	*Teijsmanniodendron holophyllum*		-	-	-
1147.	*Teijsmanniodendron simplicifolium*		-	-	-
1148.	*Teijsmanniodendron sp.*		-	-	-

Notes:

a. General:
Arranged in accordance to Lee (2003).
Species in blue are new to the list
* Endemic to Borneo

b. IUCN Red List Structure

Extinct (EX)	
Extinct in the Wild (EW)	
Threatened	Critically Endangered (CR)
	Endangered (EN)
	Vulnerable (VU)
Near Threatened (NT)	
Least Concern (LC)	

c. CITES - Appendices

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

d. Wildlife Conservation Enactment, 1997, Sabah (WCE)

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

Appendix H: List of Lower Plants

Item	Scientific Name	Descriptions	IUCN Red List	CITES	WCE
Acanthaceae		Acanthus family: herbaceous climbers or shrubs			
1.	*Acanthus sp.*		-	-	-
2.	*Gymnostachyum sp.*		-	-	-
3.	*Hemigraphis sumatrensis*		-	-	-
4.	*Justicia sp.*		-	-	-
5.	*Lepidagathis sp.*		-	-	-
6.	*Staurogyne sp.*		-	-	-
Adiantaceae		Ferns			
7.	*Taenitis blechnoides*		-	-	-
8.	*Taenitis sp.*		-		
Agavaceae		Herbaceous or arborescent plants			
9.	*Pleomele angustifolia*		-	-	-
10.	*Dasymachalon sp.*		-	-	-
11.	*Desmos sp.*		-	-	-
12.	*Disepalum anomalum*		-	-	-
13.	*Enicosanthum ereuntoides*		-	-	-
14.	*Fissistigma sp.*		-	-	-
15.	*Goniothalamus clemensii*		-	-	-
16.	*Goniothalamus fasciculatus*		-	-	-
17.	*Goniothalamus ridleyi*		-	-	-
18.	*Goniothalamus roseus*		-	-	-
19.	*Goniothalamus woodii*		-	-	-
20.	*Mezzettia parviflora*		-	-	-
21.	*Mezzettia havilandii*		-	-	-
22.	*Mitrephora humilis*		-	-	-
23.	*Neouvaria acuminatissima*		-	-	-
24.	*Neouvaria sp.*		-	-	-
25.	*Orophea myriantha*		-	-	-
26.	*Phaeanthus laxiflora*		-	-	-
27.	*Pisocarpa sp.*		-	-	-
28.	*Polyalthia bullata*		-	-	-
29.	*Polyalthia canangioides*		-	-	-
30.	*Polyalthia cauliflora*		-	-	-
31.	*Polyalthia congesta*		-	-	-
32.	*Polyalthia glauca*		-	-	-
33.	*Polyalthia insignis*		-	-	-
34.	*Polyalthia lateriflora*		-	-	-
35.	*Polyalthia microtus*		-	-	-
36.	*Polyalthia sumatrana*		-	-	-
37.	*Polyalthia sp.*		-	-	-
38.	*Popowia odoardoi*		-	-	-
39.	*Popowia pisocarpa*		-	-	-
40.	*Pseuduvaria pamathonis*		-	-	-
41.	*Sageraea lanceolata*		-	-	-
42.	*Uvaria ovalifolia*		-	-	-
43.	*Uvaria sorsogonensis*		-	-	-
44.	*Uvaria sp.*		-	-	-
45.	*Xylopia dehiscens*		-	-	-
46.	*Xylopia elliptica*		LC	-	-
47.	*Xylopia ferruginea*		-	-	-
48.	*Xylopia stenopetala*		-	-	-
49.	*Ilex glomerata*		-	-	-
50.	*Ilef cf. Glomerata*		-	-	-
51.	*Ilex revolute*		-	-	-
52.	*Ilex sp.*		-	-	-
53.	*Ilex triflora*		-	-	-
54.	*Ilex trifoliate*		-	-	-
55.	*Ilex wallichii*		-	-	-
Araceae		Aroids: Arum family			
56.	*Alocasia cuprea*		-	-	-
57.	*Alocasia sp.*		-	-	-

58.	*Amorphophallus sp.*		-	-	-
59.	*Anadendrum sp.*		-	-	-
60.	*Homalomena sp.*		-	-	-
61.	*Pothos sp.*		-	-	-
62.	*Rhaphidophora sp.*		-	-	-
63.	*Schismatoglottis sp.*		-	-	-
64.	*Scindapsis borneensis*		-	-	-
65.	*Scindapsis pictus*		-	-	-
66.	*Scindapsis rupestris*		-	-	-
67.	*Scindapsis sp.*		-	-	-
Araliaceae		Ivy family: shrubs, trees & epiphytes			
68.	*Arthrophyllum sp.*		-	-	-
69.	*Osmoxylon borneense*		-	-	-
70.	*Schefflera elliptica*		-	-	-
71.	*Schefflera petiolosa*		-	-	-
72.	*Schefflera ridleyi*		-	-	-
73.	*Schefflera trineura*		-	-	-
74.	*Schefflera sp.*		-	-	-
Aristolochiaceae		Herbs & woody vines			
75.	*Aristolachia sp.*		-	-	-
76.	*Thottea cf. triserialis*		-	-	-
Asclepiadaceae		Asclepiad family: shrubs, climbers and epiphytes			
77.	*Dischidia benghalensis*		-	-	-
78.	*Dischidia hirsute*		-	-	-
79.	*Dischidia sp.*		-	-	-
80.	*Hoya campanulata*		-	-	-
81.	*Hoya coronaria*		-	-	-
82.	*Hoya latifolia*		-	-	-
83.	*Hoya multiflora*		-	-	-
84.	*Hoya sp.*		-	-	-
85.	*Tylophora tenuis*		-	-	-
Aspleniaceae		Ferns			
86.	*Asplenium nidus*		-	-	-
87.	*Asplenium nitidum*		-	-	-
88.	*Asplenium tenerum*		-	-	-
Asteraceae		Mostly herbs			
89.	*Adenostemma macrophylla*		-	-	-
90.	*Blumea balsamifera*		-	-	-
91.	*Emilia sp.*		-	-	-
92.	*Gynura procumbens*		-	-	-
93.	*Senecio sp.*		-	-	-
Begoniaceae		Begonias: mainly herbs			
94.	*Begonia barhamania*		-	-	-
95.	*Begonia beryllae*		-	-	-
96.	*Begonia cf. Limii*		-	-	-
97.	*Begonia keena*		-	-	-
98.	*Begonia queritziana*		-	-	-
99.	*Begonia sp.*		-	-	-
Blechnaceae		Ferns			
100.	*Blechnum orientale*		-	-	-
101.	*Blechnum maliauensis*		-	-	-
Burmanniaceae		Herbs			
102.	*Burmannia longifolia*		-	-	-
103.	*Burmannia sp.*		-	-	-
Caesalpiniaceae		Includes woody climbers			
104.	*Bauhinia sp.*		-	-	-
Calymperaceae		Mosses			
105.	*Syrrophopodon confertus*		-	-	-
106.	*Syrrophopodon involutus*		-	-	-
107.	*Syrrophopodon spiculosus*		-	-	-
108.	*Syrrophopodon sp.*		-	-	-
109.	*Mitthyridium perundulatum*		-	-	-
110.	*Mitthyridium fasciculatum*		-	-	-
111.	*Mitthyridium jungquilianum*		-	-	-
112.	*Mitthyridium obtusifolium*	New record to Sabah	-	-	-
113.	*Mitthyridium subluteum*	New record to Sabah	-	-	-
114.	*Mitthyridium undulatum*		-	-	-

115.	*Arthrocormus schimperi*		-	-	-
116.	*Calymperes fasciculatum*		-	-	-
117.	*Calymperes lonchophyllum*		-	-	-
118.	*Calymperes serratum*		-	-	-
119.	*Leucophanes angustifolium*		-	-	-
120.	*Syrrhopodon parasiticus*		-	-	-
121.	*Syrrhopodon ciliatus*		-	-	-
122.	*Syrrhopodon croceus*		-	-	-
123.	*Syrrhopodon flammeonervis*		-	-	-
124.	*Syrrhopodon gardneri*		-	-	-
125.	*Syrrhopodon japonicus*		-	-	-
126.	*Syrrhopodon muelleri*		-	-	-
127.	*Syrrhopodon trachyphyllus*		-	-	-
128.	*Syrrhopodon tristicus*		-	-	-
129.	*Syrrhopodon prolifer*		-	-	-
Cecropiaceae		Trees, shrubs & woody climbers			
130.	*Poikilospermum scortechinii*		-	-	-
131.	*Poikilospermum suaveolens*		-	-	-
Cletheraceae		Shrubs & small trees			
132.	*Clethra canescens var. clementis*		-	-	-
133.	*Clethra pachyphylla*		-	-	-
Commelinaceae		Herbs			
134.	*Amischotolype griffithii*		-	-	-
135.	*Commelina mudiflora*		-	-	-
136.	*Forrestia sp.*		-	-	-
Connaraceae		Woody climbers, trees & shrubs			
137.	*Agelaea borneensis*		-	-	-
138.	*Agelaea trinevis*		-	-	-
139.	*Agelaea sp.*		-	-	-
140.	*Connarus euphlebius*		-	-	-
Convolvulaceae		Mainly climbing herbs			
141.	*Erycibe borneensis var. borneensis*		-	-	-
142.	*Erycibe sp.*		-	-	-
Costaceae		Mostly leafy-stemmed herbs			
143.	*Costus speciosus*		-	-	-
Cucurbitaceae		Herbaceous plants, mostly climbing			
144.	*Alsomitra sp.*		-	-	-
145.	*Beccariana sp.*		-	-	-
146.	*Benincasa sp.*		-	-	-
147.	*Gymnopetalum chinensis*		-	-	-
148.	*Gynostemma sp.*		-	-	-
149.	*Hodgsonia macrocarpa*		-	-	-
150.	*Hodgsonia sp*		-	-	-
151.	*Mimordica cochinchinensis*		-	-	-
152.	*Siraitia sp.*		-	-	-
153.	*Trichosanthes beccariana ssp. pusilla*		-	-	-
154.	*Trichosanthes intermedia*		-	-	-
155.	*Trichosanthes pendula*		-	-	-
156.	*Trichosanthes postarii*		-	-	-
157.	*Trichosanthes pubera*		-	-	-
158.	*Trichosanthes quinquangulata*		-	-	-
159.	*Trichosanthes sepilokensis*		-	-	-
160.	*Zehneria marginata*		-	-	-
161.	*Zehneria sp.*		-	-	-
Cyatheaceae		Mostly tree ferns			
162.	*Cyathea contaminans*		-	II	-
163.	*Cyathea latebrosa*		-	II	-
164.	*Cyathea longipes*		-	II	-
165.	*Cyathea ramispina*		-	II	-
166.	*Cyathea recommutata*		-	II	-
167.	*Cyathea annae*		-	II	-
Cyperaceae		Sedges: mostly herbs			
168.	*Carex saturate*		-	-	-
169.	*Carex sp.*		-	-	-

170.	*Cyperus diffuses*		-	-	-
171.	*Cyperus haspan*		-	-	-
172.	*Kyllinga sp.*		-	-	-
173.	*Mapania sp.*		-	-	-
174.	*Mapania urceolata*		-	-	-
175.	*Napania sp.*		-	-	-
176.	*Scleria motley*		-	-	-
177.	*Scleria purpurascens*		-	-	-
178.	*Scleria sp.*		-	-	-
179.	*Trichophorum sp.*		-	-	-
Daphniphyllaceae		Trees & shrubs			
180.	*Daphniphyllum laurinum*		-	-	-
Davalliaceae		Ferns			
181.	*Davallia denticulata*		-	-	-
182.	*Davallia repens*		-	-	-
183.	*Davallia solida*		-	-	-
184.	*Davallia sp.*		-	-	-
185.	*Humata heterophylla*		-	-	-
186.	*Humata repens*		-	-	-
187.	*Humata sp.*		-	-	-
188.	*Pectinata sp.*		-	-	-
Dennstaedtiaceae		Ferns			
189.	*Histiopteris incisa*		-	-	-
190.	*Lindsaea tenera*		-	-	-
191.	*Lindsaea sp.*		-	-	-
192.	*Tapeinidium pinnatum*		-	-	-
Dicranaceae		Mosses			
193.	*Braunfelsia plicata*		-	-	-
194.	*Campylopus sp.*				
195.	*Dicranoloma sp.*		-	-	-
196.	*Dicranoloma billardierei*		-	-	-
197.	*Campylopus crispifolius*		-	-	-
198.	*Campylopus hemitrichius*		-	-	-
199.	*Campylopus laxitextus*		-	-	-
200.	*Campylopus serratus*		-	-	-
201.	*Cladopodanthus speciosus*		-	-	-
202.	*Dicranoloma assimile*		-	-	-
203.	*Dicranoloma blumii*		-	-	-
204.	*Dicranoloma braunii*		-	-	-
205.	*Dicranoloma brerisetum*		-	-	-
206.	*Octoblepharum albidum*		-	-	-
207.	*Schistomitrium apiculatum*		-	-	-
208.	*Schistomitrium mucronifolium*		-	-	-
209.	*Schistomitrium robustum*		-	-	-
210.	*Leucobryum javanese*		-	-	-
211.	*Leucobryum sp.*		-	-	-
212.	*Leucobryum sanctum's*		-	-	-
213.	*Leucobryum aduncum*		-	-	-
214.	*Leucobryum aduncum var. scalare*		-	-	-
215.	*Leucobryum arfakianum*		-	-	-
216.	*Leucobryum bowringii*		-	-	-
217.	*Leucobryum sumatranum*		-	-	-
Dioscoreaceae		Vines & herbs arising from a tuber			
218.	*Dioscorea sp.*		-	-	-
Dipteridaceae		Ferns			
219.	*Dipteris conjagata*		-	-	-
220.	*Dipteris lobbiana*		-	-	-
221.	*Dipteris latiffiana*		-	-	-
Dracaenaceae		Trees & shrubs			
222.	*Dracaena eliptica*		-	-	-
Dryopteridaceae		Ferns			
223.	*Diplazium crenatoserratum*		-	-	-
224.	*Pleocnemia irregularis*		-	-	-
225.	*Tectaria sp.*		-	-	-
Fissidentaceae		Mosses			

226.	*Fissidens crassinervis*		-	-	-
227.	*Fissidens guangdongensis*		-	-	-
228.	*Fissidens holianus*		-	-	-
Gesneriaceae		Mainly herbs, includes climbers, treelets, shrubs and epiphytes			
229.	*Aeschynanthus albidus*		-	-	-
230.	*Aeschynanthus maquiticus*		-	-	-
231.	*Aeschynanthus cf. tricolor*		-	-	-
232.	*Aeschynanthus tricolour*		-	-	-
233.	*Aeschynanthus sp.*		-	-	-
234.	*Agalmyla sp.*		-	-	-
235.	*Cyrtandra angularis*		-	-	-
236.	*Cyrtandra areolata*		-	-	-
237.	*Cyrtandra cf. kermesina*		-	-	-
238.	*Cyrtandra cf. multibracteata*		-	-	-
239.	*Cyrtandra chrysea*		-	-	-
240.	*Cyrtandra longicarpa*		-	-	-
241.	*Cyrtandra sp.*		-	-	-
242.	*Codonoboea aff. amoenus*	Old genus was *Didymocarpus*	-	-	-
243.	*Codonoboea cf. hispida*		-	-	-
244.	*Codonoboea sp.*		-	-	-
245.	*Henckelia aff. amoena*		-	-	-
246.	*Henckelia cf. amoena*		-	-	-
247.	*Henckelia sp.*		-	-	-
248.	*Henckelia violoides*		-	-	-
Gleicheniaceae		Ferns			
249.	*Dicranopteris linearis*		-	-	-
250.	*Dicranopteris sp.*		-	-	-
251.	*Gleichenia hirta*		-	-	-
252.	*Gleichenia linearis*		-	-	-
Gnetaceae		Woody climbers and small trees: flowerless seed plants			
253.	*Gnetum diminutum*		NT	-	-
254.	*Gnetum gnemon var. brunonianum*		-	-	-
255.	*Gnetum sp.*		-	-	-
Grammitidaceae		Ferns			
256.	*Ctenopteris alata*		-	-	-
257.	*Ctenopteris contigua*		-	-	-
258.	*Grammitis fasciata*		-	-	-
259.	*Grammitis reinwardtii*		-	-	-
260.	*Oregrammitis translucens*		-	-	-
261.	*Scleroglossum pusillum*		-	-	-
262.	*Xiphopteris sp.*		-	-	-
Hanguanaceae		Herbs			
263.	*Hanguana malayana*		LC	-	-
264.	*Hanguana sp.*		-	-	-
265.	*Susum cf. malayanum*		-	-	-
Hemionitidaceae		Ferns			
266.	*Syngramma wallichii*		-	-	-
Hookeriaceae		Mosses			
267.	*Chaetomitrium horridulum*	New record to Sabah	-	-	-
268.	*Distichophyllum catinifolium*		-	-	-
269.	*Distichophyllum cuspidatum*		-	-	-
270.	*Distichophyllum mittenii*		-	-	-
271.	*Distichophyllum spathulatum*	New record to Sabah	-	-	-
272.	*Ephemeropsis tjibodensis*		-	-	-
Hymenophyllaceae		Ferns			
273.	*Hymenophyllum sp.*		-	-	-
274.	*Meringium microchilum*		-	-	-
275.	*Trichomanes meifolium*		-	-	-
276.	*Trichomanes sp.*		-	-	-
Hypnaceae		Mosses			
277.	*Ectropothecium sp.*		-	-	-
278.	*Ectropothecium eleganti-pinnatum*	New record to Sabah	-	-	-
279.	*Ectropothecium ichnotocladum*		-	-	-
280.	*Ectropothecium*		-	-	-

	ptychofolium				
Hypnodendraceae		Mosses			
281.	*Hypnodendron sp.*		-	-	-
282.	*Hypnodendron dendroides*		-	-	-
283.	*Hypnodendron beccarii*		-	-	-
284.	*Hypnodendron subspininervium*		-	-	-
Hypoxidaceae		Herbs			
285.	*Curculigo latifolia*		-	-	-
286.	*Curculigo sp.*		-	-	-
Illiciaceae		Shrubs or trees			
287.	*Illicium kinabaluensis*		VU	-	-
288.	*Illicium sp.*		-	-	-
Irvingiaceae		Trees			
289.	*Irvingia malayana*		LC	-	-
Juncaceae		Rushes: mainly herbs			
290.	*Juncus sp.*		-	-	-
Labiatae (Lamiaceae)		Herbs or shrubs			
291.	*Gomphostemma microcalyx*		-	-	-
Liliaceae		Herbs			
292.	*Dianella ensifolia*		-	-	-
Linaceae		Herbs and shrubs			
293.	*Indoronchera sp.*		-	-	-
294.	*Ixonanthes reticulata*		-	-	-
Lindsaeaceae		Ferns			
295.	*Lindsaea borneensis*		-	-	-
296.	*Lindsaea bouillodii*		-	-	-
297.	*Lindsaea oblanceolata*		-	-	-
298.	*Lindsaea orbiculata*		-	-	-
299.	*Lindsaea parallelogramma*		-	-	-
300.	*Lindsaea sp.*		-	-	-
Lomariopsidaceae		Ferns			
301.	*Elaphoglossum blumeanum*		-	-	-
302.	*Elaphoglossum commutatum*		-	-	-
303.	*Lomariopsis lineate*		-	-	-
Loranthaceae		Woody hemiparasites			
304.	*Dendropthoe varians*		-	-	-
305.	*Dendropthoe curvata*		-	-	
306.	*Helixanthera aff. maxwelliana*		-	-	-
307.	*Helixanthera sp.*		-	-	-
308.	*Loranthus sp.*		-	-	-
309.	*Macrosolen cochinchinensis*		-	-	-
310.	*Macrosolen fammeus*		-	-	-
Lycopodiaceae		Ferns			
311.	*Huperzia mummularifolia*		-	-	-
312.	*Lycopodium aelleni*		-	-	-
313.	*Lycopodium cernauum*		-	-	-
314.	*Lycopodium phegmaria*		-	-	-
315.	*Lycopodium sp.*		-	-	-
Marantaceae		Herbs			
316.	*Donax sp.*		-	-	-
317.	*Maranthus sp.*		-	-	-
318.	*Phacelophrynum sp.*		-	-	-
319.	*Starchyphrynium borneense*		-	-	-
Menispermaceae		Vines or climbing shrubs			
320.	*Coscinium fenestranum*		-	-	-
321.	*Fibraure chloroleuca*		-	-	-
322.	*Haematocarpus validus*		-	-	-
323.	*Stephania reticulate*		-	-	-
Meteoriaceae		Moses			
324.	*Aerobryopsis sp.*		-	-	-
325.	*Aerobryopsis subleptostigmata*	New record to Sabah	-	-	-
326.	*Aerobryopsis longissima*		-	-	-
327.	*Cryptopapillaria fuscescens*		-	-	-
328.	*Floribundaria floribunda*		-	-	-

329.	*Floribundaria pseudofloribunda*		-	-	-
Monimiaceae		Woody plants			
330.	*Kibara obtusa*		-	-	-
Musaceae		Tree-like perennial herbs, include bananas			
331.	*Musa borneensis*		-	-	-
332.	*Musa sp.*		-	-	-
333.	*Musa textilis*		-	-	-
Myricaceae		Gale family: includes trees			
334.	*Myrica sp.*		-	-	-
Nepenthaceae		Pitcher plants			
335.	*Nepenthes cf. mirabiles*		-	II	2
336.	*Nepenthes gracilis*		LC	II	2
337.	*Nepenthes hirsuta*		Conservation dependent	II	2
338.	*Nepenthes lowii*		VU	II	2
339.	*Nepenthes reinwardtiana*		LC	II	2
340.	*Nepenthes sp.*		-	II	2
341.	*Nepenthes stenophylla*		LC	II	2
342.	*Nepenthes tentaculata*		LC	II	2
343.	*Nepenthes veitchii*		NT	II	2
344.	*Nepenthes veitchii x stenophylla*		-	II	2
Nephrolepidaceae		Ferns			
345.	*Nephrolepis biserrata*		-	-	-
Oleadraceae		Ferns			
346.	*Oleandra oblanceolata*		-	-	-
347.	*Oleandra pistillaris*		-	-	-
348.	*Olenadra sp.*		-	-	-
Onagraceae		Herbs or shrubs			
349.	*Ludwigia hyssopifolia*		LC	-	-
Orchidaceae		Orchids			
350.	*Abdominea minimiflora*		-	II	2
351.	*Acriopsis gracilis*		-	II	2
352.	*Agrostophyllum bicuspidatum*		-	II	2
353.	*Agrostophyllum longifolium*		-	II	2
354.	*Amoetochilus sp.*		-	II	2
355.	*Aphyllorchis montana*		-	II	2
356.	*Aphyllorchis sp.*		-	II	2
357.	*Apostasia wallichii*		-	II	2
358.	*Apostasia nuda*		-	II	2
359.	*Appendicula cornuta*		-	II	2
360.	*Appendicula torta*		-	II	2
361.	*Appendicula anceps*		-	II	2
362.	*Appendicula cristata*		-	II	2
363.	*Arachnis sp.*		-	II	2
364.	*Arundina graminifolia*		-	II	2
365.	*Ascidieria longifolia*		-	II	2
366.	*Bromheadia finlaysoniana*		-	II	2
367.	*Bulbophyllum acuminatum*		-	II	2
368.	*Bulbophyllum apodum*		-	II	2
369.	*Bulbophyllum bnnendijkii*		-	II	2
370.	*Bulbophyllum cf. limbatum*		-	II	2
371.	*Bulbophyllum cf. macranthum*		-	II	2
372.	*Bulbophyllum cf. nigromaculatum*		-	II	2
373.	*Bulbophyllum cf. pugilanthum*		-	II	2
374.	*Bulbophyllum cf. gusdortii*		-	II	2
375.	*Bulbophyllum cf. trifolium*		-	II	2
376.	*Bulbophyllum conspectum*		-	II	2
377.	*Bulbophyllum sect cirrphopetalum.*		-	II	2
378.	*Bulbophyllum sp.*		-	II	2

379.	*Bulbophyllum vaginatum*		-	II	2
380.	*Bulbophyllum lobbii*		-	II	2
381.	*Bulbophyllum macranthum*		LC	II	2
382.	*Bulbophyllum sopoetanense*		-	II	2
383.	*Bulbophyllum striatellum*		-	II	2
384.	*Bulbophyllum uniflorum*		-	II	2
385.	*Calanthe pulchra*		-	II	2
386.	*Calanthe lyroglossa*		-	II	2
387.	*Chelonistele amplissima*		-	II	2
388.	*Chelonistele lurida*		-	II	2
389.	*Chelonistele sp.*		-	II	2
390.	*Chelonistele sulphorea*		-	II	2
391.	*Cleisostoma subulatus*		-	II	2
392.	*Coeloglossum sp.*		-	II	2
393.	*Chrysoglossum reticulum*		-	II	2
394.	*Coelogyne asperata*		-	II	2
395.	*Coelogyne cf. macroloba*		-	II	2
396.	*Coelogyne cf. odoardi*		-	II	2
397.	*Coelogyne cuprea*		-	II	2
398.	*Coelogyne pandurata*		-	II	2
399.	*Coelogyne pulverula*		-	II	2
400.	*Coelogyne radioferens*		-	II	2
401.	*Coelogyne rochussenii*		-	II	2
402.	*Coelogyne septemcostata*		-	II	2
403.	*Coelogyne sp.*		-	II	2
404.	*Coelogyne dayana*		-	II	2
405.	*Coelogyne incrassate*		-	II	2
406.	*Coelogyne planiscarpa*		-	II	2
407.	*Coelogyne prasina*		-	II	2
408.	*Coelogyne tenompokensis*		-	II	2
409.	*Corybas piliferus*		-	II	2
410.	*Corybas carinatus*		-	II	2
411.	*Cryptostylis acutata*		-	II	2
412.	*Cryptostylis sp.*		-	II	2
413.	*Cymbidium borneense*		-	II	2
414.	*Cymbidium dayanum*			II	2
415.	*Cystorchis variegata*		-	II	2
416.	*Dendrobium aloifolium*		-	II	2
417.	*Dendrobium anosmum*		-	II	2
418.	*Dendrobium cinnabarinum var. cinnbarinum*		-	II	2
419.	*Dendrobium crumenatum*		-	II	2
420.	*Dendrobium hosei*		-	II	2
421.	*Dendrobium lampongense*		-	II	2
422.	*Dendrobium minima*		-	II	2
423.	*Dendrobium pachyanthum*		-	II	2
424.	*Dendrobium parthenium*		-	II	2
425.	*Dendrobium rosellum*		-	II	2
426.	*Dendrobium sanguineum*		-	II	2
427.	*Dendrobium sculptum*		-	II	2
428.	*Dendrobium sp.*		-	II	2
429.	*Dendrobium kiauensis*		-	II	2
430.	*Dendrobium pictum*		-	II	2
431.	*Dendrobium prostratum*		-	II	2
432.	*Dendrobium spectatissimum*		-	II	2
433.	*Dendrobium villosulum*		-	II	2
434.	*Dendrochilum angustipetalum*		-	II	2
435.	*Dendrochilum anomalum*		-	II	2
436.	*Dendrochilum auriculilobium*		-	II	2
437.	*Dilochia cantleyi*		-	II	2
438.	*Dilochia rigida*		-	II	2
439.	*Dimorphorchis lowii*		-	II	2
440.	*Dipodium pictum*		-	II	2
441.	*Epigeneium sp.*		-	II	2
442.	*Epigeneium speculum*		-	II	2
443.	*Entomophobia kinabaluensis*		-	-	2

444.	*Eria cf. melaleuca*		-	II	2
445.	*Eria floribunda*		-	II	2
446.	*Eria ignea*		-	II	2
447.	*Eria kinabaluensis*		-	II	2
448.	*Eria longifolia*		-	II	2
449.	*Eria nutans*		-	II	2
450.	*Eria sp.*		-	II	2
451.	*Eria robusta*		-	II	2
452.	*Eria iridifolia*		-	II	2
453.	*Eria densa*		-	II	2
454.	*Eria aurantia*		-	II	2
455.	*Eria discolor*		-	II	2
456.	*Eria major*		-	II	2
457.	*Eulophia spectabilis*		-	II	2
458.	*Galeola sp.*		-	II	2
459.	*Grammatophyllum kinabaluensis*		-	II	2
460.	*Hetaeria oblongifolia*		-	II	2
461.	*Hetaeria anomala*		-	II	2
462.	*Lecanorchis sp.*		-	II	2
463.	*Liparis lacerata*		-	II	2
464.	*Liparis sp.*		-	II	2
465.	*Liparis latifolia*		-	II	2
466.	*Liparis gibbosa*		-	II	2
467.	*Malaxis cf. punctata*		-	II	2
468.	*Malaxis metallica*		-	II	2
469.	*Malleola cf. dentifera*		-	II	2
470.	*Malleola sp.*		-	II	2
471.	*Mischobulbum scapigerum*		-	II	2
472.	*Nephelaphyllum pulchrum*		-	II	2
473.	*Nephelaphyllum trapoides*		-	II	2
474.	*Neuwiedia zollingeri*		-	II	2
475.	*Oberonia ciliolata*		-	II	2
476.	*Pennilobium struthio*		-	II	2
477.	*Pholidota imbricate*		-	II	2
478.	*Phreatia densiflora*		-	II	2
479.	*Platanthera sp.*		-	II	2
480.	*Platanthera angustata*		-	II	2
481.	*Podochilus cf. tenuis*		-	II	2
482.	*Podochilus lucescens*		-	II	2
483.	*Podochilus microphyllus*		-	II	2
484.	*Pomatocalpa kunsleri*		-	II	2
485.	*Pomatocalpa spicata*		-	II	2
486.	*Pomatocalpa sp.*		-	II	2
487.	*Schoenorchis buddleiflora*		-	II	2
488.	*Schoenorchis micrantha*		-	II	2
489.	*Sigmatochilus kinabaluensis*		-	II	2
490.	*Spathoglottis confuse*		-	II	2
491.	*Spathoglottis microcheilina*		-	II	2
492.	*Spathoglottis plicata*		-	II	2
493.	*Spathoglottis aurea*		-	II	2
494.	*Stereosandra javanica*		-	II	2
495.	*Taenia speciosa*		-	II	2
496.	*Teniophyllum filiforme*		-	II	2
497.	*Teniophyllum sp.*		-	II	2
498.	*Therixspermum centipeda*		-	II	2
499.	*Trichotosia sp.*		-	II	2
500.	*Trichostosia velutina*		-	II	2
501.	*Trichostosia ferox*		-	II	2
502.	*Vanilla sp.*		-	II	2
Orthotrichaceae		Mosses			
503.	*Macromitrium ochraceum*		-	-	-
504.	*Schlotheimia emarginatopilosa*	New record to Borneo	-	-	-
505.	*Macromitrium blumei*		-	-	-
506.	*Macromitrium cuspidatum*		-	-	-
507.	*Macromitrium falcatulum*		-	-	-

508.	*Macromitrium minutum*		-	-	-
509.	*Macromitrium perdensifolium*		-	-	-
510.	*Macromitrium zollingeri*		-	-	-
Pandanaceae		Pandans			
511.	*Freycinetia sp.*		-	-	-
512.	*Pandanus basilocularis*		-	-	-
513.	*Pandanus gibbsianus*		-	-	-
514.	*Pandanus matthewsii*		-	-	-
515.	*Pandanus sp.*		-	-	-
Passifloraceae		Vines			
516.	*Adenia macrophylla*		-	-	-
517.	*Adenia sp.*		-	-	-
Phormiaceae		Herbs			
518.	*Dianella ensifolia*		-	-	-
Piperaceae		Pepper family: herbs, shrubs, epiphytes and climbers			
519.	*Peperomia sp.*		-	-	-
520.	*Piper betle*		-	-	-
521.	*Piper sp.*		-	-	-
522.	*Piper vestitum*		-	-	-
523.	*Polhomorphe sp.*		-	-	-
Poaceae		Grasses; often classified under Graminae			
524.	*Bambusa sp.*		-	-	-
525.	*Centotheca lappacea*		-	-	-
526.	*Cynodon dactylon*		-	-	-
527.	*Cyrtococcum accrescens*		-	-	-
528.	*Cyrtococcum oxyphyllum*		-	-	-
529.	*Cyrtococcum patens*		-	-	-
530.	*Dinochloa scabrida*		-	-	-
531.	*Dinochloa scandens*		-	-	-
532.	*Eriochloa procera*		LC	-	-
533.	*Ichnanthus pallens var. pallens*		-	-	-
534.	*Imperata cylindrica*		-	-	-
535.	*Joinvillea sp.*		-	-	-
536.	*Lophatherum gracile*		-	-	-
537.	*Oplismenus compositus*		-	-	-
538.	*Oplismenus hirtellus*		-	-	-
539.	*Panicum sp.*		-	-	-
540.	*Paspalum bispicatum var. scrobiculatum*		-	-	-
541.	*Paspalum conjugatum*		LC	-	-
542.	*Paspalum longifolium*		LC	-	-
543.	*Paspalum virgatum*		-	-	-
544.	*Pogonatherum crinitum*		-	-	-
545.	*Pogonatherum sp.*		-	-	-
546.	*Schizostachyum cf. longispiculatum*		-	-	-
Polypodiaceae		Ferns			
547.	*Aolcosorus bisulcatus*		-	-	-
548.	*Belvisia callifolia*		-	-	-
549.	*Belvisia mucronata*		-	-	-
550.	*Belvisia squamata*		-	-	-
551.	*Crypsinopsis platyphyllus*		-	-	-
552.	*Crypsinus oodes*		-	-	-
553.	*Crypsinus sp.*		-	-	-
554.	*Crypsinus taeniatus*		-	-	-
555.	*Crypsinus wrayi*		-	-	-
556.	*Drymoglossum piloselloides*		-	-	-
557.	*Drynaria sparsisora*		-	-	-
558.	*Goniophlebium verrucosum*		-	-	-
559.	*Lecanopteris carnosa var. pumila*		-	-	-
560.	*Lecanopteris curtisii*		-	-	-
561.	*Lecanopteris sinuosa*		-	-	-
562.	*Lemmaphyllum accedens*		-	-	-
563.	*Lepisorus longifolius*		-	-	-
564.	*Loxogramme avenia*		-	-	-

565.	*Microsorum nigrescens*		-	-	-
566.	*Paragramma longifolia*		-	-	-
567.	*Platycerium coronarium*		-	-	-
568.	*Platycerium ridleyi*		-	-	-
569.	*Pyrorosia waria*		-	-	-
570.	*Selliguea heterocarpa*		-	-	-
571.	*Selliguea platyphylla*		-	-	-
Pteridaceae		Ferns			
572.	*Pityrogramma calomelaros*		-	-	-
573.	*Pteris biaurita*		-	-	-
574.	*Pteris sp.*		-	-	-
575.	*Pteris tripartite*		-	-	-
576.	*Syngramma alismifolia*		-	-	-
577.	*Taenitis blechnoides*		-	-	-
Pterobryaceae		Mosses			
578.	*Garovaglia angustifolia*	New record to Sabah	-	-	-
579.	*Garovaglia compressa*		-	-	-
580.	*Garovaglia plicata*		-	-	-
581.	*Oedicladium pseudorufescens*		-	-	-
Prionodontaceae		Mosses			
582.	*Neolindbergia cladomnioides*		-	-	-
Rafflesiaceae		Rafflesia family			
583.	*Rafflesia tengku-adlinii*		-	-	1
Rhizogoniaceae		Mosses			
584.	*Pyrrhobryum sp.*		-	-	-
585.	*Pyrrhobryum latifolium*	New record to Sabah	-	-	-
586.	*Pyrrhobryum spiniforme*		-	-	-
587.	*Rhizogonium graeffeanum*		-	-	-
Santalaceae		Climbers, shrubs and trees			
588.	*Dendrotrophe cf. varians*		-	-	-
589.	*Scleropyrum wallichianum*		LC	-	-
Schizaeaceae		Ferns			
590.	*Lygodium circinnatum*		-	-	-
591.	*Schizaea dichotoma*		-	-	-
592.	*Schizaea digitata*		-	-	-
Scrophulariaceae		Mostly herbs			
593.	*Brookia sp.*		-	-	-
594.	*Lindernia ruellioides*		LC	-	-
595.	*Lindernia sp.*		-	-	-
596.	*Torenia peduncularis*		-	-	-
597.	*Torenia sp.*		-	-	-
Selaginellaceae		Mosses			
598.	*Selaginella boschaei*		-	-	-
599.	*Selaginella broolesis*		-	-	-
600.	*Selaginella caulescens*		-	-	-
601.	*Selaginella corferta*		-	-	-
602.	*Selaginella cupressina*		-	-	-
603.	*Selaginella intermedia*		-	-	-
604.	*Selaginella ornate*		-	-	-
605.	*Selaginella sp.*		-	-	-
Sematophyllaceae		Mosses			
606.	*Acroporium sp.*		-	-	-
607.	*Acroporium ridleyi*		-	-	-
608.	*Acroporium adspersum*		-	-	-
609.	*Acroporium convolutum*		-	-	-
610.	*Acroporium diminutum*		-	-	-
611.	*Acroporium downii*		-	-	-
612.	*Acroporium joannis-winkleri*		-	-	-
613.	*Acroporium lamprophyllum*		-	-	-
614.	*Acroporium microcladum*		-	-	-
615.	*Acroporium praelongum*		-	-	-
616.	*Acroporium rufum*		-	-	-
617.	*Acroporium secundum*		-	-	-
618.	*Acroporium stramineum*		-	-	-
619.	*Acroporium strepsiphyllum*		-	-	-

620.	*Clastobryophilum bogoricum*		-	-	-
621.	*Clastobryum sp.*		-	-	-
622.	*Isocladiella surcularis*		-	-	-
623.	*Mastopoma sp.*		-	-	-
624.	*Mastopoma armitii*		-	-	-
625.	*Mastopoma papillosum*		-	-	-
626.	*Mastopoma uncinifolium*		-	-	-
627.	*Sematophyllum sp.*		-	-	-
628.	*Trichoctellium sp.*		-	-	-
629.	*Trichosteleum boschii*		-	-	-
630.	*Trichosteleum ruficaule*		-	-	-
631.	*Trichosteleum singapurense*		-	-	-
632.	*Trichosteleum stigmosum*		-	-	-
633.	*Trisnegistria sp.*		-	-	-
634.	*Trismegistia calderensis*		-	-	-
635.	*Trismegistia korthalsii*	New record to Sabah	-	-	-
636.	*Trismegistia brachyphylla*		-	-	-
637.	*Trismegistia visida*		-	-	-
638.	*Wijkia surcularis*		-	-	-
639.	*Meiothecium hamatum*		-	-	-
640.	*Papillidiopsis bruchii*	New record to Sabah	-	-	-
641.	*Papillidiopsis malesiana*		-	-	-
642.	*Papillidiopsis ramulina*		-	-	-
643.	*Taxithelium instratum*		-	-	-
Smilacaceae		Mostly vines			
644.	*Smilax borneensis*		-	-	-
645.	*Smilax laevis*		-	-	-
646.	*Smilax sp.*		-	-	-
Solanaceae		Potato family: herbs, shrubs, vines or trees			
647.	*Lycianthus sp.*		-	-	-
Sphagnaceae		Mosses			
648.	*Sphagnum sp.*		-	-	-
649.	*Sphagnum perichaetiale*		-	-	-
650.	*Sphagnum junghuhnianum*		-	-	-
Taenitidaceae		Ferns			
651.	*Taenitis blechnoides*		-	-	-
Thelypteridaceae		Ferns			
652.	*Amphineuron immersum*		-	-	-
653.	*Christella parasitica*		-	-	-
654.	*Cyclosorus heterocarpus*		-	-	-
655.	*Pronephrium cuspidatum*		-	-	-
656.	*Pronephrium sp.*		-	-	-
657.	*Sphaerostephanos sp.*		-	-	-
Thuidiaceae		Mosses			
658.	*Thuidium pristocalyx*		-	-	-
Violaceae		Includes shrubs, trees and woody lianas			
659.	*Rinorea anguifera*		-	-	-
Vitaceae		Grape-vine family: climbers			
660.	*Ampelocissus imperialis*		-	-	-
661.	*Ampelocissus sp.*		-	-	-
662.	*Ampelocissus thyrsiflora*		-	-	-
663.	*Cissus angustata*		-	-	-
664.	*Cissus hastata*		-	-	-
665.	*Cissus simplex*		-	-	-
666.	*Cissus sp.*		-	-	-
667.	*Leea indica*		-	-	-
668.	*Pterisanthes sp.*		-	-	-
669.	*Pterisanthes polita*		-	-	-
670.	*Pterisanthes cissoides*		-	-	-
671.	*Tetrastigma cf. lanceolarium*		-	-	1
672.	*Tetrastigma dichotomum*		-	-	1
673.	*Tetrastigma diepenhostii*		-	-	1
674.	*Tetrastigma dubium*		-	-	1
675.	*Tetrastigma lanceolarium*		-	-	1
676.	*Tetrastigma papillosum*		-	-	1
677.	*Tetrastigma sp.*		-	-	1

Vittariaceae		Ferns			
678.	*Antrophyum callifolium*		-	-	-
679.	*Atrophyum sp.*		-	-	-
680.	*Vittaria angustifolia*		-	-	-
681.	*Vittaria elongate*		-	-	-
682.	*Vittaria ensiformivittaria hirtas*		-	-	-
683.	*Vittaria sp.*		-	-	-
Winteraceae		Shrubs or trees			
684.	*Drimys piperita*		-	-	-
Zingiberaceae		Gingers			
685.	*Achasma sp.*		-	-	2
686.	*Alpinia fraseriana*		-	-	2
687.	*Alpinia glabra*		-	-	2
688.	*Alpinia ligulata*		-	-	2
689.	*Alpinia sp.*		-	-	2
690.	*Amomum sp.*		-	-	2
691.	*Boesenbergia sp.*		-	-	2
692.	*Burbidgea sp.*		-	-	2
693.	*Cenolophon sp.*		-	-	2
694.	*Costus speciosus*		-	-	2
695.	*Cotylanthera tenuis*		-	-	2
696.	*Elettariopsis sp.*		-	-	2
697.	*Etlingera sp.*		-	-	2
698.	*Globba atrosanguinea*		-	-	2
699.	*Globba franciscii*		-	-	2
700.	*Globba pendula*		LC	-	2
701.	*Globba propinqua*		-	-	2
702.	*Globba sp.*		-	-	2
703.	*Globba speciosa*		-	-	2
704.	*Hedychium cf. cylindricum*		-	-	2
705.	*Hedychium sp.*		-	-	2
706.	*Languas galangal*		-	-	2
707.	*Languas sp.*		-	-	2
708.	*Plagiostachys albiflora*		-	-	2
709.	*Plagiostachys cf. strobilifera*		-	-	2
710.	*Plagiostachys sp.*		-	-	2
711.	*Zingiber coloratum*		-	-	2
712.	*Zingiber cf. coloratus*		-	-	2
713.	*Zingiber sp.*		-	-	2
714.	*Geostachys maliauensis*		-	-	2
715.	*Geostachys tahanensis*		-	-	2
716.	*Geostachys secunda*		-	-	2

Notes:
a. General:
Species in blue are new to the list
* Endemic to Borneo

b. IUCN Red List Structure

Extinct (EX)	
Extinct in the Wild (EW)	
Threatened	Critically Endangered (CR)
	Endangered (EN)
	Vulnerable (VU)
Near Threatened (NT)	
Least Concern (LC)	

c. CITES - Appendices

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

d. Wildlife Conservation Enactment, 1997, Sabah (WCE)

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

Appendix I: List of Mammals

Item	ORDER/Family/ English Name	Species	IUCN Red List	CITES	WCE 1997
PROBOSCIDEA					
	ELEPHANTIDAE				
1.	Pygmy elephant	*Elephas maximus*	EN	I	2
SCANDENTIA					
	TUPAIIDAE				
2.	Common tree shrew*	*Tupaia longipes*	LC	II	-
3.	Mountain tree shrew*	*Tupaia montana*	LC	II	-
4.	Large tree shrew	*Tupaia tana*	LC	II	-
PRIMATES					
	LORISIDAE				
5.	Slow loris	*Nycticebus coucang*	VU	I	2
	TARSIIDAE				
6.	Western tarsier*	*Tarsius bancanus*	VU	II	2
	CERCOPITHECIDAE				
7.	Long-tailed macaque	*Macaca fascicularis*	LC	II	2
8.	Pig-tailed macaque	*Macaca nemestrina*	VU	II	2
9.	Red leaf monkey*	*Presbytis rubicunda*	LC	II	2
10.	Grey leaf monkey*	*Presbytis hosei*	VU	II	2
11.	Silver leaf monkey	*Trachypithecus cristata*	-	II	2
12.	Proboscis monkey*	*Nasalis larvatus*	EN	I	1
	HYLOBATIDAE				
13.	Bornean gibbon*	*Hylobates muelleri*	EN	II	2
	HOMINIDAE				
14.	Orang-utan*	*Pongo pygmaeus morio*	EN	I	1
RODENTIA					
	SCIURIDAE				
15.	Giant squirrel	*Ratufa affinis*	NT	II	2
16.	Tufted ground squirrel*	*Rheithrosciurus macrotis*	VU	-	2
17.	Thomas`s flying squirrel*	*Aeromys thomasi*	Data deficient	-	2
18.	Spotted giant flying squirrel	*Petaurista elegans*	LC	-	2
19.	Red giant flying squirrel	*Petaurista petaurista*	LC	-	2
20.	Provost`s squirrel	*Callosciurus prevostii*	LC	-	-
21.	Bornean black-banded squirrel	*Callosciurus orestes*	LC	-	-
22.	Plaintain squirrel•	*Callosciurus notatus*	LC	-	-
23.	Whitehead`s pygmy squirrel*	*Exilisciurus whiteheadi*	LC	-	-
24.	Plain pygmy squirrel*	*Exilisciurus exilis*	Data deficient	-	-
25.	Red-bellied sculptor squirrel*	*Glyphotes simus*	Data deficient	-	-
26.	Black-eared pygmy squirrel*	*Nannosciurus melanotis (?)*	-	-	-
27.	Shrew-faced ground squirrel	*Rhinociurus laticaudatus*	-	-	-
28.	Horse-tailed squirrel	*Sundasciurus hippurus*	NT	-	-
29.	Low`s squirrel	*Sundasciurus lowii*	LC	-	-
30.	Brooke`s squirrel	*Sundasciurus brookei*	LC	-	-
	MURIDAE				
31.	Red spiny rat	*Maxomys surifer*	LC	-	-
32.	Brown spiny rat	*Maxomys rajah*	LC	-	-
33.	Whitehead`s rat	*Maxomys whiteheadi*	VU	-	-
34.	Small spiny rat*	*Maxomys baeodon*	Data deficient	-	-
35.	Chestnut-bellied spiny rat*	*Maxomys ochraceiventer*	Data deficient	-	-
36.	Dark-tailed tree rat	*Niviventer cremoriventer*	VU	-	-
37.	Long-tailed mountain rat	*Niviventer rapit*	LC	-	-
38.	Polynesian rat•	*Rattus exulans*	LC	-	-
39.	Malaysia field rat•	*Rattus tiomanicus*	LC	-	-
40.	Long-tailed giant rat	*Leopoldamys sabanus*	LC	-	-
41.	Ranee mouse*	*Haeromys margarettae*	Data deficient	-	-

42.	Muller`s rat	*Sundamys muelleri*	LC	-	-
	HYSTRICIDAE				
43.	Common porcupine	*Hystrix (Acanthion) brachyura*	LC	-	3
44.	Long-tailed porcupine	*Trichys fasciculata (?)*	LC	-	2
ERINACEOMORPHA					
	ERINACEIDAE				
45.	Moonrat	*Echinosorex gymnurus*	LC	-	-
SORICOMORPHA					
	SORICIDAE				
46.	Savi's pygmy shrew	*Suncus etruscus*	LC	-	-
47.	Southeast Asian white-toothed shrew	*Crocidura fuliginosa*	LC	-	-
48.	Sunda shrew	*Crocidura monticola*	LC	-	-
CHIROPTERA					
	PTEROPODIDAE				
49.	Grey fruit bat	*Aethalops aequalis*	NT	-	-
50.	Spotted-winged fruit bat	*Balionycteris maculata*	LC	-	-
51.	Short-nosed fruit bat	*Cynopterus brachyotis*	LC	-	-
52.	Horsefield`s fruit bat	*Cynoterus horsfieldi*	LC	-	-
53.	Long-tongued nectar bat	*Macroglossus minimus*	LC	-	-
54.	Large flying fox	*Pteropus vampyrus*	NT	II	-
	RHINOLOPHIDAE				
55.	Bornean horseshoe bat	*Rhinolophus borneensis*	LC	-	-
56.	Least horseshoe bat	*Rhinolophus pusillus*	LC	-	-
57.	Lesser wooly horseshoe bat	*Rhinolophus sedulus*	NT	-	-
58.	Trefoil horseshoe bat	*Rhinolophus trifoliatus*	LC	-	-
59.	Creagh`s horseshoe bat	*Rhinolophus creaghi*	LC	-	-
	HIPPOSIDERIDAE				
60.	Diadem roundleaf bat	*Hipposideros diadema*	LC	-	-
61.	Fawn roundleaf bat	*Hipposideros cervinus*	LC	-	-
62.	Bicolored roundleaf bat	*Hipposideros bicolor*	LC	-	-
	EMBALLONURIDAE				
63.	Greater sheath-tailed bat	*Emballonura alecto*	LC	-	-
64.	Lesser sheath-tailed bat	*Emballonura monticola*	LC	-	-
	VESPERTILIONIDAE				
65.	Small woolly bat	*Kerivoula intermedia*	NT	-	-
PHOLIDOTA					
	MANIDAE				
66.	Pangolin	*Manis javanicus*	EN	II	2
CARNIVORA					
	URSIDAE				
67.	Sun bear	*Helarctos malayanus*	VU	I	1
	MUSTELIDAE				
68.	Yellow-throated marten	*Martes flavigula*	LC	III	2
69.	Malay weasel	*Mustela nudipes*	LC	-	2
70.	Oriental small-clawed otter	*Aonyx (Amblonyx) cinerea*	NT	II	2
71.	Smooth otter•	*Lutrogale perspicillata*	-	II	2
	MEPHITIDAE				
72.	Teledu	*Mydaus javanensis*	LC	-	2
	VIVERRIDAE				
73.	Malay civet	*Viverra tangalunga*	LC	-	2
	VIVERRIDAE (PARADOXURINAE)				
74.	Binturong	*Arctictis binturong*	LC	III	2
75.	Small-toothed palm civet	*Arctogalidia trivirgata*	LC	-	2
76.	Common palm civet•	*Paradoxurus hermaphroditus*	LC	III	2
	VIVERRIDAE (HEMIGALINAE)				
77.	Banded palm civet	*Hemigalus derbyanus*	VU	II	2
	HERPESTIDAE				
78.	Collared mongoose	*Herpestes semitorquatus*	LC	-	2
79.	Short-tailed mongoose	*Herpestes brachyurus*	LC	-	2
	FELIDAE (PANTHERINAE)				
80.	Clouded leopard	*Neofelis diardi borneensis*	VU	I	1
	FELIDAE (FELINAE)				
81.	Marbled cat•	*Pardofelis marmorata*	VU	I	2
82.	Flat-headed cat•	*Prionailurus planiceps*	EN	-	2

83.	Leopard cat	*Prionailurus bengalensis*	LC	II	2
84.	Bay cat*	*Pardofelis badia*	EN	-	2
PERISSODACTYLA					
	RHINOCEROTIDAE				
85.	Sumatran rhino	*Dicerorhinus sumatrensis*	CR	I	1
ARTIODACTYLA					
	SUIDAE				
86.	Bearded pig	*Sus barbatus*	VU	-	3
	TRAGULIDAE				
87.	Lesser mouse deer	*Tragulus javanicus*	Data deficient	-	3
88.	Greater mouse deer	*Tragulus napu*	LC	-	3
	CERVIDAE				
89.	Bornean red muntjac	*Muntiacus muntjac*	LC	-	3
90.	Bornean yellow muntjac*	*Muntiacus atherodes*	LC	-	3
91.	Sambar deer	*Rusa unicolor*	VU	-	3
	BOVIDAE				
92.	Banteng•	*Bos javanicus*	EN	-	1

Notes:

a. General:

Species in blue are new to the list

Nomenclature of mammals were based on Wilson and Reeder (2005)

Online source: http://www.departments.bucknell.edu/biology/resources/msw3/browse.asp

* Endemic to Borneo

• Species only recorded in the buffer zones

? Unconfirmed sightings

b. IUCN Red List Structure

Extinct (EX)	
Extinct in the Wild (EW)	
Threatened	Critically Endangered (CR)
	Endangered (EN)
	Vulnerable (VU)
Near Threatened (NT)	
Least Concern (LC)	

c. CITES - Appendices

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

d. Wildlife Conservation Enactment, 1997, Sabah (WCE)

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

Appendix J: List of Birds

Item	Family/Common Name	Scientific name	IUCN Red List	CITES	WCE
ACANTHIZIDAE (GERYGONES)					
1.	Flyeater / Golden Bellied Gerygone	*Gerygone sulphurea*	LC	-	-
ACCIPITRIDAE (HAWKS, EAGLES & VULTURES)					
2.	Bat Hawk	*Marcheirampus alcinus*	LC	-	2
3.	Oriental Honey-Buzzard	*Pernis ptilorhyncus*	LC	-	2
4.	Brahminy Kite	*Haliastur Indus*	LC	-	2
5.	Grey-headed Fish-Eagle	*Ichthyophaga ichthyaetus*	NT	-	2
6.	Crested Goshawk+	*Accipiter trivirgatus*	LC	-	2
7.	Blyth`s Hawk Eagle	*Spizaetus alboniger*	LC	-	-
8.	Wallace's Hawk-Eagle+	*Spizaetus nanus*	VU	-	2
9.	Black Eagle+	*Ictinaetus malayensis*	LC	-	2
10.	Crested Serpent-Eagle	*Spilornis cheela*	LC	-	2
11.	Kinabalu Serpent-Eagle*	*Spilornis kinabaluensis*	VU	-	2
AEGITHINIDAE (IORAS)					
12.	Green Iora	*Aegithina viridissima*	NT	-	-
13.	Common Iora	*Aegithina tiphia*	LC	-	-
ALCEDINIDAE (KINGFISHERS)					
14.	Common Kingfisher	*Alcedo atthis*	LC	-	-
15.	Blue-eared Kingfisher	*Alcedo meninting*	LC	-	-
16.	Blue-banded Kingfisher	*Alcedo euryzona*	VU	-	-
17.	Rufous-backed Kingfisher	*Ceyx rufidorsa*	LC	-	-
18.	Stork-billed Kingfisher	*Pelargopsis capensis*	LC	-	-
19.	Banded kingfisher	*Lacedo pulchella*	LC	-	-
20.	Black-backed Kingfisher	*Ceyx erithaca*	LC	-	-
21.	Rufous-collared Kingfisher	*Actenoides concretus*	NT	-	-
ANHINGAS					
22.	Oriental Darter	*Anhinga melanogaster*	NT	-	2
APODIDAE (SWIFTLETS)					
23.	Glossy Swiftlet	*Collocalia esculenta*	LC	-	-
24.	Swiftlet sp.	*Aerodramus sp.*	-	-	2
25.	Brown-backed Needletail	*Hirundapus giganteus*	LC	-	2
26.	Silver-rumped Swift	*Raphidura leucopygialis*	-	-	-
27.	Little Swift	*Apus affinis*	LC	-	-
28.	Silver-rumped Spinetail	*Rhaphidura leucopygialis*	LC	-	-
APODIDAE (TREESWIFTS)					
29.	Grey-rumped Treeswift	*Hemiprocne longipennis*	LC	-	-
30.	Whiskered Treeswift	*Hemiprocne comata*	LC	-	-
ARDEIDAE (HERONS)					
31.	Great-billed Heron	*Ardea sumatrana*	LC	-	2
32.	Cattle Egret+	*Bubulcus ibis*	LC	-	-
33.	Little Heron	*Butorides striatus*	-	-	2
BUCEROTIDAE (HORNBILLS)					
34.	White-crowned Hornbill	*Aceros comatus*	NT	II	-
35.	Bushy-crested Hornbill	*Anorrhinus galeritus*	LC	II	2
36.	Wrinkled Hornbill	*Aceros corrugatus*	NT	II	-
37.	Wreathed Hornbill	*Aceros undulatus*	LC	II	-
38.	Black Hornbill	*Anthracoceros malayanus*	NT	II	2
39.	Oriental Pied Hornbill+	*Anthracoceros albirostris*	LC	II	-
40.	Rhinoceros Hornbill	*Buceros rhinoceros*	NT	II	2
41.	Helmeted Hornbill	*Rhinoplax vigil*	NT	I	2
CAMPEPHAGIDAE (CUCKOO-SHRIKES, TRILLERS & MINIVETS)					
42.	Bar-Winged Flycatcher-Shrike	*Hemipus picatus*	LC	-	-
43.	Black-winged Flycatcher-Shrike	*Hemipus hirundinaceus*	LC	-	-
44.	Sunda Cuckoo-Shrike	*Coracina larvata*	LC	-	-
45.	Bar-Bellied Cuckoo-Shrike	*Coracina striata*	LC	-	-
46.	Lesser Cuckoo-Shrike	*Coracina fimbriata*	LC	-	-
47.	Fiery Minivet	*Pericrocotus igneus*	NT	-	-
48.	Scarlet Minivet	*Pericrocotus flammeus*	LC	-	-
49.	Grey-chinned Minivet	*Pericrocotus solaris*	LC	-	-
50.	Large Wood-Shrike	*Tephrodornis gularis*	LC	-	-

CAPRIMULGIDAE (NIGHTJARS)					
51.	Malaysia Eared Nightjar	*Eurostopodus temminckii*	LC	-	-
52.	Large-tailed Nightjar+	*Caprimulgus macrurus*	LC	-	-
CHLOROPSEIDAE (LEAFBIRDS)					
53.	Lesser Green Leafbird	*Chloropsis cyanopogon*	NT	-	-
54.	Greater Green Leafbird	*Chloropsis sonnerati*	LC	-	-
55.	Blue-winged Leafbird	*Chloropsis cochinchinensis*	LC	-	-
COLUMBIDAE (PIGEONS & DOVES)					
56.	Large Green Pigeon	*Treron capellei*	VU	-	2
57.	Thick-billed Green Pigeon	*Treron fulvicollis*	NT	-	2
58.	Green Imperial-Pigeon+	*Ducula aenea*	LC	-	2
59.	Mountain Imperial Pigeon	*Ducula badia*	LC	-	-
60.	Emerald Dove	*Chalcophaps indica*	LC	-	2
61.	Ruddy Cuckoo-Dove+	*Macropygia emiliana*	LC	-	-
62.	Little Cuckoo Dove	*Macropygia ruficeps*	LC	-	-
CORACIIDAE (ROLLERS)					
63.	Dollarbird+	*Eurystomus orientalis*	LC	-	-
CORVIDAE (JAYS, MAGPIES, TREEPIES & CROWS)					
64.	Crested Jay	*Platylophus galericulatus*	NT	-	-
65.	Black Magpie	*Platysmurus leucopterus*	NT	-	2
66.	Slender-billed Crow	*Corvus enca*	LC	-	-
CUCULIDAE (CUCKOOS)					
67.	Large Hawk-Cuckoo	*Cuculus sparverioides*	LC	-	-
68.	Hodgson's Hawk-Cuckoo	*Cuculus fugax*	LC	-	-
69.	Moustached Hawk-Cuckoo+	*Cuculus vagans*	NT	-	-
70.	Indian Cuckoo	*Cuculus micropterus*	LC	-	-
71.	Banded Bay Cuckoo	*Cacomantis sonneratii*	LC	-	-
72.	Plaintive Cuckoo	*Cacomantis merulinus*	LC	-	-
73.	Rusty-breasted Cuckoo	*Cacomantis sepulcralis*	LC	-	-
74.	Violet Cuckoo	*Chrysococcyx xanthorhynchus*	LC	-	2
75.	Raffle's Malkoha	*Phaenicophaeus chlorophaeus*	LC	-	-
76.	Red-billed Malkoha	*Phaenicophaeus javanicus*	LC	-	-
77.	Chestnut-breasted Malkoha	*Phaenicophaeus curvirostris*	LC	-	-
78.	Black-bellied Malkoha	*Phaenicophaeus diardi*	NT	-	-
79.	Chestnut-bellied Malkoha+	*Phaenicophaeus sumatranus*	NT	-	-
80.	Greater Coucal	*Centropus sinensis*	LC	-	-
81.	Lesser Coucal+	*Centropus bengalensis*	LC	-	-
DICAEIDAE (FLOWERPECKERS)					
82.	Scarlet-breasted Flowerpecker	*Prionochilus thoracicus*	NT	-	-
83.	Yellow-rumped Flowerpecker*	*Prionochilus xanthopygius*	LC	-	-
84.	Crimson-breasted Flowerpecker	*Prionochilus percussus*	LC	-	-
85.	Yellow-breasted Flowerpecker	*Prionochilus maculatus*	LC	-	-
86.	Yellow-vented Flowerpecker	*Dicaeum chrysorrheum*	LC	-	-
87.	Black-sided Flowerpecker*	*Dicaeum monticolum*	LC	-	-
88.	Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	LC	-	-
89.	Orange-bellied Flowerpecker	*Dicaeum trigonostigma*	LC	-	-
90.	Plain Flowerpecker	*Diacaeum concolor*	LC	-	-
DICRURIDAE (DRONGOS)					
91.	Crow-billed Drongo+	*Dicrurus annectans*	LC	-	-
92.	Ashy Drongo	*Dicrurus leucophaeus*	LC	-	-
93.	Bronzed Drongo	*Dicrurus aeneus*	LC	-	-
94.	Spangled Drongo	*Dicrurus hottentottus*	LC	-	-
95.	Greater Racquet-tailed Drongo	*Dicrurus paradiseus*	LC	-	-
ESTRILDIDAE (MUNIAS)					
96.	Dusky Munia*	*Lonchura fuscans*	LC	-	-
97.	White-bellied Munia+	*Lonchura leucogastra*	LC	-	-

98.	Black-headed Munia+	*Lonchura malacca*	LC	-	-
EURYLAIMIDAE (BROADBILLS)					
99.	Green Broadbill	*Calyptomena viridis*	NT	-	-
100.	Black-and-yellow Broadbill	*Eurylaimus ochromalus*	NT	-	-
101.	Banded Broadbill	*Eurylaimus javanicus*	LC	-	-
102.	Black-and-red Broadbill	*Cymbirhynchus macrorhynchos*	LC	-	-
103.	Dusky Broadbill	*Corydon sumatranus*	LC	-	-
FALCONIDAE (FALCONS)					
104.	Borneon Falconet*	*Microhierax latifrons*	NT	II	2
105.	Peregrine Falcon	*Falco peregrinus*	LC	I	2
HIRUNDINIDAE (SWALLOWS)					
106.	Pacific Swallow	*Hirundo tahitica*	LC	-	-
INDICATORIDAE (HONEYGUIDES)					
107.	Malaysian Honeyguide+	*Indicator archipelagicus*	NT	-	2
IRENIDAE (BLUEBIRDS)					
108.	Asian Fairy Bluebird	*Irena puella*	LC	-	-
LANIIDAE (SHRIKES)					
109.	Brown Shrike+	*Lanius cristatus*	LC	-	-
110.	Tiger Shrike+	*Lanius tigrinus*	LC	-	-
MEROPIDAE (BEE-EATERS)					
111.	Red-Bearded Bee-Eater	*Nyctyornis amictus*	LC	-	-
112.	Blue-Throated Bee-Eater	*Merops viridis*	LC	-	-
MONARCHIDAE					
113.	Black-naped Monarch	*Hypothymis azurea*	LC	-	-
114.	Rufous-winged Philentoma	*Philentoma pyrhoptera*	LC	-	-
115.	Maroon-breasted Philentoma	*Philentoma velata*	NT	-	-
MOTACILLIDAE (WAGTAILS & PIPITS)					
116.	Grey Wagtail	*Motacilla cinerea*	LC	-	-
MUSCICAPIDAE (FLYCATCHERS)					
117.	Grey-headed Canary-flycatcher	*Culicicapa ceylonensis*	LC	-	-
118.	Dark-sided Flycatcher	*Muscicapa sibirica*	LC	-	-
119.	Grey-streaked Flycatcher+	*Muscicapa griseisticta*	LC	-	-
120.	Verditer Flycatcher	*Eumyias thalassina*	LC	-	-
121.	Indigo Flycatcher	*Eumyias indigo*	LC	-	-
122.	White-tailed Flycatcher	*Cyornis concretus*	LC	-	-
123.	Pale Blue Flycatcher+	*Cyornis unicolor*	LC	-	-
124.	Malaysian Blue Flycatcher	*Cyornis turcosus*	NT	-	-
125.	Hill Blue Flycatcher	*Cyornis banyumas*	LC	-	-
126.	Borneon Blue Flycatcher*	*Cyornis superbus*	LC	-	-
127.	Snowy-browed Flycatcher	*Ficedula hyperythra*	LC	-	-
128.	Narcissus Flycatcher+	*Ficedula narcissina*	LC	-	-
129.	Little Pied Flycatcher	*Ficedula westermanni*	LC	-	-
130.	Rufous-chested Flycatcher	*Ficedula dumetoria*	NT	-	-
131.	Large-billed Blue Flycatcher	*Cyornis caerulatus*	VU	-	2
132.	Grey-chested Jungle Flycatcher	*Rhinomyias umbratilis*	NT	-	-
133.	Rufous-tailed jungle Flycatcher	*Rhinomyias ruficauda*	LC	-	-
134.	Asian Brown Flycatcher	*Muscicapa dauurica*	LC	-	-
135.	Asian Paradise Flycatcher	*Terpsiphone paradisi*	LC	-	2
NECTARINIIDAE (SUNBIRDS & SPIDERHUNTERS)					
136.	Plain Sunbird	*Anthreptes simplex*	LC	-	-
137.	Plain-throated Sunbird	*Anthreptes malacensis*	LC	-	-
138.	Red-throated Sunbird+	*Anthreptes rhodolaemus*	NT	-	-
139.	Ruby-cheeked Sunbird	*Anthreptes singalensis*	LC	-	-
140.	Purple-naped Sunbird	*Hypogramma hypogrammicum*	LC	-	-
141.	Crimson Sunbird	*Aethopyga siparaja*	LC	-	-
142.	Temminck's Sunbird	*Aethopyga temminckii*	LC	-	-
143.	Little Spiderhunter	*Arachnothera longirostra*	LC	-	-
144.	Thick-billed Spiderhunter	*Arachnothera crassirostris*	LC	-	-
145.	Long-billed Spiderhunter	*Arachnothera robusta*	LC	-	-
146.	Spectacled Spiderhunter	*Arachnothera flavigaster*	LC	-	-
147.	Yellow-eared Spiderhunter	*Arachnothera chrysogenys*	LC	-	-

148.	Streaky-breasted Spiderhunter	*Arachnothera affinis*	LC	-	-
ORIOLIDAE (ORIOLES)					
149.	Dark-throated Oriole	*Oriolus xanthonotus*	NT	-	-
PACHYCEPHALIDAE (WHISTLERS)					
150.	Bornean Whistler	*Pachycephala hypoxantha*	LC	-	-
PASSERIDAE (OLD-WORLD SPARROWS)					
151.	Eurasian Tree Sparrow+	*Passer montanus*	LC	-	-
PHASIANIDAE (PHEASANTS)					
152.	Chestnut-necklaced Partridge	*Arborophila hyperythra*	NT	-	2
153.	Crested Partridge	*Rolulus rouloul*	NT	-	2
154.	Crimson-headed Partridge*	*Haematortyx sanguniceps*	LC	-	2
155.	Crested Fireback	*Lophura ignita*	NT	-	2
156.	Bulwer's Pheasant*	*Lophura bulweri*	VU	-	2
157.	Great Argus Pheasant	*Argusianus argus*	NT	II	2
PICIDAE (WOODPECKERS)					
158.	Rufous Piculet	*Sasia abnormis*	LC	-	-
159.	Speckled Piculet	*Picumnus innominatus*	LC	-	2
160.	Common Goldenback	*Dinopium javanense*	LC	-	-
161.	Olive-backed Woodpecker	*Dinopium rafflesii*	NT	-	-
162.	Crimson-winged Woodpecker	*Picus puniceus*	LC	-	-
163.	Checker-throated Woodpecker	*Picus mentalis*	LC	-	-
164.	Grey-capped Woodpecker	*Dendrocopos canicapillus*	LC	-	-
165.	Buff-rumped Woodpecker	*Meiglyptes tristis*	LC	-	-
166.	Buff-necked Woodpecker	*Meiglyptes tukki*	NT	-	-
167.	White-Bellied Woodpecker	*Dryocopus javensis*	LC	-	2
168.	Great Slaty Woodpecker	*Mulleripicus pulverulentus*	VU	-	-
169.	Grey-and-buff Woodpecker	*Hemicircus concretus*	LC	-	-
170.	Maroon Woodpecker	*Blythipicus rubiginosus*	LC	-	-
171.	Orange-backed Woodpecker	*Reinwardtipicus validus*	LC	-	-
PITTIDAE (PITTAS)					
172.	Giant Pitta	*Pitta caerulea*	NT	-	2
173.	Blue-banded Pitta*	*Pitta arquata*	LC	-	2
174.	Blue-headed Pitta*	*Pitta baudii*	VU	-	2
175.	Banded Pitta	*Pitta guajana*	LC	II	2
PITYRIASEIDAE (BELL-MAGPIES & RELATIVES)					
176.	Bornean Bristlehead*	*Pityriasis gymnocephala*	NT	-	-
PODARGIDAE (FROGMOUTHS)					
177.	Gould's Frogmouth	*Batrachostomus stellatus*	NT & LC	-	2
178.	Blyth's Frogmouth	*Batrachostomus affinis*	LC	-	-
PSITTACIDAE (PARROTS)					
179.	Blue-rumped Parrot	*Psittinus cyanurus*	NT	-	2
180.	Blue-crowned Hanging-Parrot	*Loriculus galgulus*	LC	-	2
PYCNONOTIDAE (BULBULS)					
181.	Black-and-white Bulbul	*Pycnonotus melanoleucos*	NT	-	-
182.	Olive-winged bulbul	*Pycnonotus plumosus*	LC	-	-
183.	Grey-bellied Bulbul	*Pycnonotus cyaniventris*	NT	-	-
184.	Straw-headed Bulbul	*Pycnonotus zeylanicus*	VU	II	2
185.	Puff-backed Bulbul	*Pycnonotus eutilotus*	NT	-	-
186.	Black-headed Bulbul	*Pycnonotus atriceps*	LC	-	-
187.	Black-crested Bulbul	*Pycnonotus melanicterus*	LC	-	-
188.	Scaly-breasted Bulbul+	*Pycnonotus squamatus*	NT	-	-
189.	Yellow-vented Bulbul+	*Pycnonotus goiavier*	LC	-	-
190.	Cream-vented Bulbul	*Pycnonotus simplex*	LC	-	-
191.	Red-eyed Bulbul	*Pycnonotus brunneus*	LC	-	-
192.	Spectacled Bulbul	*Pycnonotus erythrophthalmos*	LC	-	-
193.	Finsch's Bulbul	*Criniger finschii*	NT	-	-
194.	Ochraceous Bulbul	*Alophoixus ochraceus*	LC	-	-
195.	Grey-cheeked Bulbul	*Alophoixus bres*	LC	-	-
196.	Yellow-bellied Bulbul	*Alophoixus phaeocephalus*	LC	-	-

197.	Hairy-backed Bulbul	*Tricholestes criniger*	LC	-	-
198.	Buff-vented Bulbul	*Iole olivacea*	NT	-	-
199.	Streaked Bulbul	*Ixos malaccensis*	NT	-	-
200.	Ashy Bulbul	*Hemixos flavala*	LC	-	-
RALLIDAE (RAILS)					
201.	White-breasted Waterhen+	*Amaurornis phoenicurus*	LC	-	-
RAMPHASTIDAE (BARBETS)					
202.	Brown Barbet	*Calorhamphus fuliginosus*	LC	-	-
203.	Gold-Whiskered Barbet	*Megalaima chrysopogon*	LC	-	-
204.	Red-crowned Barbet	*Megalaima rafflesii*	NT	-	-
205.	Yellow-crowned Barbet	*Megalaima henricii*	NT	-	-
206.	Golden-naped Barbet*	*Megalaima pulcherrima*	LC	-	-
207.	Blue-eared Barbet	*Megalaima australis*	LC	-	-
208.	Mountain Barbet*	*Megalaima monticola*	LC	-	-
209.	Bornean Barbet*	*Megalaima eximia*	LC	-	-
210.	Red-throated Barbet	*Megalaima mystacophanos*	NT	-	-
RHIPIDURIDAE (FANTAIL)					
211.	White-throated Fantail	*Rhipidura albicollis*	LC	-	-
212.	Spotted Fantail	*Rhipidura perlata*	LC	-	-
213.	Pied Fantail+	*Rhipidura javanica*	LC	-	-
SCOLOPACIDAE (SANDPIPERS)					
214.	Common sandpiper	*Actitis hypoleucos*	LC	-	-
SCOLOPACIDAE (PHALAROPES)					
215.	Red-necked phalarope	*Phalaropus lobatus*	LC	-	-
SITTIDAE (NUTHATCHES)					
216.	Velvet-fronted nuthatch	*Sitta frontalis*	LC	-	-
STRIGIDAE (TRUE OWLS)					
217.	Buffy Fish Owl+	*Ketupa ketupu*	LC	-	2
218.	Brown Wood-Owl	*Strix leptogrammica*	LC	-	2
219.	Mountain Scops Owl	*Otus spilocephalus*	LC	-	2
STURNIDAE (STARLINGS)					
220.	Hill Myna	*Gracula religiosa*	LC	II	2
SYLVIIDAE (WARBLERS)					
221.	Bornean Stubtail	*Urosphena whiteheadi*	LC	-	-
222.	Yellow-bellied Prinia	*Prinia flaviventris*	LC	-	-
223.	Arctic Warbler	*Phylloscopus borealis*	LC	-	-
224.	Sunda Bush-Warbler	*Cettia vulcania*	LC	-	-
225.	Mountain Leaf Warbler	*Phylloscopus trivirgatus*	LC	-	-
226.	Yellow-bellied Warbler	*Abroscopus superciliaris*	LC	-	-
227.	Dark-necked Tailorbird	*Orthotomus atrogularis*	LC	-	-
228.	Rufous-tailed Tailorbird	*Orthotomus sericeus*	LC	-	-
229.	Ashy Tailorbird	*Orthotomus ruficeps*	LC	-	-
TIMALIIDAE (BABBLERS)					
230.	Black-capped Babbler	*Pellorneum capistratum*	LC	-	-
231.	Temminck's Babbler	*Pellorneum pyrrogenys*	LC	-	-
232.	White-chested Babbler	*Trichastoma rostratum*	NT	-	2
233.	Ferruginous Babbler	*Trichastoma bicolor*	LC	-	2
234.	Short-tailed Babbler	*Malacocincla malaccensis*	NT	-	-
235.	Horsfields's Babbler	*Malacocincla sepiaria*	LC	-	-
236.	Rufous-crowned Babbler	*Malacopteron magnus*	NT	-	-
237.	Scaly-crowned Babbler	*Malacopteron cinereum*	LC	-	-
238.	Moustached Babbler	*Malacopteron magnirostre*	LC	-	-
239.	Scooty-capped Babbler	*Malacopteron affine*	NT	-	-
240.	Chestnut-backed Scimitar Babbler	*Pomatorhinus montanus*	LC	-	-
241.	Striped Wren Babbler	*Kenopia striata*	NT	-	-
242.	Black-throated Wren Babbler*	*Napothera atrigularis*	NT	-	-
243.	Eyebrowed Wren Babbler	*Napothera epilepidota*	LC	-	-
244.	Striped Tit Babbler	*Macronous gularis*	LC	-	-
245.	Fluffy-backed Tit Babbler	*Macronous ptilosus*	NT	-	-
246.	Grey-throated Babbler	*Stachyris nigriceps*	LC	-	-
247.	Black-throated Babbler*	*Stachyris nigricollis*	NT	-	-
248.	Grey-headed Babbler	*Stachyris poliocephala*	LC	-	-
249.	White-necked Babbler	*Stachyris leucotis*	NT	-	-
250.	Chestnut-rumped Babbler	*Stachyris maculata*	NT	-	-
251.	Rufous-fronted Babbler	*Stachyris rufifrons*	LC	-	-

252.	Chestnut-winged Babbler	*Stachyris erythroptera*	LC	-	-
253.	Black Laughingthrush	*Garrulax lugubris*	LC	-	-
254.	SundaLauughingthrush	*Garrulax palliatus*	LC	-	-
255.	Chestnut-hooded Lauughingthrush	*Garrulax treacheri*	LC	-	-
256.	White-browed Shrike Babbler	*Ptheruthius flaviscapis*	LC	-	-
257.	Brown Fulvetta	*Alcippe brunneicauda*	NT	-	-
258.	Chestnut-crested Yuhina*	*Yuhina everetti*	LC	-	-
259.	Erponis	*Erponis Zantholeuca*	LC	-	-
TROGONIDAE (TROGONS)					
260.	Diard's Trogon	*Harpactes diardii*	NT	-	-
261.	Whitehead`'s Trogon*	*Harpactes whiteheadi*	NT	-	-
262.	Scarlet-rumped Trogon	*Harpactes duvaucelii*	NT	-	-
263.	Orange-breasted Trogon	*Harpactes oreskios*	LC	-	-
264.	Cinnamon-rumped Trogon	*Harpactes orrhophaeus*	NT	-	-
265.	Red-naped Trogon	*Harpactes kasumba*	NT	-	-
TURDIDAE (ROBINS, FORKTAILS CHAT, THRUSHES)					
266.	Siberian Blue Robin	*Luscinia cyane*	LC	-	-
267.	Magpie Robin	*Copsychus saularis*	LC	-	2
268.	Rufous-tailed Shama	*Trichixos pyrropygus*	NT	-	-
269.	White-crowned Shama*	*Copsychus stricklandii*	LC	-	-
270.	White-crowned Forktail	*Ebicurus leschenaultia*	LC	-	2
271.	Chestnut-naped Forktail	*Enicurus ruficapillus*	NT	-	-
272.	Bornean Forktail*	*Enicurus borneensis*	LC	-	-
273.	White-browed Shortwing	*Brachypteryx montana*	LC	-	-
274.	Chestnust-capped Thrush	*Zoothera interpres*	NT	-	-
275.	Black-breasted Fruithunter	*Chlamydochaera jefferyi*	LC	-	-
TYTONIDAE (BARN OWLS)					
276.	Oriental Bay Owl	*Phodilus badius*	LC	-	2
ZOSTEROPIDAE (WHITE-EYES)					
277.	Black-capped White-eye	*Zosterops atricapilla*	LC	-	-
278.	Pygmy White-Eye* / Borneon Ibon	*Oculocincta squamifrons*	LC	-	-

Notes:
a. General:

* Endemic to Borneo

b. IUCN Red List Structure

Extinct (EX)	
Extinct in the Wild (EW)	
Threatened	Critically Endangered (CR)
	Endangered (EN)
	Vulnerable (VU)
Near Threatened (NT)	
Least Concern (LC)	

c. CITES - Appendices

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

d. Wildlife Conservation Enactment, 1997, Sabah (WCE)

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

Appendix K: List of Themes, Programmes and Outputs

Programme	Output	Task	Implementation									
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Theme 1: INFRASTRUCTURE DEVELOPMENT												
1.1 Operation	1.1.1 Field/Research Stations	MBCA		✓	✓	✓	✓	✓	✓			
	1.1.2 Carpentry Workshop			✓								
	1.1.3 Recreation Club			✓								
1.2 Tourism development	1.2.1 Maliau tourism zone (TZ1)	CEMD										
	1.2.2 Inarad tourism zone (TZ2)											
	1.2.3 Kuamut tourism zone (TZ3)											
	1.2.4 Tibow tourism zone (TZ4)											
	1.2.5 Pinangah tourism zone (TZ5)											
THEME 2: CAPACITY BUILDING – HUMAN CAPITAL												
2.1 Recruitment	2.1.1 Management											
	a. Research Coordinator	CEMD		✓								
	b. Conservation Marketing Manager		✓									
2.2 Training	2.2.1 Communication and Media											
	a. Adobe Photoshop, Desktop publishing, Web development & Audio-video editing	CEMD	✓	✓	✓	✓			✓			
	2.2.2 Hospitality											
	a. Frontliners	CEMD	✓		✓		✓		✓			
	b. Foods and Beverages (F & B)		✓		✓		✓		✓			
	c. Housekeeping		✓		✓		✓		✓			
	2.2.3 Enforcement											
	a. Honorary Forest Rangers (HFR)	CEMD	✓		✓			✓				
	b. SMART training		✓		✓		✓		✓			
	2.2.4 Guides and Porters											
	a. Local Nature Tourist Guides	MBCA		✓					✓			
	b. Porters			✓					✓			
	c. Maliau Basin Guides & Porters Association			✓								
	2.2.5 Technical and Field courses											
	a. Technical courses											
	Map reading and Navigation	CEMD		✓		✓		✓				
	GPS and Basic GIS			✓		✓		✓				
	Camera trappings			✓		✓		✓				
	Single Rope Technique (SRT & Tree climbing			✓				✓				
	Photography			✓				✓				
	b. Field courses											
	Phenology	CEMD		✓				✓				
	Specimens – collection and storage			✓				✓				
	Birdwatching & survey technique			✓				✓				
	Mammals – identification & survey			✓				✓				
	2.2.6 Safety											
	a. First Aid (Basic and Intermediate)	CEMD	✓	✓	✓	✓	✓			✓		
	b. Search and Rescue (SAR)			✓					✓			
	c. Occupational Safety and Health (OSH)			✓		✓		✓				
THEME 3: RESEARCH												
3.1 Biodiversity	3.1.1 Research Management Plan	CEMD		✓								
	3.1.2 Long-term Research Plots	MBCA		✓	✓	✓	✓					
THEME 4: RESOURCE CONSERVATION AND MANAGEMENT												
4.1 Boundary	4.1.1 Demarcation	CEMD		✓	✓							
4.2 Zoning	4.2.1 Management zoning		✓									
	4.2.2 Zoning guidelines & rules		✓									
4.3 Natural resource inventory	4.3.1 Site specific	MBCA	✓	✓	✓	✓						
	4.3.2 Large-scale expedition	CEMD					✓					

THEME 5: ENVIRONMENTAL EDUCATION												
5.1 Environmental Education	5.1.1 New modules	MBCA	✓									
	5.1.2 Business plan	CEMD		✓								
	5.1.3 EE programme (IKEA)	MBCA	✓	✓	✓							
THEME 6: RECREATIONAL TOURISM												
6.1 Facilities (Activity)	6.1.1 Trails & Shelters (trekking)	MBCA	✓	✓	✓			✓	✓			
	6.1.2 Hides (birdwatching & wildlife)			✓	✓	✓						
	6.1.3 Viewing towers (wildlife & scenery)			✓	✓	✓						
	6.1.4 Interpretation trail (self-guided)			✓	✓	✓						
	6.1.5 Cycling track			✓	✓	✓						
	6.1.6 Ziptrek	CEMD			✓							
6.2 Event	6.2.1 Wildlife Conservation Day (WCD)	MBCA			✓	✓	✓	✓	✓			
THEME 7: SUSTAINABLE INCOME GENERATION												
7.1 Direct	7.1.1 User fees	CEMD	✓									
	7.1.2 Concession fees		✓									
	7.1.3 Trust fund		✓									
THEME 8: PROMOTION AND MARKETING												
8.1 Strategy and Planning	8.1.1 Marketing plan (including workplan)	CEMD		✓								
8.2 Communication	8.3.1 Publicity materials	MBCA		✓								
	8.3.2 Website	CEMD	✓	✓								
	8.3.3 Print media		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8.3 Awareness raising	8.4.1 Fam trip for media			✓		✓		✓		✓		✓
	8.4.2 Fam trip for tourism agencies			✓		✓		✓		✓		✓
	8.4.3 Outreach to targeted groups			✓		✓		✓		✓		✓
8.4 Merchandising	8.5.1 Products development		✓	✓								
	8.5.2 Outlets development			✓	✓							
8.5 Electronic reservation & payment	8.6.1 Electronic reservation mechanism			✓								
	8.6.2 Electronic payment			✓								
THEME 9: INITIATIVES												
9.1 Protected area training centre	9.1.1 Development of PA programme	CEMD		✓	✓							
9.2 Forest rehabilitation	9.2.1 Forest restoration document		✓	✓								
	9.2.2 Business plan			✓								
THEME 10: MONITORING												
10.1 Biodiversity	10.1.1 Distribution & changes of flora & fauna	MBCA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.1.2 Tree phenology						✓					✓
10.2 Climate change	10.2.2 Rainfall data (AWS)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.2.3 Landscape changes	CEMD					✓					✓
10.3 Research	10.3.1 Research information data		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10.4 Recreational Tourism	10.4.1 Visitors arrivals	MBCA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.4.2 Hospitality			✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.4.3 Visitors impact management			✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.4.4 Facilities (set-up, upgrade & maintenance)			✓	✓	✓	✓	✓	✓	✓	✓	✓
10.5 Security	10.5.1 Enforcement		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	10.5.2 Fire				✓							
A. OTHERS												
A1 Going Green	A1.1 Waste management	MBCA	✓	✓								
	A1.2 Renewable energy			✓	✓							
A2 Climate Change	A2.1 Automatic Weather Station (AWS)		✓	✓	✓							
Operational	A3.1 Safety		✓									
	A3.2 Data Management System	CEMD	✓	✓	✓							

Appendix L: Pictures from Camera Traps


Greater Mousedeer


Short-tailed Mongoose


Common Porcupine


Malay civet


Clouded Leopard


Bay Cat

Appendix M: Pictures of Birds


Scally-crowned Babbler


Buffed-necked Woodpecker


Yellow-rumped Flowerpecker


White-crowned Forktail


Yellow-bellied Bulbul


Purple-naped Sunbird


Fluffy-backed Babbler


White-crowned Shama


2013-06-15 16:38:47 M 1/3 24°C
Bulwer's Pheasant
MBCA CT 57B


2013-06-16 07:55:59 M 1/3 23°C
Great Argus (female)
MBCA CT 41A


2013-06-21 12:24:20 M 2/3 24°C
Great Argus (male)
MBCA CT 41A


Cinereous Bulbul


Little Spiderhunter

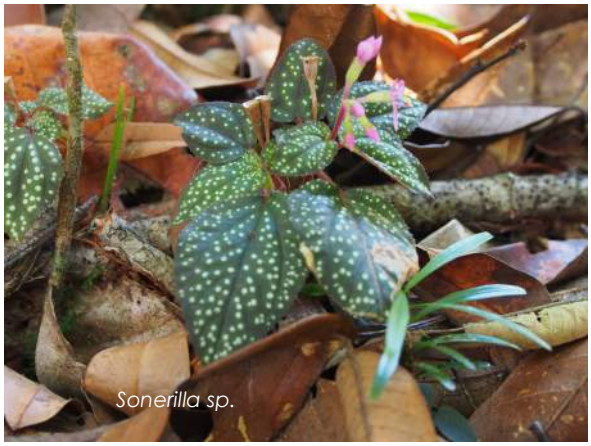
Appendix N: Pictures of Lower Plants


Rafflesia tengku adlinii


Ixora sp.


Codonoboea sp.


Cytandra sp.


Sonerilla sp.


Begonia sp.


Licuala valida


Dipteris lobii


Etlingera brevilabrum