



SHARED HERITAGE

Sabah

BIODIVERSITY
OUTLOOK

SHARED RESPONSIBILITY





SABAH BIODIVERSITY OUTLOOK



The Sabah Biodiversity Outlook was developed under the Bornean Biodiversity & Ecosystems Conservation Programme Phase II, a joint programme of the Sabah State Government, Universiti Malaysia Sabah, and Japan International Cooperation Agency.

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List of Abbreviations

BBEC	Bornean Biodiversity and Ecosystems Conservation
BCT	Borneo Conservation Trust
BORA	Borneo Rhino Alliance
CAIMS	Conservation Assessment and Information Management System
CBD	Convention on Biological Diversity
CBNRM	Community-Based Natural Resources Management
CBO	Community-Based Organisation
CEPA	Communication, Education and Public Awareness
CITES	Convention on International Trade in Endangered Species
COP	Conference of Parties
CTI	Coral Triangle Initiative
CUZ	Community Use Zones
Danida	Danish International Development Assistance (formerly the Danish Cooperation for Environment and Development)
DO	District Office
EAC	Environmental Action Committee
EAFM	Ecosystem Approach to Fisheries Management
EE	Environmental Education
EPD	Environment Protection Department
FMP	Forest Management Plan
FMU	Forest Management Unit
FR	Forest Reserve
FRC	Forest Research Centre
FSC	Forest Stewardship Council
GDP	Gross Domestic Product
GFS	Gravity Feed System
GIS	Geographic Information System
HCVF	High Conservation Value Forest
HoB	Heart of Borneo
IBA	Important Bird Area
ICCA	Indigenous and Community Conserved Areas
ITTO	International Tropical Timber Organisation
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
KOCP	Kinabatangan Orang-Utan Conservation Programme
KOPEL	Batu Puteh Community Ecotourism Co-operative
LEAP	Land Empowerment Animals People
LKSW	Lower Kinabatangan-Segama Wetlands
MAB	Man and Biosphere
MESCOT	Model for Environmentally Sustainable Community Tourism
MMEA	Malaysian Maritime Enforcement Agency
MONRE	Ministry of Natural Resources and Environment
NAP	National Agricultural Policy
NBSAP	National Biodiversity Strategies and Action Plans
NGO	Non-Governmental Organisation

NPBD	National Policy on Biological Diversity
OPPS	Outline Perspective Plan Sabah
PA	Protected Area
PACOS	Partners for Community Organisations
PFE	Permanent Forest Estate
RIL	Reduced-Impact Logging
SaBC	Sabah Biodiversity Centre
SAFE	Stability of Altered Forest Ecosystems
SAP	Sabah Agricultural Policy
SDC	Sabah Development Corridor
SEEN	Sabah Environmental Education Network
SFD	Sabah Forestry Department
SFM	Sustainable Forest Management
SFMLA	Sustainable Forest Management License Agreement
SWD	Sabah Wildlife Department
TED	Turtle Exclusion Device
TEK	Traditional Ecological Knowledge
UMS	Universiti Malaysia Sabah
UNESCO	United Nations Education, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
WWF	World Wide Fund for Nature



SECTION 1

INTRODUCTION

SECTION 1: INTRODUCTION

1.1 THE SABAH BIODIVERSITY OUTLOOK

The Sabah Biodiversity Outlook 2012 is a companion document to the Sabah Biodiversity Strategy. It aims to provide a comprehensive overview of Sabah's natural ecosystems and the species within them while identifying the threats and weaknesses that need to be addressed. The Outlook consolidates the latest available information and explores potential directions for boosting biodiversity conservation at spatial as well as operational levels, paying close attention to filling gaps and expanding the scope for participation and enhanced coordination. These assessments, together with extensive consultations conducted with stakeholders in 2011 and 2012, have resulted in the development of the Strategies and Actions Plans under the Sabah Biodiversity Strategy. The Outlook contains detailed information and would serve as an important reference to a specialised audience and anyone interested in a more in-depth understanding of Sabah's biodiversity values, threats and the challenges of mounting an effective integrated response. It can be an essential reading for students, researchers, resource managers, non-government organisations (NGOs), special interest groups, and community-based organisations (CBOs).

1.2 WHY THE NEED FOR A BIODIVERSITY STRATEGY?

Sabah's astounding biodiversity of plants, animals and micro-organisms emerged in a range of distinctive ecosystems over millions of years. Today, the State's diverse habitats from mist-covered mountain forests, to meandering rivers and floodplains and vibrant underwater kingdoms has become synonymous with nature. Within these ecosystems, we find a dynamic assemblage of plants and animals which are delicately inter-connected. Many of these species are found nowhere else in world. Some species have become cherished symbols of Sabah and draw millions of domestic and international visitors each year contributing billions to the State's economy. If they are lost today, they are lost for good.

A distinctive characteristic of biodiversity in Sabah is its long association with the indigenous people. Over generations, indigenous communities have accumulated knowledge about plant and animal diversity, ecological relationships and seasonal rhythms. These communities have drawn upon this knowledge to extract food, materials and medicines from their surroundings, and they retain a remarkable living archive of knowledge. This interconnection with nature has also richly influenced cultural traditions and spiritual beliefs, and bio-cultural diversity has become inextricably linked to the identity of the indigenous people. Today, biodiversity-rich ecosystems provide essential services enjoyed by all people of Sabah. Forested hills and mountain ranges serve as water catchments that supply

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clean water; while wetlands and coastal habitats provide a bounty of fisheries resources. Biodiversity enables much of Sabah to sustain its economy.

At the turn of the last century, Sabah was covered with dense forests teeming with wildlife while its extensive coastline featured healthy wetlands and coral reefs. However, in a matter of decades, human activities have resulted in substantive impact on these resources. Large forest areas were cleared to make way for agriculture. Wildlife species have been poached and illegally traded; and the list of threatened or endangered plant and animal species continues to grow. In the coastal areas, fisheries are showing signs of collapse due to overfishing, pollution and the prevalence of bad fishing practices. Without concerted action, we are in danger of wiping out our biodiversity.

Sabah is now at a historic turning point where urgent and decisive actions are required to restore the State's biodiversity. By facing these challenges today, we may still have the time and resources to develop the foundation for achieving the State's vision of leveraging off Sabah's geographical location, natural resources, cultural heritage and biodiversity for balanced growth, as outlined in the Sabah Development Corridor Blueprint (2008-2025).

1.3 THE SABAH BIODIVERSITY STRATEGY 2012-2022

The Sabah Biodiversity Strategy represents Sabah's commitment to protecting the irreplaceable biodiversity present within the spectrum of ecosystems that occur within the State. Understanding that many of the species and habitats found here occur nowhere else, Sabah has taken proactive steps in formulating its own strategy for biodiversity. This strategy will compliment biodiversity conservation programmes at both national and international levels.

The ten-year Strategy charts Sabah's commitment and contributions to fulfill the pledges made by Malaysia to implement the Convention of Biological Diversity (CBD). It is closely aligned with the directions of the CBD Strategic Plan for Biodiversity 2011-2020 which was launched in Nagoya, Japan at the Conference of Parties in 2010. The Strategic Plan acknowledges that globally biodiversity and ecosystems continue to be under heavy pressure and advocates for the broadening of participation in biodiversity conservation to all sectors of society, and the mainstreaming biodiversity concerns in all processes of resource governance in its member countries.

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Box 1.1: The CBD Strategic Plan for Biodiversity 2011-2020

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 in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet’s variety of life, and contributing to human well-being, and poverty eradication. To ensure this, pressures on biodiversity are reduced, ecosystems are restored, biological resources are sustainably used and benefits arising out of utilization of genetic resources are shared in a fair and equitable 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.”

1.4 READING THE OUTLOOK

The Outlook is designed to provide a background on the current status of biodiversity in Sabah. Chapter 2 provides an overview of the Policy Framework governing international and national policies and conventions on biodiversity, which are in turn translated into policies and legislation that guide efforts at the state level. These are described in more detail in the ecosystem-based chapters which also discuss the current institutional and legislative framework.

Chapter 3 provides a macro perspective in confronting the changing social, political and economic environment in Sabah and the way in which these changes will impinge on biodiversity. An increasing population, higher levels of urbanisation and limitations of current provisions for generating state revenue will need to be considered in order to develop a strategy that is mindful of the competition for scarce land and natural resources.

Detailed information on the biodiversity found in Sabah and the status of current conservation efforts are found in Chapter 4 (Wildlife), Chapter 5 (Terrestrial Ecosystems & Plants), Chapter 6 (Wetlands) and Chapter 8 (Marine Ecosystems). Chapter 7 gives an overview of the protected area network in Sabah. It highlights the problems of habitat loss, environmental degradation, and fragmentation and the need for strategies to address connectivity and to achieve conservation at a landscape level. Proposals have been made for extensions and links between protected areas but these cut across mixed landscapes that are occupied by human societies.

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Chapter 9 provides new research findings which suggest that Indigenous and Community Conserved Areas (or ICCAs) already play a key role in sustaining biodiversity and ecosystem services. Recommendations are made to integrate ICCAs in order to strengthen the protected area network and encourage community participation in achieving shared conservation aims.

Finally, Chapter 10 provides an overview on efforts to raise public awareness and concerns about the threats to biodiversity. CEPA which stands for Communication, Education and Public Awareness has an important role to play in modifying human behaviour and reducing society's impact on the environment and on wildlife species. This chapter highlights some of the strengths and milestones to date in the State's CEPA programme, and explores the opportunity to energise and build upon these in the Strategy and Actions Plans which cover both formal and informal education opportunities and the need to strategically involve the private sector in supporting conservation efforts.



SECTION 2

POLICY FRAMEWORK

SECTION 2: POLICY FRAMEWORK

2.1 INTRODUCTION

The impetus to conserve biodiversity in Sabah is influenced by a number of policies. These range from multilateral conventions which have been entered into at a national level, elements of which has been translated into national policies, and policies developed specifically for the state of Sabah. These policies address the conservation of natural ecosystems, establishment and management of protected areas (PAs), protection of plant and animal species, forestry management, and the development of agriculture. This chapter provides an overview of these policies some of which are elaborated in more detail in the chapters that follow.

2.2 MULTILATERAL CONVENTIONS**2.2.1 Convention on Biological Diversity and the Strategic Plan for Biodiversity 2011-2020**

The United Nations Convention on Biological Diversity (CBD) is the most important global treaty on biodiversity. Malaysia signed the Convention in 1992 and ratified it two years later. As a signatory to the CBD, Malaysia is committed to the sustainable use, management, and conservation of her natural resources, as spelt out in the various articles of the Convention. In October 2010, at the 10th meeting of the Conference of the Parties (CoP10) in Nagoya, Aichi Prefecture, Japan, a revised and updated Strategic Plan for Biodiversity 2011-2020 was adopted. The Strategic Plan consists of five strategic goals and 20 more detailed targets - the Aichi Biodiversity Targets (See Box 2-1). These provide the overarching framework for biodiversity conservation programmes and approaches for the entire United Nations system. The Targets specifically highlight the need to mainstream biodiversity concerns through all sectors of governance, and advocate for increasing public participation and roles for local communities.

CoP10 agreed to translate this framework into their respective National Biodiversity Strategy and Action Plans¹ within two years (by October 2012). The meeting also decided that the fifth national reports (2014) would focus on the implementation of the 2011-2020 Strategic Plan and progress towards the Aichi Biodiversity Targets. While the goals and targets encapsulate aspirations for achievement at the global level, they provide a flexible framework for the establishment of national or regional targets. Parties are allowed to set their own

¹ Article 6 of the CBD states that each Contracting Party shall, in accordance with its particular conditions and capabilities, develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned.

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targets within this framework, taking into account national needs and priorities, while also bearing in mind national contributions to the achievement of the global targets.

Box 2-1: Key Elements of the Strategic Plan 2011-2020

Rationale: The rationale for the new plan is that biological diversity underpins ecosystem functioning and the provision of ecosystem services essential for human well-being, and therefore is essential for the achievement of the Millennium Development Goals, including poverty reduction.

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."

Mission: Take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication. To ensure this, pressures on biodiversity are reduced, ecosystems are restored, biological resources are sustainably used and benefits arising out of utilisation of genetic resources are shared in a fair and equitable 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."

Strategic Goals and Aichi Biodiversity Targets:

- Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society (Targets 1-4)
- Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use (Targets 5-10)
- Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity (Targets 11-13)
- Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services (Targets 14-16)
- Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building (Targets 17-20)

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2.2.2 Ramsar Convention

The Convention of Wetlands of International Importance was adopted in the city of Ramsar, Iran in 1971. Commonly known as the Ramsar Convention, it provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources (Ramsar, 2012). The convention came into force in 1975 and is the only global international treaty that targets a specific ecosystem. The main objective of the convention was to develop and maintain an international network of wetlands for conserving global biological diversity and maintaining ecosystem services that are important for sustaining human life.

In 1994, Tasek Bera was listed as Malaysia's first Ramsar site. Malaysia then ratified the Ramsar Convention in March 1995. There are now six Ramsar sites in Malaysia - the most recent being the Lower Kinabatangan-Segama Wetlands (LKSW) in 2008 which is the country's largest Ramsar site covering 78,803 ha. The Ministry of Natural Resources and Environment (MONRE) has been appointed as the Ramsar Administration Authority in Malaysia. In Sabah, the Sabah Biodiversity Centre is the state-level Ramsar Focal Point.

2.2.3 Convention on International Trade in Endangered Species

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (or CITES) is an international agreement between governments aimed to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Malaysia became a party to CITES in 1977 and recently passed the CITES Act 2008 which applies to the import, export and re-export of CITES listed species throughout Malaysia. The government has been working with the Wildlife Trade Monitoring Network (or TRAFFIC) Southeast Asia to develop protocols and enhance the capacity of relevant agencies to ensure effective enforcement of the Act. In addition, Malaysia is a member of ASEAN Wildlife Enforcement Network, an intergovernmental initiative between ten Southeast Asian governments to combat wildlife crime. At the Federal level, MONRE is the management and scientific authority for CITES, while the designated State-level management authorities for Sabah are the Sabah Wildlife Department for plants (except marine plants and timber) and animals (except fish and coral), the Fisheries Department for fish, corals and marine plants, and the Malaysian Timber Industry Board for timber.

SECTION 2: POLICY FRAMEWORK

2.2.4 World Heritage Convention

Malaysia ratified the World Heritage Convention in 1988. By signing the Convention, each country pledges to conserve not only World Heritage sites situated on its territory, but also to protect its national heritage. Sites inscribed on the World Heritage List serves as a catalyst for heritage preservation as well as access to the World Heritage Fund. Sabah's flagship tourism destination, Kinabalu Park, was listed as a United Nations Education, Scientific and Cultural Organisation (UNESCO) World Heritage Site in 2000. It is expected to be managed to meet the high standards set by the World Heritage Committee.

2.2.5 United Nations Framework on Climate Change

Malaysia is a non-Annex 1 party to the United Nations Framework on Climate Change (UNFCCC). Under the UNFCCC, parties are obligated to formulate programmes to promote sustainable management, conservation and enhancement of carbon sinks; and to prepare and develop plans for adaptation to impacts of climate change on biodiversity.

2.3 NATIONAL CONTEXT**2.3.1 National Policy on Biological Diversity**

Malaysia's commitment to the CBD is contained within the National Policy on Biological Diversity (NPBD) published in 1998 by the Ministry of Science, Technology and Environment². The NPBD sets the long-term direction and strategic framework for the implementation of the CBD and conservation of biodiversity in Malaysia. The NPBD contains a vision, policy statements, objectives, as well as 15 strategies and 87 action plans. The 15 strategies contained in the NPBD (and number of associated Action Plans) are:

1. Improve the scientific knowledge base (11 Action Plans)
2. Enhance sustainable utilisation of the components of biological diversity (9 Action Plans)
3. Develop a centre of excellence in industrial research in tropical biological diversity (3 Action Plans)
4. Strengthen the institutional framework for biological diversity management (5 Action Plans)

² Responsibility for the NPBD has been assumed by the newly formed Ministry of Natural Resources and Environment following a cabinet reshuffle in March 2004.

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5. Strengthen and integrate conservation programmes (7 Action Plans)
6. Integrate biological diversity considerations into sectoral planning strategies (7 Action Plans)
7. Enhance skill, capabilities and competence (6 Action Plans)
8. Encourage private sector participation (4 Action Plans)
9. Review legislation to reflect biological diversity needs (5 Action Plans)
10. Minimise impacts of human activities on biological diversity (7 Action Plans)
11. Develop policies, regulations, laws and capacity building on biosafety (6 Action Plans)
12. Enhance institutional and public awareness (6 Action Plans)
13. Promote international cooperation and collaboration (5 Action Plans)
14. Exchange of information (3 Action Plans)
15. Establish funding mechanisms (3 Action Plans)

It should be noted here that the MONRE is currently undertaking a study to revise and update the NPBD.

2.3.2 National Environmental Policy

One of the three objectives of the National Policy on the Environment is to *“conserve Malaysia’s unique and diverse cultural and natural heritage with effective participation by all sectors of society”*. Of the seven strategies provisioned under this policy, one is of direct relevance to biodiversity (Strategy 2: Effective Management of Natural Resources and the Environment). This strategy includes measures for a national inventory and audit of natural resources, protection of important habitats for the conservation of flora and fauna, as well as the ecologically sustainable management of forest, freshwater and marine ecosystems.

2.3.3 National Policy on Climate Change

The National Policy on Climate Change was launched in 2010. The policy, which was prepared by MONRE in collaboration with the Institute for Environment and Development, Universiti Kebangsaan Malaysia, contains a number of strategic thrusts and key actions relating to biodiversity. The most pertinent actions are to *“conserve and enrich carbon pools in natural ecosystems including plantations and promoted rehabilitation of sensitive and degraded ecosystems”* and to *“integrate climate change considerations at the planning level by applying tools that include economic evaluation of ecological services.”*

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2.3.4 Common Vision on Biodiversity, 2008

The Common Vision, which was adopted by the National Biodiversity-Biotechnology Council in 2009 focuses on the operationalisation of the NPBD in the nation's planning and development process. Developed by MONRE under the biodiversity component of the Malaysia-Denmark Cooperation Programme, the Common Vision contains three main elements: Strengthening the Protected Areas System, application of the Ecosystem/Landscape Approach and Mainstreaming Biodiversity into national policies, plans and programmes.

2.3.5 National Wetlands Policy, 2004

The aim of the policy, which was passed by Cabinet in 2004, was to ensure the conservation and wise-use of the wetlands and to fulfil Malaysia's obligation under the Ramsar Convention. The policy's objectives include *“protecting and conserving each type of wetlands and integrating wetlands conservation interest into overall natural resource planning, management and decisions”*.

2.3.6 National Biotechnology Policy, 2006

This policy provides a framework for government, in partnership with key stakeholders, to harness the benefits of biotechnology development in accordance with established social and ethical norms. One of the objectives of this policy is to create greater values from agriculture and natural resources utilising biodiversity and the natural environment.

2.3.7 The Third National Agricultural Policy, 1998-2010

The Third National Agricultural Policy (NAP3) sets the current strategic directions for agricultural development. One of the four objectives of the NAP3 is to *“conserve and utilise natural resources on a sustainable basis”*. Correspondingly, one of the thrusts of the NAP3 states that: *“Sustainable management and utilisation of resources will be the guiding principle in pursuing agricultural and forestry development. Rules, regulations and incentives will be strengthened to encourage environment-friendly agricultural and forestry practices and to minimise the negative impact of these activities on the environment”*. While agriculture expansion has been a major cause of habitat loss in the past, the NAP3 places greater emphasis on increasing productivity through the modernisation of agriculture practices, rather than area expansion. The NAP3 also invokes the sustainable development of fisheries in Malaysia: *“The fisheries industry, particularly deep-sea fishing and aquaculture, will be further developed on a*

SECTION 2: POLICY FRAMEWORK

commercial and integrated basis. The development will focus on conservation and utilisation of fisheries resources on a sustainable basis”.

2.3.8 National Plan of Action for Conservation and Management of Sea Turtles in Malaysia, 2008

Formulated by the Department of Fisheries, Ministry of Agriculture and Agro-based Industry, this plan contains six primary objectives, including “to reduce direct and indirect causes of sea turtle mortality”; and “to protect, conserve and rehabilitate sea turtle habits”. The plan lists 85 specific activities organised into 21 programmes of work, with lead agencies and timelines for implementation. A particular strength of the plan is its concise and frank assessment of the factors that have contributed to the decline of Malaysia’s turtle populations – such as inadequate regulation and management.

2.3.9 National Ecotourism Plan

The government adopted the National Ecotourism Plan in 1996 to provide policies and guidelines for the conscientious development of ecotourism. The Plan includes 21 Action Plans, which address a host of issues ranging from legal changes to monitoring and finance; identifies existing and potential ecotourism sites; and provides comprehensive a set of guidelines, including guidelines for tourism development in different ecosystems, interpretation, accreditation, architecture and many other aspects.

2.3.10 Malaysian Plant Conservation Strategy, 2009

The Malaysian Plant Conservation Strategy is an initiative to consolidate past and existing efforts towards biological diversity conservation. Through this Strategy, 17 targets have been set to address plant conservation (Box 2-2) (MNRE & FRIM, 2009). From this initiative, Sabah Forestry Department has taken the lead for Sabah in carrying out the conservation assessment of dipterocarps for Sabah.

SECTION 2: POLICY FRAMEWORK
Box 2-2: Objectives and Targets of the Malaysian Plant Conservation Strategy*Objective 1: Understanding and Documenting Plant Diversity*

- Target 1: A widely accessible working list of known plant species, as a step towards a complete national flora
- Target 2: A preliminary assessment of the conservation status of all known plant species of the nation
- Target 3: Development of models with protocols for plant conservation and sustainable use, based on research and practical experience

Objective 2: Conserving Plant Diversity

- Target 4: Put in place national policies and legislation that will meet the plant conservation needs of the nation
- Target 5: At least 10% of each of the nation's ecological habitats effectively conserved
- Target 6: Protection of 50% of the most important areas for plant diversity assured
- Target 7: At least 30% of production lands managed consistent with the conservation of plant diversity
- Target 8: 60% of the nation's threatened species conserved *in situ*
- Target 9: 60% of threatened plant species in *ex situ* collections within the country, and 10% of them included in recovery and restoration programmes

Objective 3: Using Plant Diversity Sustainably

- Target 10: 70% of the genetic diversity of crops and other major socio-economically valuable plant species conserved, and associated indigenous and local knowledge protected
- Target 11: Management plans in place for major alien species that threaten plants, plant communities, and associated habitats and ecosystems
- Target 12: No species of wild flora endangered by national and international trade
- Target 13: 30% of plant-based products derived from sources that are sustainably managed
- Target 14: The decline of plant resources, and associated indigenous and local knowledge, innovations and practices that support sustainable livelihood, local food security and health care, halted

Objective 4: Promoting Education and Awareness about Plant Diversity

- Target 15: The importance of plant diversity and the need for its conservation incorporated into communication, education and public-awareness programmes

Objective 5: Building Capacity for the Conservation of Plant Diversity

- Target 16: The number of trained people working with appropriate facilities in plant conservation increased to achieve the targets of this Strategy
- Target 17: Networks for plant conservation activities established or strengthened at the national level

SECTION 2: POLICY FRAMEWORK**2.3.11 Action Plan for the Conservation and Sustainable Use of Fishery Resource
Biological Diversity of Malaysia, 2006**

This document, which was prepared by the Department of Fisheries Technical Committee on Biodiversity, contains 62 actions within 9 strategies. The strategies touch on areas such as effective fishery resource conservation and management, reduction of biodiversity loss, strengthening of research, improving capacity building, enhancing information dissemination and networking, as well as control and management of invasive species.

2.4 STATE LEVEL POLICIES**2.4.1 Sabah Development Corridor Blueprint, 2008-2025**

Sabah Development Corridor (SDC) Blueprint is a socio-economic vision which aims to steer the development of Sabah and enhance the quality of life of its people. The strategies and programmes within the SDC Blueprint were developed based on three underlying principles:

1. Capture higher value economic activities
2. Promote balanced economic growth with equal distribution
3. Ensure sustainable growth via environmental conservation

These principles were built upon Sabah's inherent strengths: (1) its strategic location within a vigorously developing region, (2) its robust agriculture sector, in particular, oil palm production, (3) its natural resources and biodiversity, and (4) its rich cultural and multi-ethnic community. The SDC is divided into 3 main sub-regions. The Eastern Sub-region is the largest among all sub-regions and it encompasses the Sandakan and Tawau divisions. It is home to most of Sabah's rich biodiversity and natural resources as well as its extensive oil palm plantations. Building upon these strengths, SDC's focus for the Eastern Sub-region is on tourism and agriculture development. Several major wildlife reserves and biodiversity conservation zones are located within the Eastern Sub-Region. These include the Sepilok Orangutan Rehabilitation Centre, Tabin Wildlife Reserve, Danum Valley Conservation Area, Maliau Basin Conservation Area, Imbak Canyon Conservation Area and the Gomantong Limestone Caves. These attractions are envisaged to form a network of destinations for eco-tourism and edu-tourism development.

The SDC Blueprint acknowledges the need for mitigation measures to ensure that development is sustainable. A number of unsustainable practices were highlighted which include the over-extraction of forest products; unregulated conversion of

SECTION 2: POLICY FRAMEWORK

land for agriculture which results in fragmented habitats and encroachment upon the river buffer zones; and the clear felling of sensitive swamps and mangroves habitat for property development, aquaculture and oil palm cultivation. Measures are also required to mitigate pollution stemming from palm oil mill effluent and the excessive use of pesticides and fertilisers.

The SDC Blueprint proposes a number of programmes and strategies to ensure that development will progress in a sustainable manner:

- a. Establishing Integrated Water Resources Management plans what will span entire catchment areas which will aim to safeguard water supply, mitigate water pollution and ensure that river buffer zones are protected in a holistic and integrated manner.
- b. Promoting Sustainable Agricultural Practices to control the excessive use of pesticides and fertilisers.
- c. Gazetting Special Management Areas in sensitive zones such as the Sg. Kinabatangan floodplain, where all activities will be subject to best management practices.
- d. Better overall infrastructure planning for major roads to ensure that natural habitats are not fragmented.

2.4.2 The Outline Perspective Plan for Sabah, 1995-2010

The Outline Perspective Plan Sabah (OPPS), covering the period 1995-2010 aims at creating a socially and politically stable environment through efficient management of the state economy. Eradicating hardcore poverty and reducing relative poverty are key objectives. One of the thrusts of the OPPS which relates to biodiversity conservation is *“to ensure sufficient attention is given towards protecting the environment and ecology for a sustainable development”*. The plan for the forestry sector is to focus on closely monitoring logging activities to stamp out illegal logging and banning the export of round logs to encourage downstream activities. At the same time, reforestation and afforestation activities are to be stepped up significantly to sustain a consistent and reliable supply of timber for downstream needs.

2.4.3 Halatuju Pembangunan dan Kemajuan Negeri Sabah

The Halatuju Pembangunan dan Kemajuan Negeri Sabah (Sabah Development and Progress Direction) outlines the main development agenda of Sabah’s current Chief Minister, Y.A.B. Datuk Haji Musa Aman. Three sectors, namely agriculture, tourism and manufacturing, are given emphasis in the Economic Development agenda.

SECTION 2: POLICY FRAMEWORK**2.4.4 Second Sabah Agricultural Policy, 1999-2010**

The Second Sabah Agricultural Policy (SAP2) (1999-2010) was formulated to ensure that the state's agricultural development policy is in line with the new Third National Agricultural Policy. The policy was formulated in response to the 1997 financial crisis which highlighted the importance of increasing domestic food production to offset the climbing cost of importing food. The policy places emphasis on domestic food production particularly on paddy as a strategic crop. SAP2 has several new objectives to ensure that the policies are in line with the National Agricultural Policy. SAP2 is especially relevant to the conservation of biodiversity and sustainable use of land. Its focus is on reducing the incidence of poverty in the rural sector by maximising income from sustainable agriculture food production, promoting the rehabilitation of idle land and implementing the development of agriculture, livestock and fisheries on an integrated basis. The Third Sabah Agriculture Policy (SAP3) has since been prepared and is due to be tabled in Cabinet. In SAP3, priority is given to the production of food crops. Although SAP3 encourages the conversion of State land forest to oil palm smallholdings, the total expansion of oil palm under this policy is not expected to be significant; only small pockets of new smallholdings are to be established throughout the state.

2.4.5 Sabah Conservation Strategy, 1992

The Sabah Conservation Strategy was commissioned by the Ministry of Culture, Environment and Tourism and produced by World Wide Fund for Nature (WWF) Malaysia. It is endorsed by the state government, has become an important document that is often referred to for any environmental related policies and studies for Sabah. The document provides a range of recommendations and guidelines for the sustainable management of biodiversity and natural resources of Sabah and is based on a comprehensive natural resource accounting exercise. Some of the recommendations included:

1. Broadening the scope of the Ministerial Committee on Forestry
2. Production of natural vegetation maps
3. Natural forest classification and mapping
4. Establishment of new protected areas
5. Amendments to forestry legislation
6. Management plans for reserved forests
7. Reduction of encroachment into reserved forests
8. Implementing management of water catchment areas

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Many of the recommendations contained in the Strategy have since been implemented.

2.4.6 Sabah Forestry Policy

The Sabah Forestry Policy is focussed on implementing Sustainable Forest Management (SFM) throughout the Commercial Forest Reserves which involves close supervision of forest management planning and harvesting by SFM License Holders. The Sabah Forestry Department (SFD) also manages a number of Forest Management Units (FMUs). The state has targeted for all productive forest in the Permanent Forest Estate (PFE) to be fully-certified by 2014. The SFD also has a strong focus on forest conservation, research, and rehabilitation inside the other six classes of Forest Reserves (FRs). In order to restore degraded forest, it is also involved in international initiatives to promote replanting. More information on SFD's activities can be found in Chapter 4.

2.4.7 Sabah Parks Policy

The Sabah's Parks policy is *"to preserve for all times areas which contain significant geographical, geological, biological, historical features or natural features of high aesthetic value as a national heritage for benefit, education and enjoyment of the Malaysian people, now and in the future"*. The vision of Sabah Parks is to:

1. Preserve and conserve the natural heritage of Sabah within park areas
2. Continue research efforts
3. Gazetting additional park areas to conserve nature and to address problems associated with the park.

2.4.8 Sabah Water Resources Master Plan, 1994

The main aim of the Water Resource Master Plan is to provide a framework for the development of detailed plans for specific purposes and areas, including the implementation of water resource development project. The Master Plan indicates the need for better land use planning particularly in water catchments and river basins, areas that are important in the highlands.

2.4.9 Sabah Land Utilisation Policy

The Sabah Land Utilisation Policy was prepared in 2010 by the Natural Resource Office to enhance the management of Sabah's land resources towards a balance of

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social, environmental and economic functions. A number of the objectives of state in the policy very explicitly support biodiversity conservation, including:

- To regulate the size of oil palm plantation to not encroach into land areas set aside as forest reserves;
- To ensure the preservation of all species;
- To protect and regulate the use of mangrove forest areas.

Eight strategies (and corresponding action plans) are provided in this policy; these include strategies on the sustainable management of forest resources as well as the sustainable management of marine islands and coastal areas.

2.4.10 Heart of Borneo Strategic Action Plan, 2009

Brunei Darussalam, Indonesia and Malaysia signed a historic declaration in 2007 to establish the Heart of Borneo (HoB) Initiative, which aims to foster trans-boundary cooperation to conserve and sustainably manage the HoB, which is the largest contiguous forest area remaining in Southeast Asia and is one of the most biologically diverse habitats on Earth. The HoB Strategic Action Plan was launched by three countries at the 9th Conference of Parties (COP9) to the CBD in Bonn, Germany. The plan contains five main programs, i.e. Transboundary Management, Protected Areas Management, Sustainable Natural Resources Management, Ecotourism Development and Capacity Building.

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SECTION 3 DRIVERS OF CHANGE

SECTION 3: DRIVERS OF CHANGE

3.1 INTRODUCTION

Biodiversity is directly affected by the socio-economic factors around us. Population growth, economic activities, employment patterns and resource consumption have a major influence on the integrity of our biodiversity. We need to better understand how these socio-economic factors exert influences on our flora, fauna, habitats and ecosystem so that we can design measures to minimise adverse impacts. This section provides an overview of the socio-economic forces at work in Sabah and elaborates how they are influencing and will influence biodiversity conservation in the state.

3.2 POPULATION GROWTH

Sabah is the third most populous state in Malaysia (after Selangor and Johor). The state's population has grown rapidly from 0.93 million in 1980 and 1.73 million in 1991 to 3.12 million in 2010 (Table 3-1). The population growth rate was very high from 1980 to 1991 (5.67 percent) and from 1991 to 2000 (3.92 percent) but has slowed down to 2.34 percent from 2000 to 2010. Although the rate of population growth has slowed down in recent years, the burgeoning population will continue to put pressure on land and natural resources.

Table 3-1: Sabah's Population Growth

	1980	1991	2000	2010	2025
Population (million)	0.93	1.73	2.47	3.12	4.2*

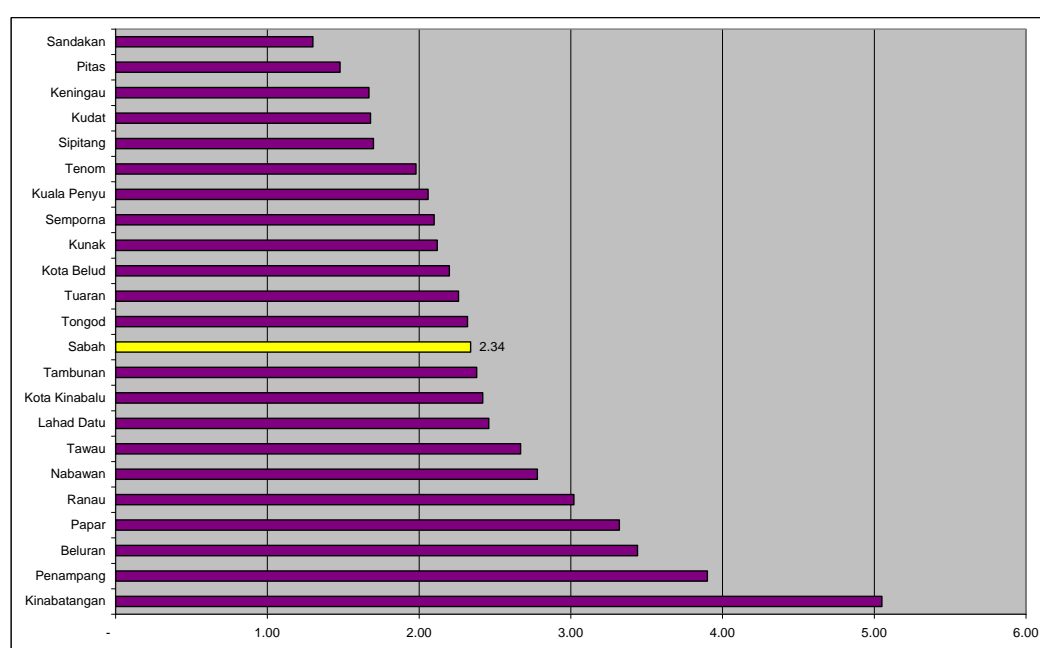
Source: Department of Statistics

* estimated based on a growth rate of 2% per annum

The population of Sabah is projected to reach 4.2 million by 2025 even with a modest annual growth rate of 2 percent, which represents an additional one million persons compared to now. The population density in 2025 will be 57 persons/km², representing a 30 percent increase over the current density. The additional population will need food, shelter, clothing, and other material needs in addition to education and employment. As a result, additional pressure on land and the natural resources of the state can be anticipated. Population density is not uniform throughout Sabah. As expected, the more urban districts (e.g. Kota Kinabalu, Penampang, Sandakan) have higher population densities than districts such as Tongod, Nabawan, Sipitang and Beluran that have population densities of less than 20 persons/km².

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Notwithstanding the urbanisation process, rural population continues to grow in Sabah. In fact, during the period 2000-2010, the average annual population growth rates of Kinabatangan, Beluran, Papar, Ranau and Nabawan were significantly higher than the state's 2.34 percent growth rate (Figure 3-1). Underlying this trend is the relatively slow pace of urbanisation in Sabah, at about 54 percent, which is much lower than the national average (71 percent). As urban areas presently only occupy less than one percent of the land area of the state, much of Sabah's population is scattered in rural areas all over the state. Given that the rural population's land utilisation rate is much higher than that of the urban population, further pressures will be exerted on the state's natural resources and environment.



Source: DOS, 2010a

Figure 3-1: Average Annual Population Growth Rate by District 2000-2010

3.3 IMPROVEMENTS IN THE STANDARD OF LIVING

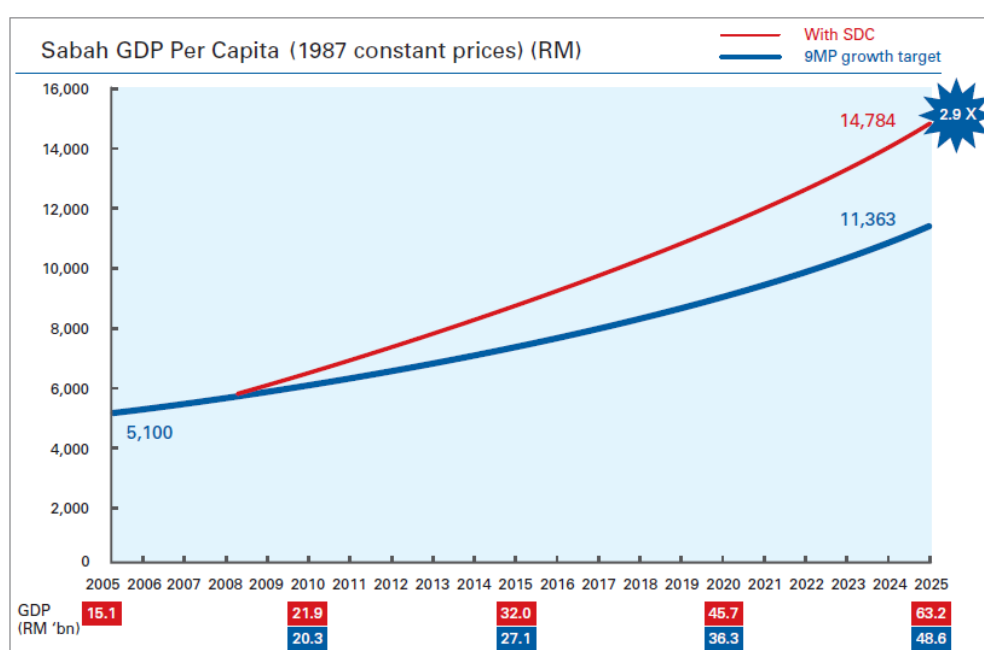
The standard of living in the state is also expected to rise. The mean gross household income per capita for Sabah increased from RM 1,212 in 1984 to RM 3,144 in 2009. One of the key objectives of Sabah Development Corridor (SDC) Blueprint (Box 3-1) is to increase the per capita GDP in Sabah from the current level of about RM 5,000 to RM 14,784 by 2025 (Figure 3-2) – an increase of almost 200 percent. To achieve this, the SDC focuses on capturing higher value economic activities and promoting balanced economic growth. The SDC aims to boost the agriculture, tourism and logistic services, and manufacturing sectors.

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Box 3-1: Sabah Development Corridor

The Sabah Development Corridor (SDC) was launched in 2008 to enhance the quality of life of the people of Sabah by accelerating the growth of state's economy, promoting regional balance and bridging the rural-urban divide while ensuring sustainable management of the state's resources. The SDC programmes are underpinned by three key principles that will guide development in Sabah, namely the need to: (1) Capture higher value economic activities; (2) Promote balanced economic growth with distribution; and (2) Ensure sustainable growth via environmental conservation.

Implementation of the SDC initiative is guided by the SDC Blueprint 2008-2025. The SDC Blueprint recognises that as the State develops, a number of critical environmental challenges will impact will need to be addressed. These include: implementing the sustainable use of natural resources, a more integrated approach to biodiversity and environmental conservation, redressing habitat fragmentation, improving wastewater treatment systems, managing pollution from industries and the need for regulations on Good Agriculture Practices (GAP). Chapter 7 of the Blueprint (Conserve and Protect the Environment for Future Generations) sets out eight core strategies that will need to be developed to enhance the conservation and protection of the environment in Sabah.



Source: IDS (2007)

Figure 3-2: Projected increase in GDP (2008-2025)

Poverty eradication is among the main agendas under the Tenth Malaysia Plan whereby state and federal government programmes are targeted at eliminating hardcore poverty and reducing relative poverty in Sabah. Under the Plan, various programmes have been implemented to help improve the economy and livelihoods

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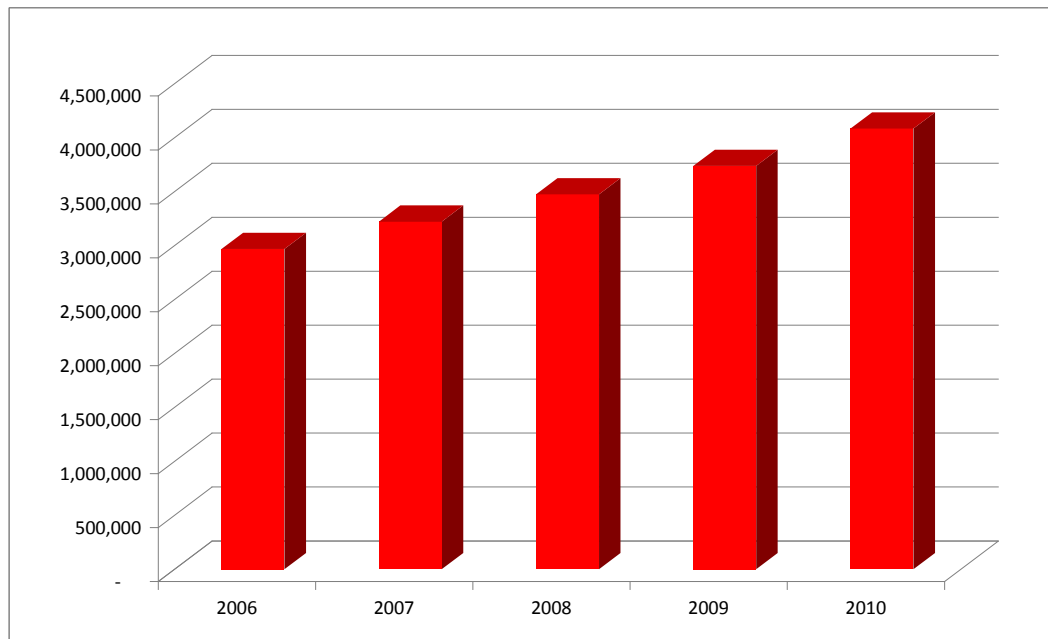
of the poor listed under the e-Kasih programme. As a result of these interventions, the incidence of poverty is expected to decline in the coming years.

Poverty-environment linkages are highly complex due to the multi-faceted issues that impact the two. However, the poverty-environment nexus is more apparent in rural areas as the poor are more likely to depend on natural resources from their immediate surroundings for their livelihood. Alleviating poverty could reduce the pressure on the natural environments as the poor become less reliant on natural resources. Similarly enhancing the environment through conservation measures and sustainable wise use increasingly demonstrate positive benefits towards reducing poverty levels. Some examples include payments for ecosystem services, work opportunities e.g. from nature based tourism, mangrove and coastal restoration for fisheries and sustainable forest management systems that allows for the continuous use of non-timber forest products.

The rise in income levels coupled with population growth will lead to higher demand for energy, water and transportation. Pollution levels and the production of household and industrial waste can be expected to increase, and these will put more pressure on biodiversity. Already, electricity and water consumption in Sabah has been steadily rising (Figure 3-3 and Figure 3-4). Similarly, demand for transportation and fuel as reflected by the total number of motor vehicles is also on the rise (Figure 3-5).

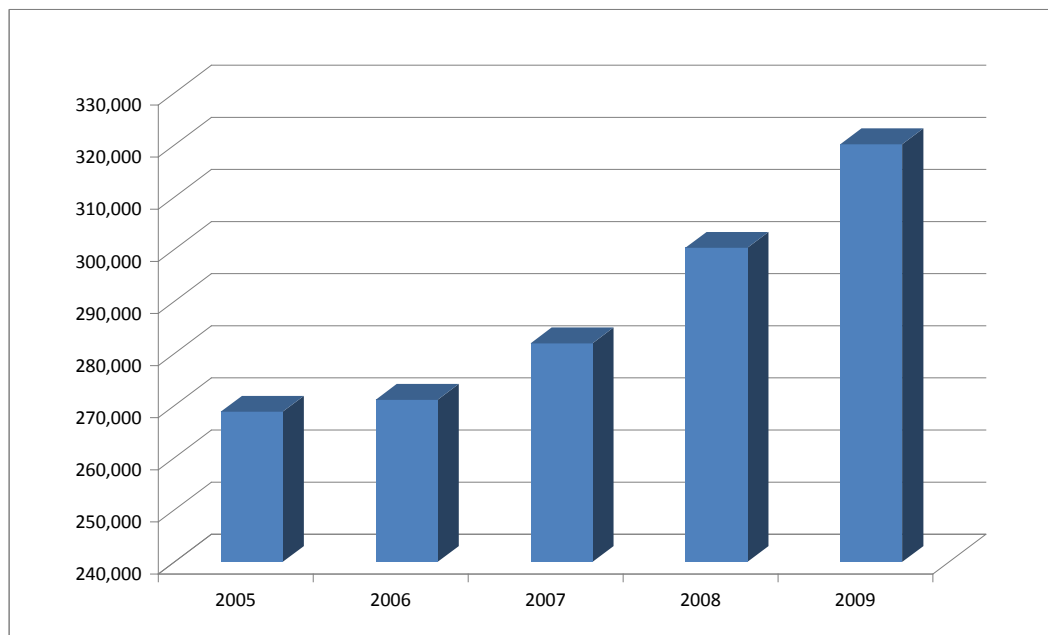
The drive to increase the income levels will impose additional pressures on the land and natural resources. With the rise in income levels, consumption rates will also increase – leading to greater demand for energy, water, transportation and infrastructure and a greater amount of waste and pollution.

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Source: DOS, 2010b

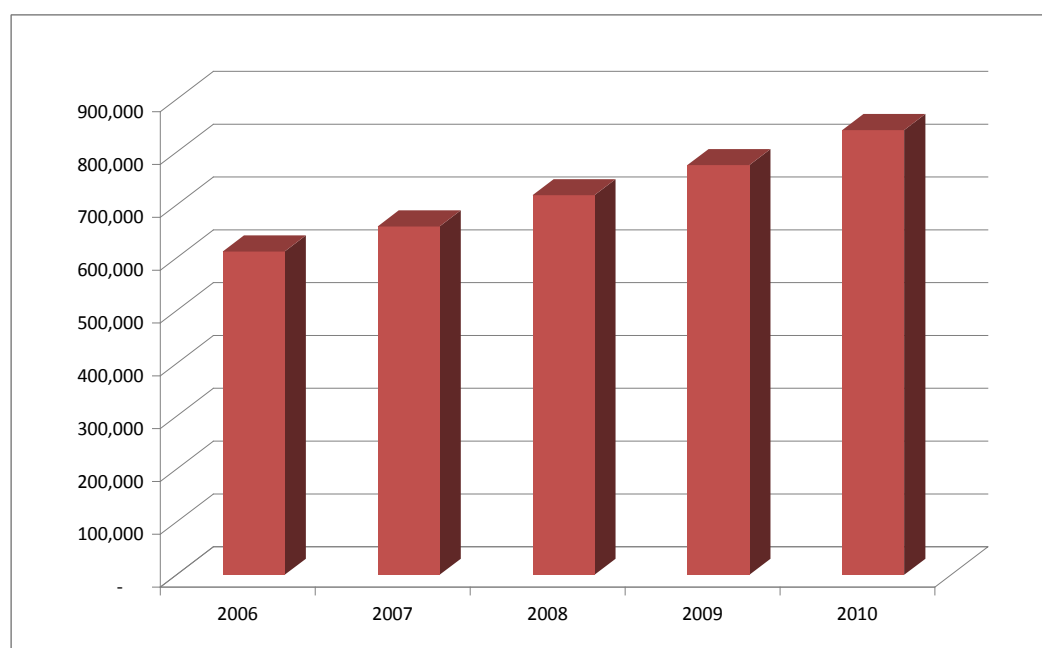
Figure 3-3: Sabah, Electricity, Unit Consumed ('000 KWH)



Source: DOS, 2010b

Figure 3-4: Sabah, Water, Total Quantity Supplied (Million Litres)

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Source: DOS, 2010b

Figure 3-5: Sabah, Number of Motor Vehicles Registered, 2006-2010

3.4 CHANGES TO THE STRUCTURE OF THE ECONOMY

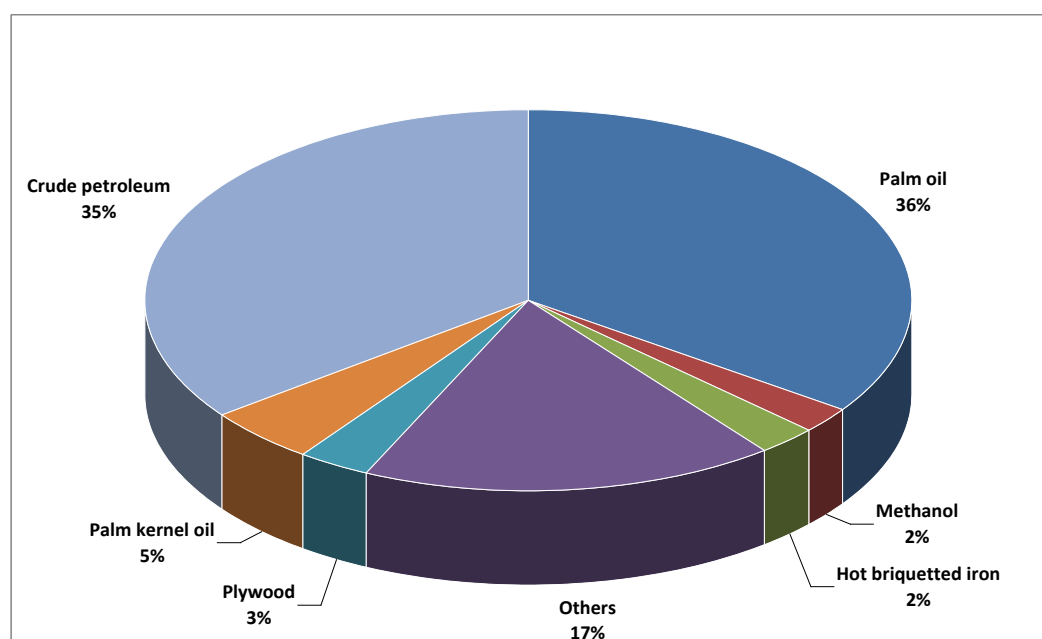
The structure of the state's economy is also changing with the primary sector now giving way to the secondary and tertiary sectors (Table 3-2). The contribution of the agriculture sector to Sabah's GDP decreased from 37.6 percent in 1993 to less than 23 percent in 2010, while the contribution of the services sector increased from 33.9 percent in 1993 to 50.4 percent.

Table 3-2: Sectoral Contribution to Sabah's GDP

	1993	2010
Agriculture	37.6	22.9
Mining & Quarrying	14.5	16.9
Manufacturing	13.8	7.9
Construction	3.2	1.4
Services	33.9	50.4

Source: Department of Statistics Sabah

On the whole, Sabah's economy is still very much resource-based with close to 40 percent of its real GDP coming from the agriculture and mining & quarrying sector. Sabah's exports in 2010 were dominated by palm oil (36 percent share of the total export value), crude petroleum (35%) and palm kernel oil (5%) (Figure 3-6).

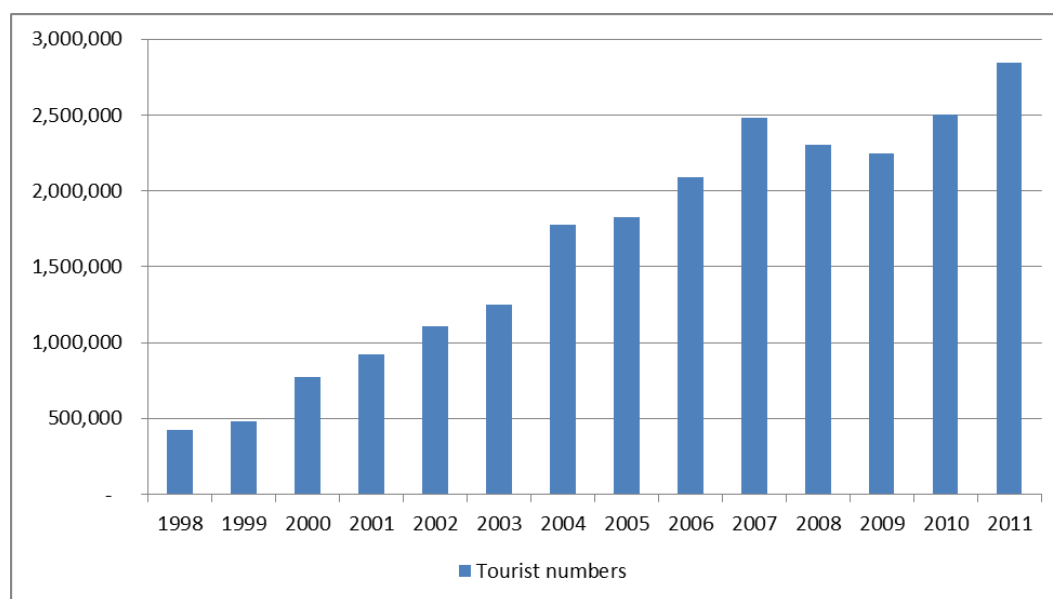
SECTION 3: DRIVERS OF CHANGE

Source: DOS, 2010b

Figure 3-6: Sabah's Major Exports in 2010

The services sector is now an important engine of growth for the state and as the sector continues to increase in prominence, this will reduce pressures on land and natural resources. The tourism industry, for example, has achieved strong growth over the past ten years. The number of visitors visiting the state had increased rapidly, from less than 0.5 million in 1998 to 2.5 million in 2010 (Figure 3-7). In 2011, tourist arrivals reached an all-time high with 2.84 million visitors, bringing the state an estimated RM4.98 billion in tourism income.

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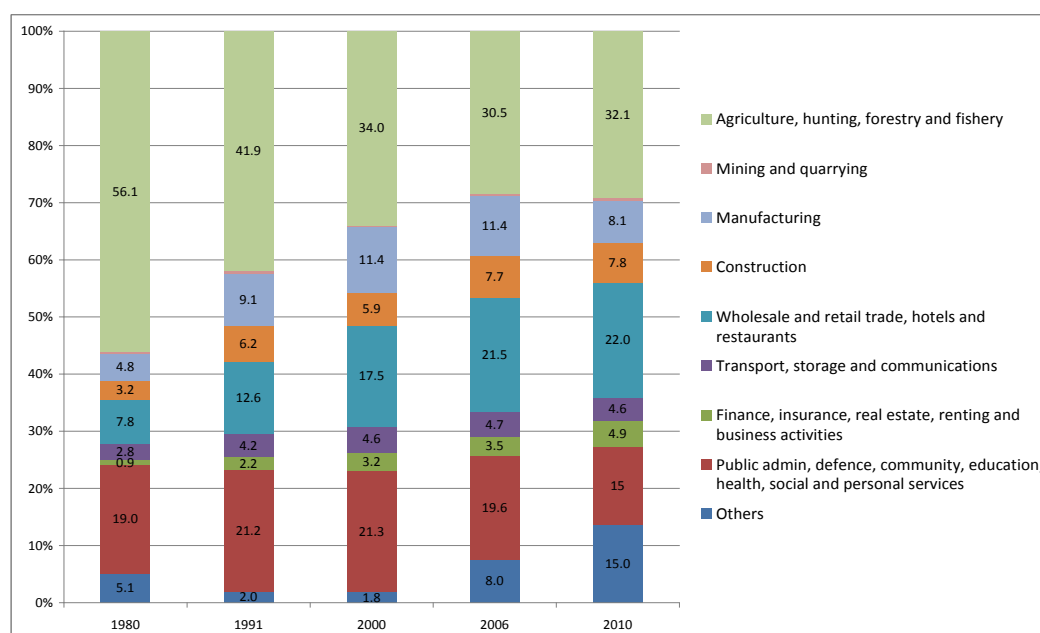
Source: Sabah Tourism Board

Figure 3-7: Sabah's Tourist Arrival, 1998-2011

Agriculture and forestry provided for more than half the employment in the state in 1980 (Figure 3-8). That figure has now dropped to less than 30 percent. Wholesale and retail trade, hotels and restaurants, which only provided 7.8 percent of employment in 1980, now provide 22 percent. The changes to the employment structure also indicate an increase in jobs in urban areas.

The implementation of the SDC programmes is expected to boost the role of the manufacturing sector in Sabah. These are aimed at boosting downstream value through activities which include the establishment of Palm Oil Industrial Clusters in Lahad Datu and Sandakan, the development of an oil and gas industrial cluster in Sipitang and the expansion of the Kota Kinabalu Industrial Park. With the momentum generated by these initiatives, the contribution of the manufacturing sector to the state's GDP is expected to increase.

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Source: Department of Statistics

Figure 3-8: Changes in Employment Structure, 1980-2010

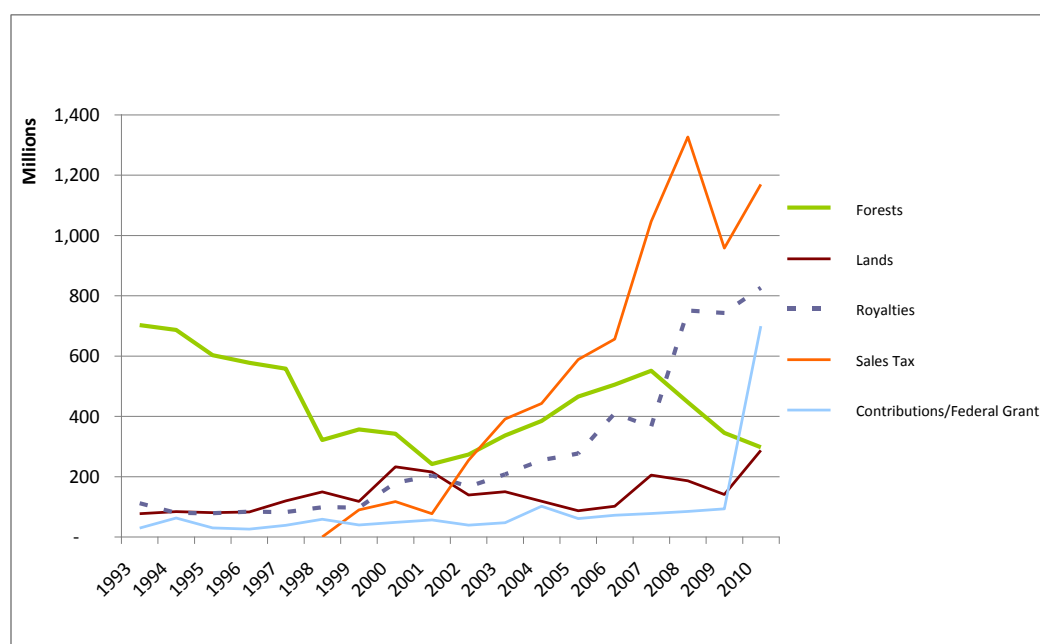
In terms of resource use and environmental impacts, the secondary and tertiary sectors are far more efficient than the primary sector in terms of per Ringgit GDP. The move from the reliance on primary sector towards the secondary and tertiary sectors will, in the long-run, reduce the pressures on the land and natural resources.

3.5 STATE GOVERNMENT'S RELIANCE ON NATURAL RESOURCES FOR REVENUE

Despite the impressive diversification of the state's economy over the last 30 years, the state government continues to rely heavily on revenue from the extraction of natural resources and land-based activities. Sales taxes from crude palm oil, royalties and fees from forest produce and petroleum remain the major revenue contributors (Figure 3-9).

Prior to 1998, revenue from forestry was the biggest contributor to the state revenue. Some 25 to 50 percent of the state's total revenue was derived from this source. However, the relative importance of forestry revenue to state revenue has declined since forest resources have become depleted and the state has intervened to strictly enforce sustainable forest management and focus on rehabilitating its degraded forest estate.

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Source: Sabah Treasury Department, State Estimates of Revenue and Expenditure

Figure 3-9: Sabah: Main Sources of State Revenue (RM), 1993 - 2010

Customs duties in the form of import and excise duties on petroleum used to be the second biggest contributor to the state's revenue, with an average annual contribution of more than 17 percent during the period 1995-1999. However customs revenue has dropped to a negligible level following the state's decision to support the national government's commitment under the ASEAN Free Trade Area to abolish import and excise duties on petroleum products effective 1 January 2000. Petroleum royalty from the federal government has since become one of the main sources of state revenue. In 2010, about 20 percent of state revenue came from this source.

In 1998, Sabah introduced the State Sales Tax Enactment, focusing heavily on collection of sales tax on crude palm oil. Revenue derived from the sales tax has increased significantly since the early 2000s on the back of higher crude palm oil prices. To date, this form of sales tax represents the most important source of revenue; it now accounts for over 30 percent of the state total revenue. To diversify its revenue sources, Sabah began to impose two new forms of sales tax in 2000s, namely, a sales tax on lottery tickets and sales tax on sale of bets through slot machine. However, these taxes contribute only around five percent of state revenue.

Sabah's heavy reliance on revenue from the extraction of natural resources and land-based activities is of course a direct result of the provisions in the Federal

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Constitution that give the state government jurisdiction over land and natural resources. Although the services sector is growing rapidly in the state, the state government derives very little revenue from these activities save for indirect land premium and quit rents from premises such as hotels and retail outlets.

The state government's reliance on revenue from land and natural resources will continue to exert significant pressure on biodiversity. The structural changes to the economy towards the services sector may not yield much additional revenue to the state government.

3.6 IMPLICATIONS ON BIODIVERSITY CONSERVATION

Population growth, the expansion of the economy and the increase in purchasing power of the people in Sabah has the potential to impose tremendous pressure on biodiversity. The biggest pressure will be the competition for land. Given that the land is finite, forests and wilderness areas will have to compete with schools, houses, hospitals and agriculture for precious land. It is therefore vital that we have policies and strategies that promote efficient use of land. This could mean that we have to improve our agriculture productivity, enhance our downstream economic activities and embrace the services sector to lead our economy. The other significant pressure will be wastes and pollution that will arise from the expanding production and consumption – the impacts of which will affect our ecosystems and biodiversity in many ways.

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SECTION 4 WILDLIFE

SECTION 4: WILDLIFE

4.1 INTRODUCTION

This section provides an overview of wildlife diversity in Sabah based on our current state of knowledge. These are organised according to the major animal groups. A more detailed status review is presented on the iconic flagship species and Bornean endemics as there are considerably more data available for these species. The main threats to wildlife in Sabah are discussed, alongside an evaluation of the institutional and legislative arrangements for wildlife protection, to identify specific gaps that need to be addressed and potential opportunities for intervention. Recent and on-going conservation initiatives are also presented to outline future directions for wildlife conservation in the state and to identify initiatives that require support.

4.2 WILDLIFE DIVERSITY IN SABAH

Many decades of research on Sabah's wildlife have been dedicated towards describing its biodiversity, and wildlife ecology. In recent years, the focus of wildlife surveys and biological research has centred on ascertaining the status of some of the State's threatened wildlife populations in order to mobilise appropriate conservation responses.

The first comprehensive faunal survey of Sabah was carried out by Davies & Payne (1982) and provided information on the distribution and status of selected mammal and bird species in Sabah. It set the direction for the State's subsequent wildlife research and conservation efforts. In 2002, the Sabah Wildlife Department (SWD) and HUTAN (a French non-governmental organisation) undertook a second faunal survey of the state (Ancrenaz *et al.*, 2003) with a specific focus on assessing the status of mammals and birds outside Sabah's PAs. This has contributed to a better understanding of the importance of Sabah's unprotected forests for certain wildlife species. Together, the two faunal surveys provide a good appraisal of mammal distribution and population trends.

The diversity of mammal and bird species found in Sabah is relatively well-documented (Table 4-1). Reptiles, amphibians and fishes are less thoroughly inventoried and new species continue to be described. Other than insects such as butterflies, moths, beetles and social insects, invertebrates have not been extensively studied and remain poorly described.

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Table 4-1: Diversity and Status of Major Groups of Fauna In Sabah

	Total Number of Species	Total Number of Families
Mammals	206	31
Birds	352	65
Reptiles	215	28
Amphibians	112	6
Freshwater Fishes	155	?
Invertebrates	150,000?	?

Sources: Chin (1990); Das and Yaacob (2007); IOC (2011); IUCN (2011); Payne and Francis (2007); Phillipps and Phillipps (2009)

4.2.1 Mammals

There are 206 species of terrestrial mammals in Sabah classified into 104 genera and 31 families (Table 4-2). The most species-rich groups of Sabah's mammals are the bats (86 species) and rodents (58 species). Three mammalian orders are each represented by only a single local species i.e. the pangolin, the elephant and the flying lemur. These orders are particularly vulnerable to local extinction. The hairy-nosed otter, a species previously thought to be extinct, was recently recorded in Sabah after a gap of more than 100 years. Seven species of mammal are considered endemic to Sabah. These include two species of shrew, two species of bat, two rat species and one species of badger (Table 4-3).

Sabah harbours some mammal populations of global significance. Sha *et al.* (2011) estimates that Sabah's proboscis monkey population (estimated at 6,000) may represent a third of the world population of this Bornean endemic. It is estimated that there are about 11,000 orang-utans in Sabah, one of the largest populations in the world and of exceptional conservation importance. Sabah is also home to about 2,000 Asian elephants - about 5% of the world Asian elephant population. Sabah's elephants are a genetically distinctive sub-species also called the Borneo pygmy elephant (*Elephas maximus borneensis*) which is found nowhere else in the world. The Sumatran rhinoceros which is critically endangered worldwide occurs in the eastern lowlands of Sabah, although only 40 individuals are thought to remain.

SECTION 4: WILDLIFE**Table 4-2: Diversity of Mammals in Sabah**

Order	Represent	No. of species	Remarks
Eulipotyphla	Shrews and gymnures	9	Include the moonrat, lesser gymnure, house shrew, black shrew, Savi's pigmy shrew, Sunda shrew, South-East Asian white-toothed shrew. Kinabalu shrew (VU) and the Bornean Water Shrew (EN).
Scandentia	Treeshrews	8	Include the pentail treeshrew, common treeshrew, Mountain treeshrew, lesser treeshrew, slender treeshrew, large treeshrew, striped treeshrew and smooth-tailed treeshrew.
Dermoptera	Flying lemur	1	Only one representative, the flying lemur (or colugo).
Chiroptera	Bats	86	The most species-rich order in Sabah. Threatened species include the bare backed rousette (VU), Ridley's roundleaf bat (VU) and Tomes' false serotine (VU) and the Flores woolly bat (VU).
Primates	Prosimians, monkeys and apes	10	Include the Bornean slow loris (VU), Western tarsier (VU), Hose's langur (VU), maroon langur, silvered langur, proboscis monkey (EN), long-tailed macaque, pig-tailed macaque (VU), Müller's Bornean gibbon (EN) and Bornean orang-utan (EN). Five of Sabah's primate species are endemic to Borneo.
Pholidota	Pangolin	1	Only one representative, the Malayan pangolin (EN).
Rodentia	Squirrels, rats and porcupines	58	Threatened species include the ear-spot Squirrel (VU), whiskered flying squirrel (VU), Vordermann's flying squirrel (VU), smoky flying squirrel (EN) and tufted ground squirrel (VU).
Carnivora	Civets, otters, mustelids, cats mongooses and bear	24	Threatened species includes the Hose's civet, otter civet, banded civet (VU), binturong (VU), hairy-nosed otter, Bornean ferret badger, Bornean bay cat (EN), flat-headed cat (EN), Sunda clouded leopard (VU), marbled cat (VU), collared mongoose and sun bear.
Proboscidea	Elephant	1	Only one representative, the Asian elephant (EN).
Perissodactyla	Odd-toed Ungulates	1	Only one representative, the Sumatran rhinoceros (CR).
Artiodactyla	Even-toed Ungulates	7	Include the bearded pig (VU), lesser mouse-deer, greater mouse-deer, red muntjac, Bornean yellow muntjac, sambar deer and tembadau (or banteng) (EN).

Note: CR: Critically endangered, EN: Endangered, VU: Vulnerable

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Table 4-3: Endemic Mammals in Sabah

English name	Scientific name	Habitat
Black Shrew	<i>Suncus ater</i>	Montane (Kinabalu)
Kinabalu Shrew	<i>Crocidura baluensis</i>	Montane (Kinabalu)
Gomantong Myotis	<i>Myotis gomantongensis</i>	Lowland
Coppery Pipistrelle	<i>Pipistrellus cuprosus</i>	Lowland
Mountain spiny rat	<i>Maxomys alticola</i>	Montane
Bornean pithecheirops	<i>Pithecheirops otion</i>	Lowland (Danum Valley)
Bornean ferret badger	<i>Melogale everetti</i>	Montane

Based on the International Union for Conservation of Nature (IUCN) Red List, 86 mammals (or about 40%) in Sabah are under various levels of conservation risk. Six mammal species are already totally protected in Sabah (under Schedule 1, Part I of the Wildlife Conservation Enactment 1997): Sumatran rhinoceros (*Dicerorhinus sumatrensis*), the orang-utan (*Pongo pygmaeus*), the sun bear (*Helarctos malayanus*), the proboscis monkey (*Nasalis larvatus*), the clouded leopard (*Neofelis diardi*), the dugong (*Dugong dugon*) and the Asian elephant (*Elephas maximus*). Eight species of large terrestrial mammals are now considered threatened (Table 4-4).

Table 4-4: Threatened & Endangered Species of Large Terrestrial Mammals in Sabah

Species	Global Status	Status in Sabah (under the Wildlife Conservation Enactment 1997)
Sumatran Rhinoceros <i>Dicerorhinus sumatrensis</i>	CR	Totally Protected (Schedule 1) (<i>ssp. harrissoni</i>)
Orang-utan <i>Pongo pygmaeus</i>	EN	Totally Protected (Schedule 1) (<i>ssp. morio</i>)
Asian Elephant <i>Elephas maximus</i>	EN	Protected (Schedule 2) (<i>ssp. borneensis</i>)
Banteng/Tembadau <i>Bos javanicus</i>	EN	Protected (Schedule 2) (<i>ssp. lowi</i>)
Sambar Deer <i>Rusa unicolor</i>	VU	Game species (Schedule 3)
Sun Bear <i>Helarctos malayanus</i>	VU	Totally Protected (Schedule 1)
Clouded Leopard <i>Neofelis diardi</i>	VU	Totally Protected (Schedule 1)
Bearded Pig <i>Sus barbatus</i>	VU	Game species (Schedule 3)

Note: CR: Critically endangered, EN: Endangered, VU: Vulnerable

4.2.2 Birds

A total of 352 bird species belonging to 65 families have been recorded in Sabah (IOC, 2011). Three bird species are considered endemic – the Bornean falconet (*Microhierax latifrons*), the world's smallest bird of prey, and the black-headed pitta (*Pitta ussheri*) are both mostly founds in lowland forest, while the friendly bush warbler (*Bradypterus accentor*) has only been recorded in montane habitats (Phillipps and Phillipps, 2009). Moyle *et al.* (2007) has proposed to split the Bornean swiftlet (*Collocalia dodgei*) only found in Sabah's montane habitat from the wider ranging glossy swiftlet, which would make the Bornean swiftlet a fourth Sabah endemic.

Lowland forests of Sabah harbour the greatest diversity of bird species. Lowland specialists include the Bornean ground cuckoo, great slaty woodpecker, blue-headed pitta, Bonaparte's nightjar and bristlehead. Characteristic residents of hill and submontane forests include the Bulwer's pheasant, orange-breasted trogon, Hose's broadbill, banded and blue-banded pitas. At higher altitudes, the number of bird species decreases but the incidence of endemism is higher. Characteristic upper montane birds include the island thrush, friendly bush warbler, pale-faced bulbul and fruit hunter.

Characteristic birds of peat swamps include the wrinkled hornbill, hooked-billed bulbul, grey-chested jungle flycatcher, scarlet-breasted flowerpecker and fiery minivet. Kerangas or heath forests are rare habitats that typically harbour species such as the white-chested babbler, hooked-billed bulbul and thick-billed flowerpecker. The birds of freshwater swamps, rivers and lakes comprise an array of herons, egrets, bitterns, stork, darters and other waterbirds. Specialised and rare species include the Storm's stork and the oriental darter. Typical mangrove birds include the ruddy kingfisher, great tit, mangrove blue flycatcher, mangrove whistler, lesser adjutant, herons and migrant waders.

Over 240 bird species have been recorded as migrants or vagrants to Borneo. It is roughly estimated that about 15 million birds reach Borneo each winter from Siberia and North East Asia and a smaller number from Australia and Java. The corridor through which these waterbirds migrate is known as the East Asian-Australasian Flyway. It extends from within the Arctic Circle, through East and South-east Asia, to Australia and New Zealand. Stretching across 22 countries, it is one of eight major waterbird flyways recognised around the globe. Forest migrants to Sabah include the Asian brown and Mugimaki flycatchers, grey nightjar, Siberian blue robin and brown hawk-owl. Migrants are most common in coastal habitats and Sabah boasts numerous important stopover sites for migrant waterbirds, such

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as Pulau Mantanani, Pulau Tiga, Klias wetlands, the Kota Kinabalu area and Pulau Layang-Layang. The 78,803 ha LKSW Ramsar Site may represent an important stop-over site along the East Asian Australasian Flyway, and particularly for the Chinese egret (Lackman and Manokaran, 2010). Sabah has 14 Important Bird Areas (IBAs). These are areas being globally important habitat for the conservation of birds (BirdLife International, 2005) (Table 4-5).

Table 4-5: Important Bird Areas for Sabah

No.	Important Bird Areas	Forest Types
1	Crocker Range Park	Hill forest, sub-montane forest, montane forest
2	Kinabalu Park	Hill forest, sub-montane forest, montane forest
3	Trus Madi Range	Hill forest, sub-montane forest, montane forest
4	Kinabatangan Floodplain	Mangrove forest, intertidal habitat, peat swamp forest, freshwater swamp forest, floodplain lakes, lowland forest, karst/caves
5	Danum Valley Conservation Area	Lowland forest, hill forest, sub-montane forest
6	Maliau Basin Conservation Area	Lowland forest, hill forest, sub-montane forest, montane forest, tropical heath forest
7	Tawau Hills Park	Lowland forest, hill forest, sub-montane forest
8	Tabin Wildlife Reserve	Lowland forest, hill forest
9	Klias Peninsula	Mangrove forest, intertidal habitat, peat swamp forest, freshwater swamp forest, lowland forest, tropical heath forest
10	Kabili-Sepilok Forest Reserve	Mangrove forest, lowland forest, hill forest, tropical heath forest
11	Kulamba Wildlife Reserve	Freshwater swamp forest, lowland forest
12	Sipadan Islands	Offshore islands, coral reefs, beach forest
13	Mantanani Islands	Offshore islands, open sea, beach forest, karst/ caves
14	Tempasuk Plain	Mangrove forest, freshwater swamp forest, lowland forest, open sea, secondary forest, farmland

Source: Aik *et al.* (2005)

4.2.3 Amphibians and Reptiles

Altogether, 112 species of amphibians and 215 species of reptiles have been described for Sabah so far (Table 4-6). A relatively high number of species have been discovered or recognised as new only in the last five years and the figures are expected to increase significantly as further field surveys and detailed molecular examinations are conducted.

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Table 4-6: Herpetofauna Diversity in Sabah

Taxonomic groups	Total Number of Species Described	Total Number of Families
<i>Amphibians</i>	112	6
Frogs	111	5
Caecilians	1	1
<i>Reptiles</i>	215	28
Snakes	123	11
Lizards	76	10
Crocodiles	1	1
<i>Turtles, terrapins and tortoises</i>	14	6

Sources: Das and Yaacob (2007); Graeme Gillespie (pers. comm.), Malkmus *et al.* (2002)

There are 111 species of frog described from Sabah and it is anticipated that this represents only a fraction of actual species diversity, particularly as montane areas have not been completely explored. To date, only one species of caecilian (a group of amphibians that superficially resemble earthworms or snakes) has been recorded in Sabah i.e. *Ichthyophis monochrous* (Malkmus *et al.*, 2002). A total of 123 snake species (28 families) and 76 lizard species (10 families) have been recorded (Das and Yaacob, 2007).

The estuarine crocodile (*Crocodylus porosus*) is widely distributed in Sabah, inhabiting mangroves, river basins, freshwater swamps and inland oxbow lakes. It has also been encountered more than 20 km off Sabah's east coast. The population of estuarine crocodiles in Sabah was on the verge of collapse in the mid-80s due to overexploitation but seems to have recovered since then. The population is estimated at 13,000 to 15,000 (SWD, 2002). The estuarine crocodile has been listed as a Protected Species since 1982 by the Wildlife Conservation Enactment 1997. However, although protection efforts over the past decades seem to have been successful, little is known about important crocodile nesting areas and these may need special protection.

Three species of sea turtles are known to nest along the shores of Sabah, the green turtle, the hawksbill turtle and the olive Ridley turtle. Nesting sites are found primarily on the three islands within Turtle Islands Park, namely Selingan, Bakungan Kechil and Gulisan, as well as on Sipadan island. The green turtle is the most abundant, whereas the Olive Ridley turtle is only rarely found nesting on the beaches. There are records of three species of softshell turtles in Sabah, six species of hardshell turtles and one species of tortoise (Table 4-7). Most of the 14 species of turtles, terrapins and tortoises inhabiting Sabah are considered by the IUCN to

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be threatened (2011). The hawksbill turtle is listed as Critically Endangered, five are considered Endangered and four are Vulnerable.

Table 4-7: Turtles, Terrapins and Tortoise Recorded in Sabah

Common Name	Scientific Name	IUCN status (2011)	Protection in Sabah (under the Wildlife Conservation Enactment 2007)
Sea Turtles	Cheloniidae		
Green turtle	<i>Chelonia mydas</i>	EN	Schedule 1
Hawksbill turtle	<i>Eretmochelys imbricata</i>	CR	Schedule 1
Olive Ridley turtle	<i>Lepidochelys olivacea</i>	VU	
Softshell turtles	Trionychidae		
Asian softshell turtle	<i>Amyda cartilaginea</i>	VU	
Malayan Soft-shelled Turtle	<i>Dogania subplana</i>	LC	
Frog-faced Softshell Turtle	<i>Pelochelys cantorii</i>	EN	
Asian hardshell turtles	Geoemydidae		
South Asian box turtle	<i>Cuora amboinensis</i>	VU	
Asian leaf turtle	<i>Cyclemys dentata</i>	NT	
Spiny hill turtle	<i>Heosemys spinosa</i>	EN	
Malayan flat-shelled turtle	<i>Notochelys platynota</i>	VU	
Malaysian giant turtle	<i>Orlitia borneensis</i>	EN	Schedule 2
American hardshell turtles	Emydidae		
Red-eared slider*	<i>Trachemys scripta</i>	LC	
Land tortoises	Testudinidae		
Asian brown turtle	<i>Manouria emys</i>	EN	Schedule 2

Note: CR: Critically endangered, EN: Endangered, VU: Vulnerable, NT: Near Threatened, LC: Least Concern

*Introduced species

4.2.4 Fishes

Freshwater fishes of Sabah are diverse and inhabit a great variety of habitats ranging from small torrential streams to estuarine, highly acidic ecosystems and alkaline waters. A total of 155 freshwater fish species, including 12 exotic species have been recorded to date (Inger and Chin, 1990). Overall, the state is poorly inventoried and the actual number of freshwater fish species in Sabah is likely to be much higher.

Sabah contains the largest concentration of coral reefs and reef fishes in Borneo (Oakley *et al.*, 2000). The southeast and northeast shores of Sabah and the Spratly islands in the South China Sea are most notable for coral reef development. In a

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review of the status of the reefs of East Malaysia however, Pilcher and Cabanban (2001) painted a general picture of decline as a result of destructive fishing with bombs and cyanide. Layang Layang and Sipadan were identified as exceptions, with high fish diversity and live coral cover. The waters off Sabah's north and east coasts are part of WWF's Coral Triangle Initiative. The area is estimated to have more than 3,000 species of reef fish, 8% of which are endemic or locally restricted species. It is also a feeding ground for migrating whale sharks and manta rays that are attracted to the region by abundant plankton. The largetooth sawfish (*Pristis microdon*) is the only fish in Sabah listed as Critically Endangered on the 2011 IUCN Red List.

4.2.5 Invertebrates

The diversity of Sabah's invertebrates is extremely high. However, only a fraction of this vast group of animals which comprises 33 phyla distributed across in all terrestrial and aquatic habitats has been documented. Around 80% of all invertebrates belong to the phylum Arthropods which include the insects, millipedes, centipedes, spiders and crustaceans. The main studies on insect taxonomy that have been conducted in Sabah have primarily focused on charismatic insect groups such as the butterflies and moths, beetles, wasps, ants and bees, and termites.

From these we know that an estimated 936 species of butterfly are found in Borneo, 94 of which are endemics. Moths are particularly species-rich: just over 4,000 species of macromoths are known from Borneo (Chey, 2007). The Sabah Forest Insect Museum in Sepilok houses more than 2,400 species of macromoths with 18,000 pinned specimens. Among the beetles, a total of 106 families have been recorded in Borneo. There are about 1,700 species of beetles from 89 families in the collection at the Forest Research Centre (FRC) in Sepilok, Sandakan (Chung, 2003).

Of Sabah's karst-endemic land snails, a total of 13 species were listed as critically endangered in the 2004 IUCN Red List (Schilthuizen *et al.*, 2005).

4.3 STATUS REVIEW OF FLAGSHIP SPECIES

4.3.1 Bornean Orang-utan

The orang-utan is found only in Borneo and Sumatra. It is the only Asian great ape. Over the past few decades, orang-utan numbers have declined at an unprecedented scale. Several populations have already disappeared and the species is expected to be extirpated in much of its natural range unless decisive conservation management measures are identified and urgently implemented. Sabah's orang-utan, the *Pongo pygmaeus morio*, is a sub-species and has been listed as endangered on the IUCN Red List since 2008. It is a Totally Protected species under the Wildlife Conservation Enactment 1997.

Orang-utan distribution in Sabah is irregular throughout the State's forested areas; the apes are primarily found in the lowland forests of eastern and central Sabah. Only two small isolated populations are found in western Sabah, in the Crocker Range Park (CRP) and Kinabalu Park (Table 4-8). The most recent estimates place the Sabah orang-utan population at about 11,000 individuals (Ancrenaz *et al.*, 2005; Alfred *et al.*, 2010b). Although these surveys indicate that the population has declined by an estimated 35% over the past 20 years (Goossens *et al.*, 2006), this figure still represents a fifth of the entire Borneo population and makes Sabah a critical stronghold for the conservation of the species.

Major Threats

Habitat Loss - Throughout its range in Borneo and Sumatra, the drastic decline observed in orang-utan numbers has been attributed to the large-scale conversion of lowland mixed dipterocarp forests to logging and plantation agriculture (Rijksen and Meijaard, 1999; Wich *et al.*, 2008). It is estimated that Sabah has lost around 50% of its original forest cover, most of which used to be prime orang-utan habitat. Today, 65% of Sabah's remaining wild orang-utans live in habitats outside of PAs. Further forest conversion will diminish the remaining habitat and result in orang-utan losses and displacement.

Habitat Degradation - A large proportion of Sabah's orang-utans is concentrated in forests managed for timber production by the SFD and the Sabah Foundation (see Table 4-8). Forest over-exploitation is already known to have caused the decline of some orang-utan populations, possibly leading to local extinctions (Ancrenaz *et al.*, 2005; Ancrenaz *et al.*, 2010). Unsustainable logging practices still used in some of Sabah's timber concessions constitutes a threat to the State's remaining orang-utan populations.

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Table 4-8: List of High Priority Areas for Orang-utans in Sabah

No.	Area	Status	Orang-utan Population (estimated)
1	Sabah Foundation Forest Concession Area	Commercial Forest Reserve	Ulu Segama Malua: 2600 to 3000 (1295-5866) ^{1,2,3} Other FMUs: 2100 ^{1,2,3}
	Danum Valley Conservation Area	Protection Forest Reserve	425 (309-570) ³
2	Forest of Upper Kinabatangan (North)	Commercial Forest Reserve	1700 to 2100 (1016-3403) ^{1,3}
3	Tabin Wildlife Reserve	Wildlife Reserve	1200 (868-1606) ^{1,3}
4	Lower Kinabatangan Floodplain	Virgin Jungle Reserve, Wildlife Sanctuary & private land	700 to 825(546-955) ^{2,3}
5	Kulamba Wildlife Reserve and Trusan Kinabatangan Forest Reserve	Wildlife Reserve, Mangrove Forest Reserve	480 (276-1214) ^{2,3}
6	Ulu Kalumpang, Mt. Wullersdorf and Tawau Hills	Protection Forest Reserve, National Park	144 (54-408) ¹ to 605 (487-783) ³
7	Trus Madi Forest Reserve	Commercial Forest Reserve and Protection Forest	282 (126-736) ¹
8	Kabili-Sepilok Forest Reserve	Virgin Jungle Reserve	200 (100-300) ⁴
9	Crocker Range Park	National Park	181 (62-528) ¹
10	Bonggayya Forest Reserve	Commercial Forest Reserve	111 (38-324) ¹
11	Lingkabau Forest Reserve	Commercial Forest Reserve	100 (75-150) ⁴
12	Silabukan Forest Reserve	Protection Forest Reserve	58 (21-159) ¹
13	Kinabalu Park	National Park	50 (25-75) ¹
14	Ulu Tungud Forest Reserve	Commercial Forest Reserve	29 (9-99) ¹

Sources: ¹Ancrenaz *et al.*, 2005; ² Ancrenaz *et al.*, 2010, ³Alfred *et al.*, 2010b; ⁴ Payne 1987 - All confidence intervals have been bootstrapped.

Habitat Fragmentation and Human-Wildlife Conflict - Since the 1980s, orang-utan habitat has become increasingly fragmented. Fragmentation prevents gene-flow between isolated orang-utan sub-populations and may result in inbreeding and deleterious genetic effects which could jeopardise the viability of the population in the long-term. Increasing habitat fragmentation also intensifies conflicts between humans and orang-utans.

The development of large-scale oil palm plantations in Sabah has precipitated conflict between orang-utans and planters. As displaced orang-utans are attracted to the nutritious shoots of young oil palm trees, there have been many instances in which orang-utans have been shot for crop-raiding. Although these killings have become less frequent, they still constitute a threat for orang-utans living near newly established plantations. The use of orang-utan as bush meat or for medicinal

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purposes in Sabah still occurs in some non-Muslim areas. These practices however are now declining as the orang-utan populations in most of these areas have already been hunted to extinction.

Limitations of the Protected Area Network - The current system of PAs in Sabah is not adequate for the purpose of orang-utan conservation. This is because the largest PAs, Kinabalu Park, Crocker Range Park and the network of mangrove forest reserves constitute only marginal habitat for orang-utans. Other PAs, such as Virgin Jungle Reserves are too small and isolated to sustain viable orang-utan populations.

In East Sabah, where orang-utan populations are distributed, the main PAs - Tabin Wildlife Reserve, Kulamba Wildlife Reserve and the Lower Kinabatangan Wildlife Sanctuary are becoming increasingly isolated from each other due to decreasing connectivity arising from habitat conversion. While the Commercial Forest Reserves contain habitat suitable for orang-utans, the areas set aside as conservation zones tend to be small areas of steep terrain that are of limited value for conserving most wildlife species including the orang-utan.

The survival of Sabah's orang-utan will depend closely on the ability to retain connectivity between suitable habitat within PAs and adjoining landscapes. To do so it is necessary to engage a wide range of stakeholders from corporations to local people, to ensure that the apes are protected from harm and humane and legal approaches are used to resolve incidents of human-wildlife conflict.

4.3.2 Asian Elephant

The Asian elephant in Sabah, also called the Bornean Pygmy Elephant (*Elephas maximus borneensis*) is regarded as an evolutionary significant unit found nowhere else in the world (Fernando *et al.*, 2003). Wild elephants occur only in the north-eastern part of Borneo, astride the border between Sabah and Kalimantan. In Sabah itself, they occur in forested areas in the south, centre and east of the State. They generally prefer low-lying forests near rivers with adequate open areas for feeding and secluded areas to which they can retreat to during the day. Recent surveys carried out by the SWD and WWF-Malaysia provides a population estimate of 2,040 elephants in Sabah (Alfred *et al.*, 2010a). The number of individuals in Kalimantan is thought to be fewer than 20 (Alfred *et al.*, 2009).

Table 4-9 shows the elephant population size and density estimate for the five major elephant ranges in Sabah. Population trends are difficult to assess for the Bornean elephant as only one state wide survey has been conducted so far. However, wildlife experts believe that the conversion of large areas of elephant

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habitat to oil palm plantations has increased fragmentation between the main elephant ranges and will have negative impacts on the elephant population. The Asian elephant has been listed as endangered on the IUCN Red List since 1986. In Sabah, the elephant is totally protected under the Wildlife Conservation Enactment 1997.

Table 4-9: Population Size and Density Estimates in the Five Managed Elephant Ranges in Sabah (after Alfred *et al.*, 2010a)

Range	Range description	Area (sq. km)	Population Size (No. of individuals & CI 95%)	Density (ind/km ²) (standard error)
Lower Kinabatangan	Kinabatangan Floodplain	400	298 (152-581)	2.15 (0.84)
North Kinabatangan	Deramakot, Tangkulap and Segaliud-Lokan Forest Reserves	1,400	258 (131-511)	0.56 (0.22)
Central Sabah	Ulu Segama, Malua, Kuamut, Gunung Rara, Kalabakan and Sapulut Forest Reserves and Danum Valley Conservation Area	7,900	1,132 (748-1,713)	1.18 (0.34)
Tabin	Parts of Tabin Wildlife Reserve	1,200	342 (152-774)	0.60 (0.28)
Ulu Kalumpang	Ulu Kalumpang Forest Reserve and the northern part of Tawau Hills Park	510	10 (1-73)	0.12 (0.11)
Total		11,410	2,040 (1,184-3,652)	

Major Threats

Habitat Loss and Fragmentation - Elephants require large feeding grounds and enough space for social groups to migrate between them. In Sabah, the primary threat to the Bornean elephant is the loss and degradation of continuous forests. The conversion of forests to plantations is a particularly serious threat as it deprives the elephants of a wide range of forest foods which are necessary to sustain breeding populations. Fragmentation of habitats causes elephant groups to become isolated from each other in pockets of habitat. The rapid increase in the local human population in conjunction with plantation operations can result in increases in elephant-human conflict arising from elephant displacement.

Low Genetic Diversity - A recent genetic study found extremely low genetic diversity in the Bornean elephant population and significant genetic differentiation between currently demographically isolated populations (Goossens *et al.*, in prep). These results stress the urgent need to re-establish gene flow between populations to avoid the incidence of inbreeding.

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Poaching, Illegal Killing, Snare Trapping and Illegal Trade - There have been numerous incidences of elephants being killed usually in relation to their intrusion into oil palm plantations where they can cause extensive damage. Moreover, snare traps set by estate workers in the forests bordering the plantations to catch wild mammals for meat pose a threat to elephants. This has been a problem in the Kinabatangan floodplain where it is estimated that 20% of resident elephants have sustained injuries from illegal snares. Although poaching may not have been a serious problem to elephants in the past (Tuuga, 1992), the recent reduction of population size in Ulu Kalumpang area might indicate the contrary (Alfred *et al.*, 2011).

4.3.3 Sumatran Rhinoceros

The Sumatran rhinoceros is one of the most endangered animal species anywhere in the world. It is listed as Critically Endangered with only six substantial populations in the wild: four in Sumatra, one in Borneo, and one in the Malay Peninsula. The global population is estimated to be less than 250 individuals. The Bornean population of Sumatran rhinoceros (also known as the Bornean rhino) formerly occurred throughout the island of Borneo but is now restricted to Sabah; only 40 individuals or less are thought to remain. There are two, very small rhino breeding populations, one in Tabin Wildlife Reserve (possibly up to 15 rhinos in 1,220 km²) and another in and immediately adjacent to Danum Valley Conservation Area (13 or more rhinos in 500 km²). In addition, surviving in at least three scattered locations in pockets of remaining forest habitat in eastern and central Sabah, are a few remnant rhinos. The rhino is a totally protected species under provisions in the Wildlife Conservation Enactment 1997.

Major Threats

Very Low Population Numbers - If Danum and Tabin are each assumed to contain 15 rhinos, and that about half are females, and that of those females some are too old or too young to reproduce, perhaps only three or four rhinos in each area will be reproductively active. With a birth interval of three years under optimum conditions, only one rhino will be born into each population annually – this would explain the apparent zero rate of population increase in these PAs. A period of active capture of wild Sumatran rhinoceroses from sites in Sumatra, Peninsula Malaysia and Sabah where forest was being converted to plantations between 1984 and 1995 revealed that at least half the female rhinos had reproductive tract pathology (Schaffer, 2001), a phenomenon associated with lack of breeding and carrying of foetuses to successful birth that appears to particularly afflict rhinos (Hermes *et al.*, 2006).

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The fact that at least some wild female Sumatran rhinos have exhibited this pathology at the time of capture indicates that not all wild female rhinos are breeding, presumably due to insufficient fertile males to meet and mate. In the absence of specific actions to bring Sumatran rhinos together and boost production of offspring, there is a strong possibility that the Sumatran rhino may go extinct even if protection of rhino habitats and rhinos can be maintained and improved.

Hunting and Trapping - There is no quantitative information on the prevailing intensity of active rhino poaching, or of the risk of casual shooting of rhinos by hunters seeking other prey. Snare traps set illegally in the border forests to catch wild mammals for meat pose a risk to rhinos, especially in Tabin Wildlife Reserve. Poachers were active in the Danum area in the early 1990s, but it is not clear if such groups are still actively seeking rhinos in Sabah. Experts warn that at any time, a single rhino poaching or inadvertent trapping event may represent the tipping point that pushes the species to a trajectory of extinction in Sabah.

4.4 THREATS TO WILDLIFE POPULATIONS IN SABAH

4.5.1 Habitat Change

Over the past three decades, extractive industries concerned primarily with logging, as well as large-scale commercial plantations have transformed landscapes in regions once known for concentrations of wildlife.

Loss of Habitat - Throughout Borneo, the drastic decline observed in wildlife populations is primarily attributed to the large-scale loss of natural habitat through intensive timber exploitation and the ensuing conversion of large expanses of lowland mixed dipterocarp forests to agriculture, particularly to oil palm plantations. It is estimated that Sabah, has lost about half of its natural forest cover, most of which used to be prime habitat for wildlife.

The conversion of natural forests to monoculture, crops or trees, still remains the biggest threat to wildlife diversity, because no industrial plantation can provide the diversity and quantity of foods, shelter and basic resources necessary to replace complex natural ecosystems and sustain breeding communities of wildlife (e.g. Koh and Wilcove, 2008). Today, a large proportion of wildlife populations, including 65% of the Sabah's wild orang-utans, survive in forests that are not protected and prone to human exploitation. Any new conversion of natural forests to oil palm plantation and other forms of monoculture will further diminish the remaining habitat available for Sabah's wildlife.

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In 2009, around 1.4 million hectares of Sabah's fertile lowlands were already covered with oil palm plantations and another 150,000 hectares were planted with other industrial crops (rubber, paddy, coconut, etc.). The richest wildlife diversity is associated with Sabah's lowland forest habitats. With the loss of large swathes of lowland habitat, surviving wildlife populations are now displaced into overcrowded adjacent forested areas, where they face competition for resources and the disruption of their social and breeding systems.

Much of Sabah's wildlife is now found within the Commercial Forest Reserves which are divided into large FMUs leased by concessionaires for commercial timber extraction. In some areas, years of prior unsustainable logging has made many of these concessions commercially unviable in the short to medium term. Therefore, some FMU concessionaires have started to convert part of their holdings into wood or oil palm plantations. The conversion of wildlife-rich areas within Sabah's FMUs, such as the Gunung Rara FR within the Benta Wawasan area, will have disastrous consequences on the survival of numerous endangered species such as the orang-utan and the elephant.

Habitat Degradation - The degradation of natural habitats resulting from unsustainable forest exploitation is also a key threat to the survival of Sabah's wildlife. Different species respond differently to forest degradation according to their ability to adapt to new habitat conditions. Some specialised species are highly vulnerable to even minor changes whereas more adaptable species can adjust to higher levels of degradation. Intensive ecological research on orang-utans living in the logged-over forests of the Lower Kinabatangan has shown that this species is sufficiently flexible to adapt to certain levels of habitat degradation and can even thrive in regenerating secondary forests. Higher levels of degradation however have been shown to cause the rapid decline and extinction of other orang-utan populations (Ancrenaz *et al.*, 2005; Ancrenaz *et al.*, 2010).

Some would argue that secondary forests have no use for wildlife and would be more profitable if converted to agriculture or other land uses. However, long-term studies in tropical regions consistently show that where pristine forests are not available, many wildlife species such as the orang-utan can adapt and thrive in secondary forests. Secondary forests should therefore be protected against conversion to oil palm and any future expansion of agriculture should be restricted to pre-existing cropland or overly degraded habitats.

In Sabah, important wildlife populations are found within FMUs in the State's Commercial Forest Reserves. FMU licensees have shown various degrees of compliance to the guidelines for sustainable forest management established by the SFD. In some FMUs, for instance FMUs 15 and 16 located within the Sungai

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Pinangah FR, continuous unsustainable logging practices have left the forests there in a highly degraded state, unsuitable for the survival of the two isolated orang-utan populations still living in the area. Most wildlife species in these FMUs, and in the buffer zone of the Maliau Conservation Area into which logging has encroached, also face the threat of localised extinction (HUTAN, 2011). Conversely, FMUs that have implemented sustainable management practices are still able to harbour a high diversity of wildlife, including healthy populations of orang-utan, elephant, tembadau, clouded leopard, and sun bear. Examples of these are the Deramakot FR (FMU 19A), Tangkulap FR (FMU 17) Segaliud-Lokan FR (FMU 19B) and Ulu Tungud FR (FMU 4) in central Sabah (Ancrenaz *et al.*, 2005; Alfred *et al.*, 2010a,b).

The biology of some species makes them particularly sensitive to habitat degradation. All eight hornbill species found in Sabah for instance form monogamous pairs with a unique nesting behaviour – hornbills are hole-nesters, preferring natural cavities in large hollow trees. The female hornbill seals the entrance to her nest cavity, leaving only a narrow slit through which she, and later her chicks, receives food from her mate. The extraction of larger trees therefore constitutes a major obstacle for the breeding of the hornbills and a serious threat to their survival.

Many other forms of habitat degradation also threaten wildlife populations in Sabah. One example is the level of pollution found in some of Sabah's main rivers which affects all life forms depending on freshwater ecosystems. Another example is sand dredging of exposed sandbanks which destroys the feeding and resting grounds of resident and migrant waders. (Lackman and Manokaran, 2010). A third example is the uncontrolled colonisation of some of Sabah's natural forests by *Acacia mangium* which was initially introduced in Sabah's commercial acacia plantations; the Acacia now poses a threat to the native flora and fauna.

Habitat Fragmentation - Habitat fragmentation disrupts the continuity of wildlife habitats by restricting natural movements and breeding patterns. It is known to cause the rapid extinction of small and isolated wildlife populations. In Sabah, deforestation, agricultural land conversion and urbanisation have created highly fragmented landscapes. The imbrications of human activities alongside fragments of wildlife habitat has also increased the rate of human-wildlife conflicts, poaching as well as the risks of transmission of infectious diseases between humans and wildlife.

The current system of PAs itself in Sabah, although accounting for an impressive 16% of the State's landmass, is very fragmented and unlikely on its own to maintain

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viable populations of terrestrial fauna in the long-term. Sabah's largest parks, the Kinabalu Park and Crocker Range Park, are completely isolated from each other and from any other PAs. Sabah's Virgin Jungle Reserves, the forest reserves with the highest level of protection managed by the Sabah forestry Department, are disseminated throughout the state, too small and isolated to sustain viable wildlife populations.

The connectivity of the mangrove forest reserves along Sabah's north-eastern coast with other PAs is also threatened. The largest Protection Forest Reserves (the Danum Valley and Maliau Basin Conservation Areas) as well as other conservation zones set aside in Commercial Forest Reserves are also becoming isolated and disconnected from other PAs. The major PAs of east Sabah, including the Lower Kinabatangan Wildlife Sanctuary, Kulamba Wildlife Reserve and Tabin Wildlife Reserve are becoming increasingly cut off from each other with the conversion of the remaining corridors of privately-owned forests to oil palm plantations.

Today, a large proportion of Sabah's wildlife is found outside of PAs. Careful and efficient land-use planning is therefore crucial to maintain or even re-create sufficient connectivity between protected and non-protected forests with high biodiversity conservation value to ensure the long-term survival of many of Sabah's wildlife populations.

4.5.2 Unsustainable Use of Wildlife Resources

Hunting - In most areas of Sabah, hunting for self-consumption or commercial purpose might be the most immediate and significant threat to wildlife populations already weakened by the impact of recent habitat changes. Although hunting practices are strictly regulated by the Wildlife Conservation Enactment 1997, systematic law enforcement often proves difficult, especially in remote areas. Hunting pressure is already known to have driven many of Sabah's wildlife populations to local extinction.

Traditionally, wild meat has been an important resource for rural people in Sabah. In some parts of Sabah, hunting has been estimated to supply around 120 kg of wild meat per household annually (PACOS Trust, 2002). A recent survey conducted among the communities living between the Kinabalu Park and the Crocker Range Park showed that subsistence hunting, which is practiced illegally with unsustainable methods, has already decimated large prey species such as the sambar deer and bearded pig. Hunting in this area is also believed to have resulted in the local extinctions of two protected ape species, the orang-utan and the Bornean gibbon. Many other wildlife populations are now at risk of short to

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medium-term extinctions in the area (Lackman and Manokaran, 2011). The practice of subsistence hunting seems to have lessened over the past ten years in many of Sabah's rural areas. This is partly due to the availability of farmed meat, but mostly because wildlife populations have already been depleted in these areas.

Traditional medicine in Sabah relies largely on a rich pharmacopeia of plant and animal parts. Although rural communities in Sabah now have easier access to clinics and hospitals and are much less dependent on traditional medicine, some remedies are still widely trusted. There are many examples where wild animal parts are still used today to treat ailments and illnesses – the flying fox meat is believed to cure asthma; broken bones are thought to be healed with parts of the reticulated python, sun bear or coucal hatchlings.

Commercial hunting is thriving in Sabah and there is high market demand for the meat of the Bearded pig and other ungulates throughout the state. These species have already been decimated by over-hunting. Commercial hunters favour the game-rich expanses of oil palm plantations of eastern Sabah. In these remote areas however, they are often found to breach the terms of hunting licenses issued by the SWD by exceeding their quotas or hunting in the wrong locations. Poaching is widespread among local and foreign oil palm plantation workers trying to supplement their diet and income by hunting in adjacent PAs. Poaching is also known to be common in Commercial Forest Reserves.

Illegal Wildlife Trade - Wildlife trade, the sale or exchange of wild animal resources, is a major concern as the species traded are often already threatened and in danger of extinction. Typically this involves live animals, body parts, medicinal ingredients, tourist curios, eggs, fish and other food products. Illegal wildlife trade operators are often unscrupulous and damage the environment. Illegal wildlife trade undermines many nations' efforts to manage their natural resources sustainably and is often said to be the third most valuable illicit global commerce behind drugs and arms. Most wildlife trade in Sabah probably occurs within the State's borders, but there is evidence that a growing volume of the State's wildlife is being traded internationally taking advantage of the remote borders around and within Sabah's shores. Local and international illegal wildlife trade in Sabah occurs in many different forms:

- Food - wild meat, fish and shellfish as well as turtle eggs
- Traditional medicine - bats, snakes, sun bears gall bladder, international trade of pangolin parts (see Box 4-1) and foetuses, and of long tail porcupine bezoars, etc.

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- Ornaments and cultural artefacts - feathers (such as great Argus pheasant or hornbills) , skins, scales, furs, skulls, etc
- Live pets – caged-bird trade (straw-headed bulbul), amphibians and reptiles, etc.
- Collections – curios (butterflies, rhinoceros beetle, corals and shells), private and museum collections.

Illegal wildlife traders operating in Sabah range from small scale local collectors to major international operations. Between collectors of wildlife and the ultimate users, any number of middlemen may be involved, including specialists in storing, handling, transporting, manufacturing, marketing, and retailing wildlife produces.

Box 4-1: The International Trade of Pangolins

Throughout Southeast Asia, pangolins are illegally harvested in large numbers to supply international trade, mainly markets in China where they are prized for their meat and their skins. Pangolin scales are particularly targeted in the Chinese traditional medicine and are considered the most valuable part of the pangolin. Pangolin scales are used for tonics and claimed to treat allergies. Pangolin foetus soup is also believed to increase men's stamina.

Pangolins are exceptionally vulnerable to over-exploitation. They are easily hunted and have a slow reproduction rate. They do not easily breed in captivity. While subsistence hunting of pangolins has likely been prevalent for centuries, large-scale commercial harvesting appears to have come about relatively recently. They command a high black market price which appeals to hunters and traders.

Pangolins have been listed since 1975 in the Appendix II of the CITES. In 2000, CITES established a "zero annual export quota" for all Asian pangolin species which bans all international trade. Regardless of this trade prohibition, reports from Traffic Southeast Asia reveal that more than 30,000 pangolins were seized between 2000 and 2007 across East and Southeast Asia, most of these bound for China. Countries closest to China have seen dramatic declines in their wild populations of pangolins and it is believed that today a large amount of pangolins being traded illegally originate from Malaysia.

The prevalence and tradition of turtle egg consumption in Sabah is a major threat to the survival of the marine turtles in the state. The sale and consumption of eggs of all marine turtle species are banned in Sabah and offenders risk being fined up to RM50,000 or five years jail, or both, upon conviction under the Wildlife Conservation Enactment 1997. Despite these strict regulations, the turtle egg market is still thriving in Sabah. Some of the turtle eggs sold in Sabah are reported

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to be legally harvested in the Philippine Turtle Islands, and smuggled into Sandakan for sale in the local markets there. Illegal egg collection is also known to be widespread around Sandakan, Semporna and Jambongan. Sandakan is the chosen destination for turtle eggs because of its proximity to the maritime boundary with the Philippines. From Sandakan, turtle eggs are dispatched to major cities in Sabah, including Kota Kinabalu. There have been reports of turtle eggs smuggled from Sabah being sold in the thriving Terengganu market in Peninsula Malaysia (TRAFFIC, 2009).

Poorly regulated ecotourism - Ecotourism is increasingly used in Sabah as a means to promote wildlife conservation by enhancing economic opportunities for local residents and increasing public awareness of the natural and cultural heritage of the state. Unfortunately, indiscriminate ecotourism development in some cases has contributed to habitat degradation and negatively impacted wildlife (Muehlenbein and Ancrenaz, 2009).

Habituation of animals to the presence of humans can increase the likelihood that animals will actively seek the contact of humans, particularly in the form of crop raiding, the invasion of garbage pits and human households. Habituation may lead to alterations in animal stress responses, and this may lead to immune-suppression, increasing susceptibility to infectious diseases, and decreased reproductive success. Other risks may include pollution, crowding, the introduction of invasive species, and transmission of pathogens through direct and indirect infection routes. Zoonotic (animal to human) and anthroozoonotic (human to animal) infection transmission are of vital consideration. It is therefore important to enforce strict guidelines that will protect visitors from possible risks as well as ensure the long-term well-being of wildlife.

4.5.3 Human-Wildlife Conflict

With ever increasing encroachment of human activities into wildlife habitats, human-wildlife conflict has emerged as a serious threat to the survival of many endangered and protected species throughout the world. Several species in Sabah and are well known for their capacity to cohabitate with humans by extending their dietary habits to human-produced food sources. Some species of mice, rats and squirrels as well as sparrows and munias commonly cause damage to crop fields. Pigs and porcupines are frequent crop raiders. The large flying fox raids domestic fruit trees. Macaques are well known throughout Sabah to raid crops and houses. The Malay weasel, some civets and the monitor lizard often kill chickens in rural areas. The Oriental small-clawed otter is also reported to hunt in fish farms. Systematic killing of raiding wildlife by crop and farm owners is the most common

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method to control pest animals and may lead to the local extinction of vulnerable wildlife populations.

Habitat loss and degradation throughout Sabah has also forced many other wildlife species to establish their home ranges alongside human activities, sometimes with serious consequences, as in the case of the elephants and the orang-utans displaced by extensive oil palm plantations in eastern Sabah. Rapid changes in orang-utan habitat and the disruption of the traditional elephant migration routes along the Kinabatangan River for instance have forced the displaced mammals to look for alternative food sources inside oil palm plantations and villagers' orchards. The killing of elephants and orang-utans damaging oil palm plantations is not so prevalent today, however occasional killings are still reported.

4.5.4 Climate Change

Climate change is recognised as a major threat to terrestrial and marine biodiversity as well as ecosystem functions. In Sabah, altered rainfall and run-off patterns, a rise in sea levels, raised air and sea temperatures, and changes in the frequency of weather events are expected. Many species may not be able to tolerate these changes. Droughts and forests fires brought about by climatic changes have already contributed to the loss of important wildlife habitat. During the last two decades, Sabah experienced six major drought periods which resulted in 1983, 1986 and during the El Nino event of 1997-98.

4.5.5 Invasive Species

Invasive species are defined as non-native plants or animals that adversely affect the habitats and bioregions they invade economically, environmentally, and ecologically. Invasive species prey upon, or out-compete native species, or modify natural ecosystems, causing the extinction of native wildlife populations. Sabah suffers from a range of invasive plant species, such as the water hyacinth (*Eichhornia crassipes*), a very fast growing aquatic plant from South America which blocks waterways and prevents sunlight and oxygen from reaching the water column and submerged plants. This dramatically reduces biological diversity in aquatic ecosystems. Common invasive animal species in Sabah include the following species:

- The house crow (*Corvus splendens*) has established itself in at least 25 countries, including Malaysia and Sabah. It proliferates in human settlements and disturbed habitats. The house crow causes problems across

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a range of areas, including crop and livestock sustainability and poses serious risks to the native avifauna.

- The red-eared slider (*Trachemys scripta elegans*) has been the most popular turtle in the pet trade worldwide with more than 52 million individuals exported from the United States to foreign markets between 1989 and 1997. Their omnivorous diet and ability to adapt to various habitats, gives them great potential for impacting indigenous habitats. It is now found in Sabah's natural ecosystems.
- The American bullfrog (*Rana catesbeiana*), native to North America, has been introduced all over the world to over 40 countries and four continents. It is also found in Sabah. Many introductions have been intentional with the purpose of establishing new food sources for human consumption. Other populations have been established from unintentional escapes from bullfrog farms.
- The golden apple snail (*Pomacea canaliculata*) is a freshwater snail with a voracious appetite for water plants. Introduced widely from its native South America for the aquarium trade and as a source of human food, it is now a major crop pest in Southeast Asia (primarily in rice cultivation) and poses a serious threat to many wetlands around the world through habitat modification and competition with native species. An outbreak of the golden apple snail was reported in Sabah in the early 1990s.
- Exotic fishes such as the tilapia and carp were introduced to Sabah mostly for aquaculture purposes and have since colonised freshwater ecosystems. They are known to cause serious problems, such as the decline of native fish species, the alteration of natural benthic communities and the transmission of various diseases.
- The crazy yellow ant (*Anoplolepis gracilipes*), so called because of its frenetic movements, has invaded native ecosystems and caused environmental damage from Hawaii to the Seychelles and Zanzibar. Crazy ants also prey on, or interfere in, the reproduction of a variety of arthropods, reptiles, birds and mammals on the forest floor and canopy. A recent study showed that the crazy ant is dominating the ground dwelling ant community in oil palm plantations in Sabah (Carsten *et al.*, 2010)

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- The invasive coral-feeding starfish (*Acanthaster planci*) poses a threat to native coral communities in coral ecosystems already affected by coral bleaching, excess tourism and natural events such as storms and El Nino such as found in Sabah.

4.5.6 Accidental Deaths

Accidental deaths pose considerable threats to vulnerable species. Accidental entanglement in fishing nets and collisions with ships pose major threats to marine mammals. Vehicles strike birds and other wildlife when driving along roads. Large buildings and towers also injure or kill many different species of wildlife.

4.6 LEGAL AND INSTITUTIONAL FRAMEWORK

Table 4-10 presents the list of Sabah's legislation relevant to biodiversity conservation. A number of these laws are relatively recent and progressive (Biodiversity Enactment 2000, Wildlife Conservation Enactment 1997, Environment Protection Enactment 2002), while others need to be revised and made relevant to the current context and issues (e.g. Parks Enactment 1984).

4.6.1 Sabah Wildlife Department

The Sabah Wildlife Department (SWD) is the main agency directly responsible for wildlife conservation in Sabah. It was established in 1988 under Sabah's state Ministry for Tourism, Culture and Environment. The overall mission of the SWD is to conserve the integrity and diversity of nature in Sabah and to ensure the sustainable and equitable use of the State's wildlife resources. The SWD is responsible for the implementation and administration of the Wildlife Conservation Enactment, 1997 which aims to protect the endangered species of fauna and flora in the state as well as to control international trade of these species.

The SWD enforces the proper use, protection, conservation and management of wildlife in Sabah as well as of birds' nest caves and protected wildlife areas. The SWD is responsible for issuing hunting licenses and permits for wildlife research, wildlife tour operators, wildlife guides, wildlife filming, wildlife trade, wildlife farming and zoological gardens. The SWD can also appoint selected members of the public as Honorary Wildlife Wardens. The SWD also manages the Sepilok Orangutan Rehabilitation Centre and the Lok Kawi Wildlife Park.

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The SWD has its headquarters in Kota Kinabalu and a number of district offices and stations throughout the state. Wildlife District Offices are located in Keningau, Sandakan, Kota Kinabatangan, Lahad Datu, and Tawau. The West Coast Wildlife Office is in Kota Kinabalu. In 2010, the SWD formed a Wildlife Rescue Unit.

4.6.2 Sabah Biodiversity Council

The Sabah Biodiversity Council was created in 2007 and the Sabah Biodiversity Centre (SaBC) was established in 2008 to implement the Biodiversity Enactment 2000 which aims to safeguard and sustainably manage biodiversity and biological resources of the state. The Council is tasked to advise the Sabah Government on the conservation and sustainable utilisation of biodiversity in the state. The SaBC acts as a secretariat of the Council and implements the Council's directives. Its mission is to ensure that biodiversity in the state is sustainably managed by:

- Mobilising, facilitating, and coordinating biodiversity conservation activities;
- Regulating access to biological resources;
- Providing reliable information on the status, distribution, magnitude, usage and value of biodiversity;
- Educating the public about the importance of biodiversity;
- Promoting the utilisation of biological resources through biotechnology activities.

Although Sabah possesses progressive laws pertaining to wildlife conservation, there is a need for a more integrated approach among key agencies responsible for protecting, managing and sustainably using wildlife. The Sabah Biodiversity Council provides the best avenue to clarify and coordinate operational roles not only of the three agencies listed here, but of the entire membership of the Council which straddles all major sectors and resource management authorities.

SECTION 4: WILDLIFE**Table 4-10: Government Agencies and Legal Framework Relevant to Wildlife and Biodiversity Conservation in Sabah**

Agency/Institution	Date Est.	Legislation	Main Functions (related to wildlife conservation)
Sabah Wildlife Department	1988	Wildlife Conservation Enactment 1997; Wildlife Regulation 1998	Wildlife protection, management, research, and education
Sabah Biodiversity Council and Sabah Biodiversity Centre	2008	Biodiversity Enactment 2000; Biodiversity (Access and Benefit-Sharing) Regulations 2011	The Council advises the State Government on conservation and sustainable use of biodiversity, the Centre implements the Council's directives
Sabah Parks	1962	Parks Enactment 1984	Wildlife protection, management, research, education, collections (Research & Education Division) in National Parks
Sabah Forestry Department	1974	Forest Enactment 1968	Forestry research, herbarium, insect diversity research, education, training, protection (Forest Research Centre, Malua Wildlife Unit) in Forest Reserves
Environment Protection Department	1998	Environment Protection Enactment 2002; Environment Protection Enactment (Amendment) 2004	Planning, implementation and control of development activities and the exploitation of natural resources, Environmental Impact Assessments
Department of Fisheries	1968	Fisheries Act 1985 (Revised 1993); Inland Fisheries and Aquaculture Enactment 2003	Management of the exploitation and conservation of fisheries resources
Department of Sabah Museum	1965	-	Research , collections, education (Zoology Division)
University Malaysia Sabah (Tropical Biology and Conservation Research Institute, School of International Tropical Forestry, Borneo Marine Research Institute)	1994	-	Wildlife and habitat research, collections (Borneensis), education, training

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4.6.3 Protected Wildlife Species

The Wildlife Conservation Enactment 1997 lists nine species as totally protected (Schedule 1, Part I) – six mammals i.e. Sumatran rhinoceros, orang-utan, Sun bear, Proboscis monkey, Clouded leopard and the dugong as well as three reptiles i.e. False gharial, Green turtle and Hawksbill turtle. Recent faunal surveys (Ancrenaz *et al.*, 2003) strongly warrant the inclusion of additional species for total protection under Schedule 1, Part I of the WCE 1997 such as the Asian elephant, Bornean gibbon, Silver-leaf monkey, Grey-leaf monkey and White-crowned hornbill. A federal regulation, the International Trade in Endangered Species Act 2008, controls the international trade of species listed under CITES and ensures Malaysia's compliance with CITES obligation.

4.7 PAST AND CURRENT WILDLIFE CONSERVATION AND MANAGEMENT INITIATIVES

A wide range of government agencies, national and international research institutions and NGOs as well as bilateral agencies have been involved in wildlife conservation and management in Sabah (section 4.7.1). Although numerous initiatives were conducted in the past, efforts which took place after 2000 are reviewed here. Some of these initiatives (section 4.7.2) were concerned with wildlife conservation in its natural habitat (in-situ) while others (section 4.7.3) focused on the care and reproduction of endangered species in captive conditions (ex-situ).

4.7.1 Actors in Wildlife Conservation in SabahGovernment Agencies

The main government agencies directly involved in wildlife diversity conservation in Sabah are listed in Table 4-10.

International Cooperation Agencies

Since 2000, two main bilateral agencies have been involved in programmes with wildlife conservation components, namely Japan International Cooperation Agency (JICA) (see Box 4-2) and Danida (Table 4-11). The Darwin Initiative funded a total of 13 wildlife conservation related projects in Sabah since 2000.

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Box 4-2: JICA's BBEC Programme

The Bornean Biodiversity and Ecosystems Conservation (BBEC) Programme is a joint technical cooperation among the Sabah State Government, Malaysian Federal Government and Japan International Cooperation Agency (JICA) under Japan's Official Development Assistance (ODA). The overall goal of the BBEC Programme is to assist the development of an integrated and durable system for biodiversity and ecosystems conservation in Sabah. The Phase I (2002-2007) focused on the transfer of skills and knowledge to strengthen technologies required for the conservation practice. The Phase II (2007 – 2012) aims to support the implementation of the Biodiversity Enactment 2000 in order to achieve a balance between development and conservation by linking conservation activities and decision-making process. A range of 15 Sabah State government agencies and 4 federal agencies are involved in the BBEC programme.

Source: www.bbec.sabah.gov.my/index.php

Table 4-11: International Cooperation Agencies with Wildlife Conservation Components in Sabah (from 2000 onwards)

Agency	Programme	Dates Active	Activities related to Wildlife Conservation
Japan International Cooperation Agency	Bornean Biodiversity and Ecosystems Conservation	Phase 1: 2002-2007 Phase 2: 2007-2012	Transfer of skills and knowledge to strengthen technologies required for the conservation practice (Phase 1); support for the implementation of the Biodiversity Enactment 2000 (Phase 2)
Danish International Development Assistance	Capacity Building Project	2000-2005	Capacity building; Pilot projects
Darwin Initiative	Research projects	1995-present	13 wildlife research and conservation projects funded in Sabah since 2000

Non-governmental Organisations

At least 13 national and international NGOs have been involved in various aspects of wildlife conservation in Sabah since 2000 (Table 4-12). Some NGOs work on a comprehensive range of wildlife conservation issues i.e. WWF-Malaysia, HUTAN, Borneo Conservation Trust (BCT) while others only concentrate on a single species i.e. Borneo Rhino Alliance (BORA), Orangutan UK Appeal or a single area e.g. Sabah Wetlands Conservation Society.

SECTION 4: WILDLIFE**Table 4-12: Non-governmental Organisations Active in Wildlife Conservation in Sabah (since 2000)**

Organisation	Periods Active	Main Activities related to Wildlife Conservation	Work Location
World Wide Fund for Nature Malaysia	1972 - present	Research, protection, management, education, training and policies	Sabah
HUTAN	1998 - present	Research, protection, management, education, training, policies, community conservation and sustainable community development	Sabah
Borneo Rhino Alliance	2008 - present	Management of the Borneo Rhino Sanctuary, Rhino Protection Units	Tabin Wildlife Reserve
Orangutan Appeal UK	2000 - present	Orang-utan rehabilitation	Tabin Wildlife Reserve; Sepilok Orang-utan Rehabilitation Centre
Borneo Conservation Trust	2006 - present	Orang-utan bridges, land purchase for conservation, Borneo Green Corridor	Lower Kinabatangan; Lower Segama
Partners for Community Organisations Trust	1987 - present	Community resource management, sustainable socio-economic development, education, land rights, community organising training	Sabah
Global Diversity Foundation		Community resource management, sustainable socio-economic development, participatory research action and training	Communities living near Kinabalu Park and Crocker Range Park
Land Empowerment Animals People	2005 until now	Facilitation, advocacy, fund raising	Sabah
Tropical Research and Conservation Centre	1999 - present	Research, coral planting, Green Connection Aquarium	Sabah
Marine Research Foundation		Research, education, sustainable livelihoods	Sabah
Kudat Turtle Conservation Society	Started in 2011	Restoration of turtle breeding grounds, public awareness	Kudat
Sabah Wetlands Conservation Society	2006 - present	Management of the Kota Kinabalu City Bird Sanctuary	Kota Kinabalu City Bird Sanctuary
Malaysian Nature Society		Research, education	Sabah

Some NGOs are involved in wildlife research and management (WWF-Malaysia, HUTAN) and others focus on advocacy and fund-raising i.e. Land Empowerment Animals People (LEAP). Three NGOs - Partners for Community Organisations (PACOS) Trust, Global Diversity Foundation and HUTAN - work closely with local

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communities to promote community management of natural resource and sustainable socio-economic development. Three other NGOs only work with marine wildlife (Marine Research Foundation, Tropical Research and Conservation Centre and Kudat Turtle Conservation Society).

All the NGOs working in wildlife conservation in Sabah collaborate closely with at least one government agency, usually the SWD, SFD or Sabah Parks. With so many different parties involved, the establishment of a framework for more effective coordination and communication among both NGOs and government partners would be beneficial as it would promote information sharing, avoid duplication of efforts and will optimise the use of resources.

4.7.2 Wildlife Research and Conservation Facilities

There are eleven main facilities in Sabah conducting field research and conservation activities (Table 4-13). Five are managed by government agencies while the others are co-managed by NGOs or international research institutions.

4.7.3 In-situ Conservation Initiatives

There have been more than 25 in-situ wildlife and habitat research and conservation projects conducted in Sabah since 2000 (Table 4-14). Some of these initiatives are long-term programmes established ten or more years ago and still on-going, such as HUTAN's Kinabatangan Orang-Utan Conservation Project and WWF's Sulu Sulawesi Marine Ecoregion and Asian Rhinoceros, Elephant Action Strategy. Many others are short and medium-term projects. Most of these initiatives were conducted by national and international research institutions and NGOs in close collaboration with Sabah government agencies (usually the SWD, SFD or Sabah Foundation). Numerous short-term research studies were also conducted in Sabah by Malaysian and international researchers and students but they are too many to list.

A specific area identified for improving in-situ conservation efforts is the need to boost coordination among NGOs and agencies working in particular sites. For example, over 15 project initiatives have been undertaken in the Lower Kinabatangan region in recent years. In most cases there was almost no communication between the parties involved and often wasteful duplication of data collection activities, community dialogues and establishment of management or advisory committees.

SECTION 4: WILDLIFE**Table 4-13: Main Wildlife Research and Conservation Facilities in Sabah (since 2000)**

Research Facility	Agency	Dates Active	Main Activities related to Wildlife Conservation	Work Location
Sepilok Orangutan Rehabilitation Centre	Sabah Wildlife Department	1964 - present	Research on socio-ecology of orang-utans and other wildlife	Kabili-Sepilok Forest Reserve and Sepilok Forest Reserve
Forest Research Centre	Sabah Forestry Department	1974 - present	Forestry research, herbarium, insect diversity research, education, training	Sabah
Sabah Parks Research & Education Division	Sabah Parks	1994	Wildlife and habitat research, education, collections	Sabah Parks
Sabah Museum	Department of Sabah Museum	1965 - present	Research , collections, education	Sabah
Danum Valley Field Centre	Britain's Royal Society (SEARRP); Sabah Foundation	1985 - present	Wildlife and habitat research, education, training and wilderness recreation	Danum Valley Conservation Area
HUTAN Field Centre	HUTAN; Sabah Wildlife Department	1998 - present	Wildlife and habitat research , protection, management, education, training and community conservation	Sabah
Sukau Field Station	University Malaysia Sabah (Tropical Biology and Conservation Research Institute)	2008 - present	Wildlife research	Lower Kinabatangan
Danau Girang Field Centre	Cardiff University; Sabah Wildlife Department	2008 - present	Wildlife and habitat research, training	Lower Kinabatangan Wildlife Sanctuary
Borneo Sun Bear Conservation Centre	Sabah Wildlife Department; Sabah Forestry Department	2008 - present	Research on the ecology of sun bears	Sepilok Forest Reserve
Borneo Rhino Sanctuary	Sabah Wildlife Department; Borneo Rhino Alliance	2009 - present	Research on the ecology and artificial reproduction of Sumatran rhinoceroses	Tabin wildlife Reserve
Stability of Altered Forest Ecosystems (SAFE)	Britain's Royal Society (SEARRP); Sabah Forestry Department	2011 - 2021	Research on the impact of logging, deforestation and forest fragmentation	Maliau Basin Conservation Area Ulu Segama Benta Wawasan area

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Table 4-14: Major In-Situ Wildlife and Habitat Research and Conservation Programmes in Sabah (since 2000)

Project	Implementing Agency(s)	Dates Active	Location	Description
Kinabatangan Orang-Utan Conservation Project	HUTAN, SWD	1998 – present	Sabah	Orang-utan and other wildlife socio-ecology, distribution, conservation, genetics, health, etc.
Partners for Wetlands	WWF, SWD and other government agencies	1999-2006	Lower Kinabatangan	Mechanism to promote wise investment in freshwater wetlands
INFAPRO	Sabah Foundation, Face the Future	1992 – present	Sabah Foundation	Improved forest management, reforestation, carbon crediting
Ulu Padas Community Based Conservation and Tourism	WWF	2000 – 2006	Long Pasia and Long Mio	Integrated land use planning, tourism development, sustainable management of community forest
People and Plants (Southeast Asia Program)	WWF	2000 - 2006	Kiau	Sustainable use of plant resources by local communities
Sulu Sulawesi Marine Ecoregion	WWF, WWF Philippines, WWF Indonesia	2000 - present	Kudat-Banggi and Semporna	Strengthening the management of natural resources by all stakeholders
Asian Rhinoceros, Elephant Action Strategy	WWF, SWD and other government agencies	2001 - present	Sabah	Conservation of the Asian elephant and Sumatran rhinoceros
Honorary Wildlife Wardens	SWD	2003 - present	Sabah	Involvement of local communities, private sector, and members of the public in wildlife protection
Elephant Conservation Programme	HUTAN, Danau Girang Field Centre, SWD	2003 - present	Lower Kinabatangan	Conflict mitigation, socio-ecology, satellite collaring, genetics, conservation
Rhino Rescue Project	WWF, SWD, SFD, Sabah Foundation	2005 - present	Sabah	Rhino Protection Units
Sukau Reforestation Programme	HUTAN, SWD	2005 - present	Lower Kinabatangan	Reforestation
Bornean Wild Cat Project	Global Canopy Programme, SWD	2006 - 2009	Sabah	Carnivores distribution and conservation status

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Project	Implementing Agency(s)	Dates Active	Location	Description
Heart of Borneo	WWF, Government agencies from Malaysia, Indonesia and Brunei	2006 - present	Borneo highlands (Malaysia, Indonesia, Brunei)	Conservation of the HoB through a network of PAs and sustainably-managed forest, and through international co-operation.
Kinabatangan Corridor of Life	WWF, SWD and other government agencies	2006 –2011	Lower Kinabatangan	Establishing a balance between the demands of private land development, the local community and wildlife protection
Sabah Orang-utan Landscape	WWF, SFD, SWD, SF	2007 - present	Ulu Segama-Malua Forest Reserve	Identifying factors that could balance impacts of heavy logging with maintaining high densities of orang-utans
Securing the Ulu Segama Malua Orangutan Population	WWF, SFD, SWD, SF	2007 -present	Ulu Segama Malua area	Restoration of orang-utan habitats
Malua Wildlife Habitat Conservation Bank (Malua BioBank)	SFD, New Forests Pty Limited	2008 - present	Malua Forest Reserve	Reforestation, carbon crediting, wildlife monitoring (camera traps)
HEAP (HUTAN Education and Awareness Programme)	HUTAN, SWD	2008 - present	Sabah	Environmental education and awareness focusing on wildlife conservation for school children and local communities
Kinabatangan Tour Operators Association	Tourism operators in Lower Kinabatangan	2008 -present	Lower Kinabatangan	Sustainable funding mechanism for conservation efforts
Slow Loris Conservation Programme	Danau Girang Field Centre, SWD	2010 - present	Lower Kinabatangan	Movement patterns (satellite collaring)
Bornean Banteng Programme	HUTAN, Danau Girang Field Centre, SWD	2010 - present	Sabah	Banteng (tambadau) distribution and conservation status
Clouded Leopard Project	Leibniz Institute for Zoo and Wildlife Research, SWD	Not available	Borneo	Carnivores distribution models and conservation status
Nestle RiLeaf	Nestle (Malaysia) Berhad	2011- 2014	Lower Kinabatangan	Reforestation of 2,400 ha of riparian sites along the Kinabatangan River
Kinabatangan Carnivore Programme	Danau Girang Field Centre, HUTAN, SWD, WildCRU	Started in 2011	Lower Kinabatangan	Carnivore socio-ecology, distribution and conservation status

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Project	Implementing Agency(s)	Dates Active	Location	Description
Proboscis Monkey Conservation Programme	Danau Girang Field Centre, SWD	Started in 2011	Sabah	Movement patterns (satellite collaring), genetics

Note: SWD: Sabah Wildlife Department; SFD: Sabah Forestry Department; WWF: World Wide Fund for Nature

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4.7.4 Ex-Situ Conservation Initiatives

In addition to in-situ wildlife research and conservation initiatives described above, a number of ex-situ wildlife conservation projects are on-going in Sabah (Table 4-15). These initiatives focus on the captive breeding and the rehabilitation of endangered species (orang-utan, Sumatran rhinoceros, Sun bear, and Birdwing butterflies). Some of these initiatives, such as the Lok Kawi Park and the Sepilok Orang-utan Rehabilitation Centre have become popular tourism destination which actively promotes conservation awareness.

Table 4-15: Ex-situ Wildlife Conservation Initiatives in Sabah (since 2000)

Project	Operating Dates	Location	Managing Agency	Main Activities
Sepilok Orang-utan Rehabilitation Centre	1964 - present	Kabili-Sepilok Forest Reserve and Sepilok Forest Reserve (22 km west of Sandakan)	Sabah Wildlife Department	<ul style="list-style-type: none"> - Orang-utan rehabilitation - Tourism - Education and awareness - Wildlife rescue - Research
Lok Kawi Wildlife Park	2007 - present	Lok Kawi (20 km south of Kota Kinabalu)	Sabah Wildlife Department	<ul style="list-style-type: none"> - Zoological park - Education and awareness - Tourism - Captive breeding - Wildlife hospital
Borneo Rhino Sanctuary	2009 - present	Tabin Wildlife Reserve	Borneo Rhino Alliance; Sabah Wildlife Department	<ul style="list-style-type: none"> - Captive breeding of Sumatran rhinoceroses
Bornean Sun Bear Conservation Centre	2008 - present	Sepilok Forest Reserve	Sabah Wildlife Department; Sabah Forestry Department; Mr. Wong Siew Te	<ul style="list-style-type: none"> - Sanctuary for ex-captive and orphaned sun bears - Education - Research
Kipandi Butterfly Park	2008 - present	Kg. Kipandi, Moyog (36km from Kota Kinabalu)	Sabah Wildlife Department; Kipandi Entomofauna Ecotours Sdn Bhd	<ul style="list-style-type: none"> - Captive breeding of Birdwing butterflies - Tourism - Education

4.8 ADDRESSING GAPS IN THE CURRENT WILDLIFE CONSERVATION AND MANAGEMENT SYSTEMS

Sabah's policy and legal framework related to wildlife conservation is often said to be among the more advanced in Malaysia. Sabah also has a comparatively high number of on-going wildlife conservation initiatives. Nevertheless, there are a number of prevailing factors that seriously threaten wildlife populations in Sabah in the short and medium term. These include habitat loss, unsustainable use of wildlife resources, human-wildlife conflicts, accidental deaths as well as other global environmental threats such as climate change and invasive alien species.

It seems paradoxical that Sabah's wildlife can be so seriously threatened, despite its remarkable diversity, sound policies and laws as well as the numerous conservation efforts undertaken. The rapid assessment of the gaps in current wildlife conservation and management systems presented below examines the underlying drivers behind wildlife diversity loss in Sabah with the view to providing direction toward a more effective conservation strategy to reverse this decline.

4.8.1 Drivers of Wildlife Diversity Loss within Protected Areas

Issue 1: The existing system of PAs is not suitable to ensure the long-term conservation of wildlife populations.

- Insufficient representation of important habitats and species within existing PAs.
- Insufficient size and habitat quality in many existing PAs to sustain wildlife populations.
- Insufficient connectivity between PAs which are generally isolated from each other.
- Insufficient human and financial resources to protect and manage existing PAs adequately and enforce laws to protect wildlife and prevent illegal activities.
- Insufficient mitigation of conflicts between PAs and neighbouring communities (land issues, human-wildlife conflicts).

4.8.2 Drivers of Wildlife Diversity Loss Outside of Protected Areas

Issue 2: Human activities in wildlife habitats outside of protected areas are not compatible with the long-term conservation of wildlife populations.

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- Threats and underlying drivers associated with the utilisation of wildlife habitats outside of PAs are not controlled (see Table 4-18).
- Insufficient capacity, resources and awareness among users of wildlife habitats outside of PAs.
- Insufficient enforcement of wildlife and habitat conservation policies and laws outside of PAs.

4.8.3 Institutional Gaps

Issue 3: A need for improved coordination among key agencies and players under the leadership of the State government.

- Inadequate communication and coordination among government agencies, conservation NGOs, research institutions, corporations and local community organisations for planning, implementing and monitoring sound wildlife conservation strategies.
- Insufficient compliance with existing multilateral environmental agreements, and national and state policies related to wildlife conservation.
- Inadequate capacity, resources and awareness among government agencies, wildlife habitat users, conservation NGOs and research institutions.

4.8.4 Information Gaps

Issue 4: Current knowledge of Sabah's wildlife (especially for groups other than mammals and birds) limits the ability to design appropriate conservation measures.

- Incomplete inventories of wildlife species occurring in Sabah for groups other than mammals and birds.
- Insufficient information on population distribution, numbers and conservation status of wildlife species present in Sabah, especially for groups other than mammals and birds, to monitor population trends and take appropriate management measures.
- Insufficient knowledge of the biological requirements of many wildlife species to design efficient conservation strategies (such as for planning new conservation areas)

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Table 4-18: Underlying Drivers of Wildlife Diversity Loss Outside of Protected Areas in Sabah
(Risks Associated with Sabah's Major Uses of Wildlife Habitats)

Major Threats	Oil Palm and other Plantations	FMUs and Other Logging Operators	Rural Communities	Tourism Operators	Other Users and Managers	
HABITAT CHANGE	Habitat Loss	<ul style="list-style-type: none"> - On-going large-scale conversion of wildlife-rich privately-owned forests - No guidelines to create conservation areas (quantity, quality, location according to wildlife needs) - Encroachment into adjacent PAs 	<ul style="list-style-type: none"> - Unsustainable logging practices make large areas unusable by wildlife - On-going large-scale conversion of wildlife-rich forests to oil palm plantation and tree plantations - Encroachment into adjacent PAs 	<ul style="list-style-type: none"> - On-going conversion of wildlife rich privately-owned forests to grow subsidised oil palm and other crops - Systematic land applications and sale of land titles to oil palm plantations as a means of income - Lack of alternative sources of income compatible with wildlife conservation 	Forest clearing for tourism infrastructure	Land clearing activities in wildlife-rich areas
	Fragmentation Loss of connectivity	<ul style="list-style-type: none"> - On-going conversion of privately-owned forests still connecting PAs - Infrastructure development blocking wildlife movements (roads, trenches and drains, fences, etc.) - Destruction of riparian forests for access to rivers and to increase planted 	<ul style="list-style-type: none"> - On-going conversion and degradation of forests still connecting PAs - Infrastructure development blocking wildlife movements (roads, trenches and drains, fences, etc.) 	<ul style="list-style-type: none"> - On-going conversion of privately-owned forests still connecting PAs - Infrastructure development blocking wildlife movements (roads, trenches and drains, fences, etc.) - Destruction of riparian forests for access to rivers 	Forest clearing for tourism infrastructure	Land clearing activities in forested areas connecting still connecting PAs

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Major Threats	Oil Palm and other Plantations	FMUs and Other Logging Operators	Rural Communities	Tourism Operators	Other Users and Managers	
	area					
Habitat degradation	<ul style="list-style-type: none"> - Unsustainable agricultural practices (plantations and mills) lead to environmental degradation (pollution, improper waste disposal, noise disturbance, etc.) - Do not comply to international standards (RSPO) 	<ul style="list-style-type: none"> - Unsustainable logging practices lead to environmental degradation (unsustainable forest management, improper waste disposal, noise disturbance) - Do not comply to international standards (FSC) 	<ul style="list-style-type: none"> - Unsustainable collection of forest resources - Pollution, improper waste disposal, noise disturbance 	Tourists disturb wildlife habitats (trampling, improper waste disposal, noise disturbance)	Activities leading to wildlife habitat degradation	
UNSUSTAINABLE USE OF WILDLIFE RESOURCES	Hunting	<ul style="list-style-type: none"> - Plantation workers hunt for their own consumption or to supplement their income - Plantation managers involved in sport and trophy hunting - Illegal and unsustainable hunting methods - Easy access for outsiders hunting in remote plantation areas 	<ul style="list-style-type: none"> - FMU workers hunt for their own consumption or to supplement their income - FMU managers involved in sport and trophy hunting - Illegal and unsustainable hunting methods - Easy access for outsiders hunting in remote FMU areas 	<ul style="list-style-type: none"> - Community members mostly hunt for their own consumption and also to supplement their income - Illegal and unsustainable hunting practices (no hunting license, no licensed firearms, no designated community hunting areas) - Use of wildlife in traditional medicine and ceremonies 	Unknown	Illegal and unsustainable hunting, and use of its produces
	Illegal Wildlife trade	<ul style="list-style-type: none"> - Plantation workers supply middle-men to supplement 	<ul style="list-style-type: none"> - FMU workers supply middle men to 	Community members supply middle men to	Unknown	Illegal wildlife trade and use of its

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Major Threats	Oil Palm and other Plantations	FMUs and Other Logging Operators	Rural Communities	Tourism Operators	Other Users and Managers
	<p>their income</p> <ul style="list-style-type: none"> - Easy access for outsiders to poach in remote plantation areas 	<p>supplement their income</p> <ul style="list-style-type: none"> - Easy access for outsiders to poach in remote plantation areas 	<p>supplement their income</p>		<p>produces</p>
Uncontrolled ecotourism	<ul style="list-style-type: none"> - Tourism ventures inside plantation do not comply to responsible ecotourism principles (wildlife feeding, mini zoos) 	Unknown	<p>Community based tourism initiatives which do not follow responsible ecotourism principles</p>	<p>Tourism operations which do not follow responsible ecotourism principles</p>	<p>Tourism operations which do not follow responsible ecotourism principles</p>
Human – wildlife conflicts	<ul style="list-style-type: none"> - Infrastructure and crop raiding control block wildlife movements creating wildlife conflicts neighbouring in plantation or communities - Killing of wildlife as a means of crop protection - Do not invest in non-harmful mitigation methods (strategic fences, squads) 	<ul style="list-style-type: none"> - Killing of wildlife as a means of sapling and tree protection - Do not invest in non-harmful mitigation methods (strategic fences, squads) 	<ul style="list-style-type: none"> - Killing of wildlife as a means of sapling and tree protection - Cannot afford to invest in non-harmful mitigation methods (strategic fences, squads) - Infrastructure blocks wildlife movements creating wildlife conflicts - Do not grow alternative crops not attractive to wildlife 	<p>Block wildlife movements by infrastructure or tourists presence, creating wildlife conflicts neighbouring communities and plantations</p>	<p>Activities and infrastructure blocking wildlife movements and creating wildlife conflicts</p>
Climate change	<ul style="list-style-type: none"> - Greenhouse gas release (plantations and mills) - Improper waste disposal 	<ul style="list-style-type: none"> - Greenhouse gas release - Improper waste disposal 	<ul style="list-style-type: none"> - Greenhouse gas release - Improper waste disposal 	<ul style="list-style-type: none"> - Greenhouse gas release - Improper waste disposal 	<p>Activities contributing to climate change</p>

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Major Threats	Oil Palm and other Plantations	FMUs and Other Logging Operators	Rural Communities	Tourism Operators	Other Users and Managers
Invasive species	Introduction of exotic species (pest control, etc.)	Introduce of exotic species (tree plantations.)	Unknown	Unknown	Introduction of invasive species
Accidental deaths	<ul style="list-style-type: none"> - Wildlife is killed during forest clearing operations - Do not call the Sabah Wildlife department to rescue wildlife before land clearing - Animal fatalities from vehicle traffic in plantations - Infrastructure harmful to wildlife (trenches, towers, cables, etc.) 	<ul style="list-style-type: none"> - Wildlife is killed during logging operations - Do not call the Sabah Wildlife department to rescue animals before logging - Animal fatalities from vehicle traffic in FMUs - Infrastructure harmful to wildlife (trenches, towers, cables, etc.) 	<ul style="list-style-type: none"> - Wildlife is killed during land clearing operations - Do not call the Sabah Wildlife department to rescue wildlife before land clearing - Animal fatalities from vehicle traffic - Infrastructure harmful to wildlife (trenches, towers, cables, etc.) 	<ul style="list-style-type: none"> - Animal fatalities from vehicle traffic near PAs - Infrastructure harmful to wildlife (towers, cables, etc.) 	<ul style="list-style-type: none"> - Activities causing accidental death of wildlife

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SECTION 5

TERRESTRIAL ECOSYSTEMS

SECTION 5: TERRESTRIAL ECOSYSTEMS

5.1 INTRODUCTION

Ecosystems are the dynamic complexes of plant, animal and micro-organism communities and their non-living environment, together interacting as a functional unit. This chapter provides an overview of Sabah's diverse terrestrial ecosystems, paying particular attention to the existing policies and frameworks for conservation and forest management, and highlighting specific efforts to document and conserve plant diversity that is being undertaken by various government agencies, institutions and local communities. As most terrestrial ecosystems are found within Sabah's system of PAs and forest reserves, this chapter also contains a review of the status of implementation of the SFM policy and its implications for plant and ecosystem conservation³. The chapter attempts to identify where weaknesses and gaps are present in the existing systems and explores avenues for improved coordination, professional expertise, and for enlisting a wider participation in plant and habitat conservation initiatives.

5.2 TERRESTRIAL ECOSYSTEMS

Almost all of Sabah's natural forests can be classified as evergreen tropical rainforests. These forests comprise of many diverse ecosystems and floristic assemblages which correlate closely with variations in topography and soil conditions. Sabah's topography is characterised by a large elevation range which produces distinct altitudinal zones ranging from lush lowland forest, to the distinctive montane forests at elevations over 1,500 m, and the sub-alpine meadows at elevations over 3,300 m on Mt. Kinabalu (4,097 m). In addition, the unique physical and chemical properties of unusual soil types has also influenced the emergence of forest types such ultramafic forest on soils with concentrations of heavy metal compounds, and kerangas or heath forest on sandy acidic soils – both forest types are known for rare and endemic species. In view of this high level of floristic heterogeneity, coupled by the presence of modified landscapes caused by various levels of human disturbance, the formulation of an appropriate vegetation classification scheme for Sabah is a difficult task.

The vegetation classification developed by Fox (1972) is considered to be the most complete reference to the 'original' forests of Sabah⁴. In the past 40 years, Sabah's landscape has become highly modified in conjunction with resource land exploitation and land use change. The vegetation classification scheme currently utilised by the SFD is the Conservation Assessment and Information System (CAIMS) which was developed in 2002 through a project supported by the

³ Wetland ecosystems will be discussed in greater detail in the following Section 6.

⁴ http://www.forest.sabah.gov.my/caims/Level%201%20frame%20pgs/fox_classi_fr.htm

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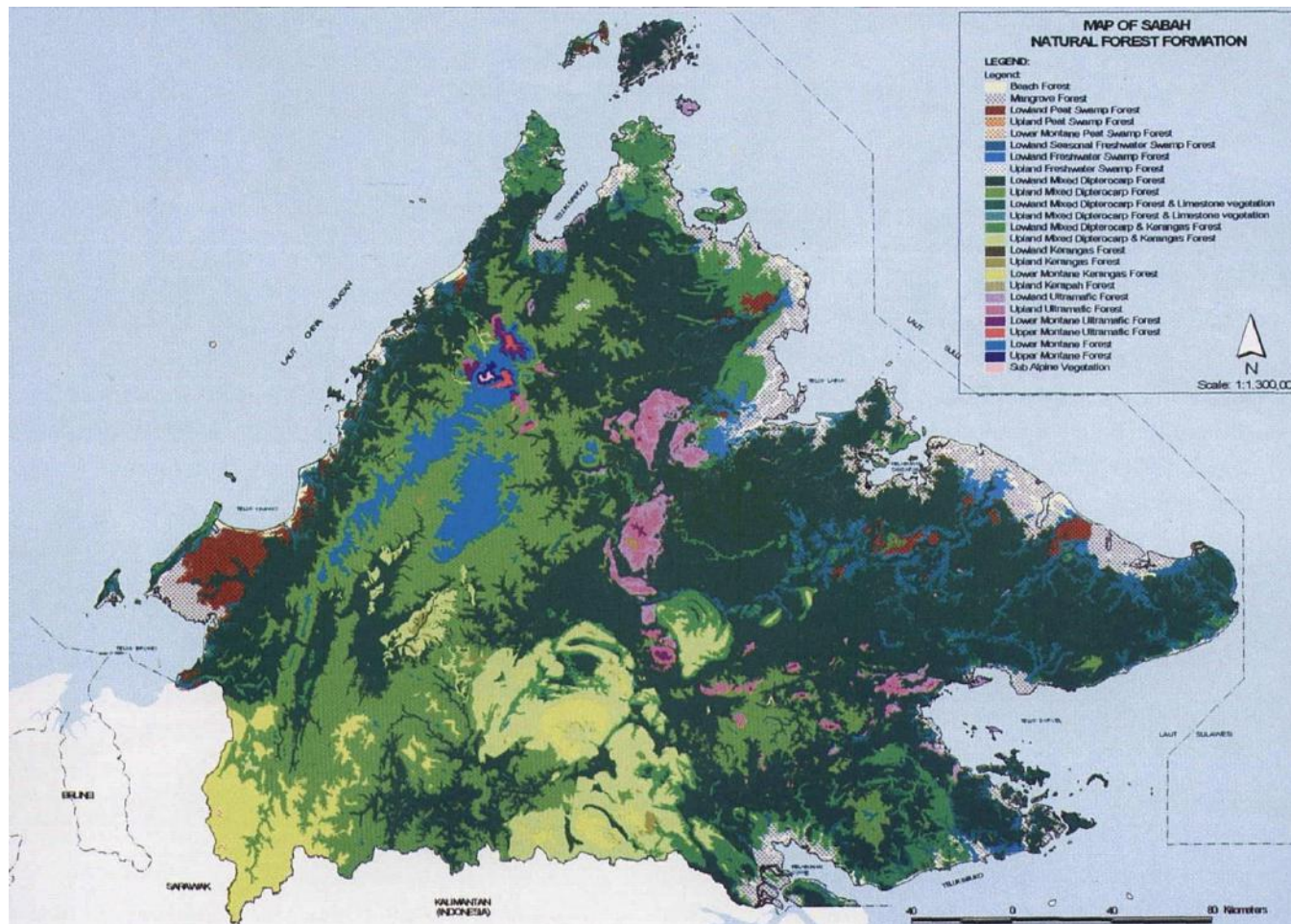
International Tropical Timber Organisation (ITTO). The new scheme provides for the classification of natural forests (Table 5-1) as well as secondary forest/vegetation and cultivated vegetation such as rubber, timber plantation and oil palm, and for other human modified landscapes. The spatial model of the different ecosystem types found in Sabah was prepared using Geographic Information System (GIS), extrapolating data on soil types and elevation gleaned from published and unpublished records from previous forest surveys by the department and other researchers. This data is maintained by SFD's Forest Resource Management Division, and is actively utilised in forestry activities.

Based on the CAIMS data, Table 5-2 shows the estimated percentage of each of the original forest types that fall within the State's PFE which comprises FRs in seven different classifications ranging from Protection (Class 1) and Virgin Jungle Reserve (Class VI) to Commercial (Class II) which includes areas under forms of natural forest management as well as areas of Industrial Tree Plantations (see Box 5-1). The percentage of these forest types found on State land is shown in Column 3.

The table indicates that although most types of ecosystems occur within the PFEs, several types were poorly represented, namely Peat Swamp forest, Dipterocarp forest and Freshwater Swamp forest. This indicates that a conservation priority would be to identify areas where poorly represented forest types still occur on State Land so that they may be safeguarded from proposals for land alienation and conversion. Ideally, forest remnants should also be afforded some form of protection and be slated for rehabilitation.

In general, the most extensive terrestrial ecosystems in Sabah are disturbed forests that have undergone one or more logging cycles, or have previously been cleared for shifting agriculture. What remains of Sabah's primary forests is now confined to a number of Protection forest reserves, remote or steep sections of other types forest reserves, and state parks. Unfortunately, a complete assessment of the conservation status of Sabah's natural forest types is not yet available. However, a Rapid Assessment was conducted by SFD for the purpose of the preparation of this Outlook. Table 5-3 gives a summary of the outcomes of SFD's rapid assessment, with additions by the Consultant, and supplementary comments from Anthony Lamb. The criteria used by SFD to identify threatened ecosystems in the Rapid Assessment were based on the current extent of each ecosystem, along with past management activities and information on threats.

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Source: SFD (2005)

Figure 5-1: Model of Original Terrestrial Ecosystem in Sabah

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Table 5-1: The Natural Forest Classification Scheme of Sabah

Soil Water	Localities	Soils	Natural Vegetation/ Ecosystem	Soil Association	Vegetation /Forest Type
Dryland	Inland	Zonal	Sub-alpine	Kinabalu	Sub-alpine; > 3500 m a.s.l.
			Montane	Kinabalu, Trusmadi, Pinosuk, Crocker	Upper montane forest; 1800–3500 m a.s.l.; Lower montane forest; 1000–1800 m a.s.l.
			Dipterocarp	Tuaran, Karamuak, Labau, Bingkor, Brantian, Sook, Sinarun, Tungku, Tapang, Semporna, Lungmanis, Table, Orchid Plateau, Silabukan, Rumidi, Sipit, Apas, Kalabakan, Mawing, Dalit, Tengah Nipah, Kretam, Beruang, Dagat, Kennedy Bay, Tiger, Gomantong, Lokan, Bang, Mentapok, Tinagat, Malubok, Wullersdorf, Gumpal, Crocker, Maliau	Upland mixed dipterocarp forest; 500-1000 m a.s.l.; Lowland mixed dipterocarp forest; < 500 m a.s.l.
		Podsolised sand	Kerangas (<i>Heath</i>)	Kepayan, Brantian, Maliau, Serudong, Sook	Montane kerangas forest; > 700 m a.s.l.; Upland kerangas forest; 350-700 m a.s.l.; Lowland kerangas forest; < 350 m a.s.l.
		Ultramafic	Ultramafic	BiduBidu, Binalik	Montane ultramafic forest; > 700 m a.s.l.; Upland ultramafic forest; 350-700 m a.s.l.; Lowland ultramafic forest; < 350 m a.s.l.
		Limestone	Limestone	Gomantong	Scrub vegetation occurring on limestone outcrops, or forest stand growing on deeper soils (derived from limestone, and forest structure and species composition similar to mixed dipterocarp forest)

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Soil Water	Localities	Soils	Natural Vegetation/ Ecosystem	Soil Association	Vegetation /Forest Type
	Coastal		Beach	Usukan, TanjongAru	Beach Forest
High water table	Salt water		Tidal	Weston	Coastal and estuarine areas where the forest is influenced by tidal waves.
	Brackish water				Transitional Forest (narrow strip of forest dividing tidal and dryland vegetation)
	Fresh water	Oligotrophic peats	Peatswamp	Klias, Sipitang	Forest occurring on peaty wetlands.
		Eutrophic soils	Freshwater swamp	Kinabatangan	Seasonal Freshwater Swamp Forest (low-lying wetlands exposed to seasonal flooding)
Sapi	Freshwater swamp forest (low-lying wetlands exposed to almost permanently inundated)				

Source: Sabah Forestry Department

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Table 5-2: Composition of Natural Ecosystems in the Permanent Forest Estate and Stateland

Ecosystem	Permanent Forest Estate		Stateland (%)
	Natural Forest (%)	Industrial Tree Plantation (%)	
Sub-alpine	100.0		
Montane	74.6	0.4	25.0
Dipterocarp	43.7	6.5	49.8
Kerangas (Heath)	69.9	17.0	13.1
Ultramafic	79.8	2.8	17.4
Limestone	76.3	1.2	22.5
Beach	27.9		72.1
Tidal Swamp (Mangroves)	74.5		25.5
Peat Swamp	41.6	0.2	58.2
Freshwater swamp	18.8	0.8	80.4

Source: Sabah Forestry Department

Box 5-1: Forest Reserve Classes

To achieve the dual objectives of economic utilisation and environmental conservation, the Forest Reserves are gazetted under one of seven classes under Section 5 of the Forest Enactment 1968.

- CLASS I - PROTECTION FOREST. Forests conserved for the protection of watershed and maintenance of the stability of essential ecological functions and other environmental factors. These areas cannot be logged. *Area:* 466,756.95 ha of Protection Forest in 58 locations.
- CLASS II - COMMERCIAL FOREST. Forests allocated for logging to supply timber and other produce, contributing to the State's economy. Logging is carried out according to Sustainable Forest Management (SFM) principles. *Area:* 2,550,022 ha of Commercial Forest Reserves in 31 locations.
- CLASS III - DOMESTIC FOREST. The produce from this forest is for consumption of local communities only and commercial use is discouraged. *Area:* 6,919 ha of Domestic Forest Reserves in 9 locations.
- CLASS IV - AMENITY FOREST. Forest for providing amenity and recreation to local inhabitants. Recreational facilities may be provided in attractive sites, often on roadsides, within these reserves. Exotic tree species are sometimes planted to enhance the amenity value of these areas. *Area:* 16,358.766 ha in 19 locations.
- CLASS V - MANGROVE FOREST. Forest for supplying mangrove timber and other produce to meet the general demands of trade. *Rhizophora* sp. are the most commonly harvested, and the products range from firewood to fishing stakes. *Area:* 326,487.12 ha in 23 locations.
- CLASS VI - VIRGIN JUNGLE FOREST. Forests conserved intact strictly for forestry research purposes and biodiversity conservation. Logging is strictly prohibited in these forest reserves. *Area:* 103,037.733 ha in 60 locations.
- CLASS VII - WILDLIFE RESERVE. Forests conserved primarily for the protection and research of wildlife. The Sumatran Rhinoceros is one of the endangered wild animals found in the Wildlife Reserves. *Area:* 137,065 ha of Wildlife Reserves in 4 locations in the East Coast of Sabah.

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Table 5-3: Status of Terrestrial Ecosystems in Sabah

Ecosystem	Status	Remarks
Sub-alpine	Not threatened	- Only found on Mt Kinabalu. Human threat is negligible, although threatened by prolonged periods of drought. Climate change may pose a threat in the near future.
Montane	Not threatened	- Large extent of this ecosystem is gazetted as State Parks and Class I Protection Forest. Threatened by prolonged periods of drought and forest fires. Climate change may pose a threat in the near future.
Dipterocarp	Threatened	- The most productive ecosystem (in terms of timber), but also harbours tremendously high diversity of flora and fauna. - Formerly the most widespread ecosystem in Sabah. However, the coverage of pristine dipterocarp forest is of limited extent. - Almost all of the dipterocarp forests on State land have been converted to plantations. In the permanent forest estates, especially Class II Commercial Reserve, most of these forests have been damaged due to repeated logging and short cutting cycles.
Kerangas (Heath)	Threatened	- This ecosystem is of limited extent in the state – most of the coastal heath forests are now gone. What is left are pockets of inland heath forests, the largest extent being in the Sook and Pendawan plains. Well maintained pockets may be found in the Upper Padas and Nabawan. - Highly vulnerable to wild fires – a large portion of these forests have been burnt. - High conservation importance because of the high number of rare and endemic plants found here.
Ultramafic	Not threatened	- Steep and mountainous ranges with V-shaped valleys dominate this ecosystem. - Most of these ecosystems are protected in State Parks, Class I Protection Forest, Class VI Virgin Jungle Reserve, as well as conservation areas within FMUs. - Although not threatened, ultramafic forests are extremely important for conservation, as they are globally rare – Sabah has the largest extent of ultramafic outcrops in Malaysia and the third largest in the world (Chung, 2006). They harbour a high number of endemic plant species. - Research on ultramafic ecosystems is still lacking.
Limestone	Threatened	- Of limited extent in the state. Important for the in situ conservation of plant species that are endemic to limestone. - Large limestone outcrops in Sabah are protected under Class I Protection Forest and Class VI Virgin Jungle Reserve. However, they are still vulnerable to quarrying.
Beach	Threatened	- This ecosystem is mostly found on State land, which has largely been converted for urban development and settlements. In particular, most of the beach forests on the west coast of Sabah have been lost to development. - The only protected beach forest is in Pulau Tiga. There is a need to

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Ecosystem	Status	Remarks
		protect endemic plant species found on Pulau Semporna.
Tidal swamp (Mangroves)	Not threatened	- Almost all of Sabah's mangroves are protected under Class V Mangrove Reserve.
Peat Swamp	Threatened	- This unique and fragile ecosystem was estimated to have once covered about 100,000 ha. However to date about 80% of the peat swamp forests of Sabah have been lost due to peat fires, logging and urbanisation.
Freshwater swamp	Threatened	- Virtually, the entire ecosystem has been disturbed and converted into oil palm estates.

5.3 PLANTS

The Tree Flora of Sabah and Sarawak project, a collaboration initiated in 1992 between the Sabah and Sarawak Forestry Departments and the Forest Research Institute of Malaysia, is the most important taxonomic project for Borneo, and the first systematic attempt to document some of the important tree families of these two states in modern times. The project, which has since published six volumes covering 72 families, is expected to produce seven volumes in total to complete the revision of about 4,000 estimated tree species found in Malaysian Borneo. So far, the project has listed 432 species endemic to Sabah and Sarawak. Upon completion of the Tree Flora of Sabah and Sarawak project, a second project on the Flora of Sabah and Sarawak covering non-tree species will commence. However, this is only envisaged to happen around 2015. Experts estimate that the Flora of Sabah and Sarawak will contain about 12,000 species (Saw and Chung, 2005).

Although there is yet to be a complete checklist of wild plants in Sabah, this does not mean that there is a dearth of information on plant diversity in Sabah. The more charismatic groups such as the orchids, gingers, hoyas, rhododendrons and nepenthes have attracted continued interest with a number of monographs produced in recent times such as the *Nepenthes of Borneo* (Clarke, 1997), the *Orchids of Borneo* (Beaman *et al.*, 2001), the *Rhododendrons of Sabah* (Argent *et al.*, 2007) and the *Etilingera* (Zingiberaceae) of Borneo (Poulsen, 2006). The *Rafflesia* is another species that has attracted attention from scientists and conservationists. These are parasitic plants that grow on the *Tetrastigma* vine. Three species are known to occur in Sabah and about 80 locations. Although the flowers and vines are protected, less than half of the *Rafflesia* flowers occur within formal PAs.

Site-specific checklists have been collated for areas where various agencies and research bodies have previously undertaken floristic expeditions or collections – these generally involve areas within the State Parks, Forest Reserves and other proposed PAs. Mount Kinabalu, which has been recognised as one of 234 primary

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centres of plant diversity in the world (Martin *et al.*, 2002), is possibly one of the most studied site in the region. Information on the conservation status of plants in Sabah is not readily available. The SFD is currently assessing the conservation status of Sabah's dipterocarps in an on-going project funded under the 10th Malaysia Plan based on Ashton's revision of the family in 2004 for the Tree Flora of Sabah and Sarawak. Ashton (2004) recorded 191 taxa of dipterocarp in Sabah; out of this figure, 150 taxa or 78.5% of described species are considered threatened.

5.4 SUSTAINABLE FOREST MANAGEMENT

5.4.1 Sabah's Permanent Forest Estates

Almost half (48% or 3.61 million ha) of Sabah's land area falls within the State's PFE (Table 5-4), a network of forest reserves gazetted under one of seven functional classes under Section 5 of the Forest Enactment 1968 (see Box 5-1). Most of these were re-gazetted in 1984 under the Forest Enactment 1968. Forest reserves are relatively secure in that any proposal to excise or reclassify a reserve requires the approval of the State Cabinet as well as the State Assembly. Areas designated as Commercial Forest (Class II) comprise over 70% of the PFE. These areas are responsible for the continued production of timber, where the greatest challenge is in achieving an optimal balance between timber extraction and sustaining the environmental, biodiversity and social values of the forest ecosystem. As such, the following sections will focus on the management of these important areas.

Table 5-4: Permanent Forest Estate in Sabah

Forest Reserve Classes	Area (Ha)
Class I Protection Forest	466,757
Class II Commercial Forest	2,550,022
Class III Domestic Forest	6,919
Class IV Amenity Forest	16,359
Class V Mangrove Forest	326,487
Class VI Virgin Jungle Forest	103,038
Class VII Wildlife Reserves	137,065
Total	3,606,647

Source: Sabah Forestry Department

5.4.2 Progress in Sustainable Forest Management

In Sabah, decades of unsustainable logging from the 1980's led to widespread ecosystem and environmental degradation and the depletion of commercial trees. Radical intervention was necessary to preserve the forest resource and this came in

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the form of Sabah's SFM policy in 1997. The introduction of SFM represented a radical shift from the convention of regarding forest as either "protection" or "production" forest. It is based on the central tenet that a single concession area can be managed both to conserve biodiversity and to produce wood on a sustainable basis.

The restoration of a healthy and productive PFE depends on creating the conditions that contribute to the long-term stewardship of the forest resource, in contrast to short-term logging concessions. The commercial forest reserves were divided into 27 FMUs of between 50,000 ha and 100,000 ha in size (SFD, 2005); 18 FMUs were allocated to ten private companies for 100-year terms with the signing Sustainable Forest Management License Agreements (SFMLA). The SFD manages the remaining FMUs⁵.

Under the agreement, the SFMLA holders take responsibility for the full range of activities required under SFM including forest management planning, silviculture and harvesting operations. SFD serves as a monitoring and enforcement agency to ensure continuous compliance with the policy and legislative requirement. Sabah's Commercial Forest Reserves are to be managed to ensure a balance of competing, but potentially reconcilable uses to timber production. These include the conservation of biodiversity, the collection and storage of water for rural and urban needs, soil conservation, education, research, and nature tourism.

Long-term license holders are obliged to undertake the preparation of FMPs. NGOs and local communities are expected to be involved in the identification of High Conservation Value Forest (HCVF). Mitigation measures for logging operations are also to be implemented in accordance with the SFD's Reduced-Impact Logging (RIL) Guidelines, in addition to requirements within Environmental Impact Assessment Handbooks and Guidelines prepared by the Environmental Protection Department. With this long-term commitment in place, a number of major initiatives made under the SFM policy have been made:

- Short-term logging licenses, now very few in number, are being phased out and should be eliminated in the next two years.
- The performance of the SFMLA holders is continuously being audited independently under an EU-FLEGT collaboration since 2009.
- Harvesting of timber under natural forest management has been under RIL since 2010, with third party independent auditing.

⁵ The first such long-term license agreement was actually issued in the 1980 to Sabah Forest Industries, a company operating in the Sipitang district, with pulp and paper production as its main objective.

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- All SFMLA holders must obtain forest certification under a credible internationally recognised system by 2014.
- SFMLA holders are also required to set aside a minimum of 15% of their FMU for the conservation of ecological, cultural and biodiversity values (this effectively translates into half a million ha of the commercial forest reserve being set aside for conservation).

Acknowledging the impact historically wrought on Sabah's natural landscape by destructive forestry practices and short-sighted land alienation policies has been an important first step to initiative positive change and facilitating recovery in the long-term. In the interim, it is unavoidable that the revenue from forestry will remain low for the next 20 years⁶. This important shift in forest policy required courage, vision and political will. Maintaining the course will require strong commitment, particularly in confronting recurring calls to convert degraded FRs to oil palm plantations.

5.4.3 Forest Certification

In July 1997, Deramakot FR received the Gold standard of the Forest Stewardship Council (FSC) certification, a first for any tropical rainforest in the world. Having been re-certified twice since, it is now the oldest and longest FSC-certified tropical rainforest. Based on the experience of successfully implementing SFM in the Deramakot FR, the SFD recognises the importance of forest certification as a tool for improving forest governance, broadening market horizons (both in terms of premium markets and "green" financing), as well as in demonstrating the importance of SFM in meeting the socio-economic and environmental aspirations of the state. The SFD has set a target for all Class II FRs to be certified by 2014. While the SFMLA holders may choose to be certified under any recognised scheme, the SFD has opted to pursue FSC certification for forest reserves under its direct supervision.

To date, 431,554 ha of commercial forest reserve has been fully certified; a further 408,520 ha has been partially certified, for a total of 840,074 ha (Table 5-5). Although this represents a notable achievement, fully certified forests presently constitute less than 17% of the target. The SFD is targeting five more areas totalling about 166,581 ha for FSC certification within the next two to three years (Table 5-6). It is important that commitments to meet these targets are fulfilled. To this end, creative approaches may need to be called upon to fulfil forest management

⁶ Text of speech given by Datuk Sam Mannan, Director of Sabah Forestry Department, 2011.

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planning needs; other agencies and even NGOs and CBOs could be given expanded roles to assist these processes.

Table 5-5: Fully and Partially Certified Forests in Sabah

Locality	Certification System	Validity	Size (Ha)
Deramakot FR (SFD)	Full Certification Under the FSC (Natural Forest)	Apr. 2008-Apr. 2013 (re-certified twice since 1997)	55,139
Sabah Softwoods (Private Land)	Full Certification under the FSC (Tree Plantation)	Sept. 2007- Sept. 2012	27,313
KTS Plantation	Full Certification under the MTCS (Malaysian Timber Certification Scheme)	Dec. 2009-Dec. 2012	57,247
UluSegama-Malua (SFD)	Full Certification Under the FSC (Natural Forest)	June 2011-June 2016	241,098
Talungkap-Pinangah FMU 17A (SFD)	Full Certification Under the FSC (Natural Forest)	June 2011- June 2016	50,070
	Sub-total (full certification)		430,867
Sungai Pinangah FR (FMUs 15 & 16) (Sabah Foundation)	VLC (verified legal compliance) of the FSC system under Smartwood (Natural Forest)	May 2010- May 2013	176,933
Sipitang/Ulu Padas FRs (Sabah Forest Industries)	CW (Controlled Wood) Forest Management Certificate (Natural Forest)	Nov. 2010- Nov. 2015	224,199
	Sub-total (partial certification)		408,520
	Total certified forest		809,652

Source: Sabah Forestry Department

Table 5-6: New Areas for FSC Certification

Forest Reserve	Management Objective	Size (Ha)	Remarks
Trus Madi FR	Conservation and Eco-tourism	78,804	Forest Management Plan approved and being implemented
Pin-Supu (VJR)	Conservation and ecotourism under indigenous community conservation area	4,696	Forest Management Plan approved and being implemented
Banggi FR	Conservation and ecotourism under indigenous community conservation area	11,206	No Forest Management Plan yet. Probably poorest community in Sabah
Timimbang & Botitian FR	SFM timber production under NFM	13,610	Forest Management Plan being prepared
Ulu Kalumpang-Mt. Waldorf-Kalumpang-Madai Baturong FRs	Water conservation and protection	61,285	Forest Management Plan approved and work on-going in the area

Source: Sabah Forestry Department

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5.4.4 Forest Restoration

Forest restoration is, and will continue to be in the next 20 years, one of the most important management activities in Sabah's commercial forest reserves. In recent years, the SFD has actively pursued funding for rehabilitation efforts mainly by leveraging on carbon or biodiversity offsets as well as smart partnerships with NGOs and the private sector. However, so far these projects have only involved forest reserves managed by the SFD, the largest of which is the Malua-Ulu Segama rehabilitation project targeting a total of 241,098 ha of degraded forests for the purpose of conservation and future production (Ulu Segama-Malua SFMP website). Additionally, all SMFLA holders have been directed to carry out forest restoration within their own concession areas.

5.5 RESEARCH ON ECOSYSTEMS

Within the Malaysian and the Southeast Asian regional context, Sabah is at the forefront of practical research and knowledge on rehabilitating vast areas of damaged rainforests (Payne and Prudente, 2010). FRC, SFD's research arm is leading these efforts (Table 5-7 gives a list of on-going projects). Due to the inherent complexities of rainforest ecosystems, the SFD acknowledges that its understanding of the ecological characteristics of specific sites and selection of suitable species for re-introduction is still limited. Further research is needed to support the SFD's efforts to restore degraded ecosystems, bearing in mind that this is more than just the replanting of tree species, but restoring the floristic assemblage and ecological relationships that are consistent with these forest types. The existing SFM framework, in particular the close cooperation between SFD and the SFMLA holders is conducive for this as research findings can be readily integrated into forest management and restoration practices on the ground.

Ecosystem research in Sabah was strengthened through the BBEC project, with the setting up of Permanent Research Plots in Crocker Range Park. A manual, which includes methodologies for plot establishment, tree census, monitoring and data analysis, was published to support the continuity of this research. The SFD has a strong history of collaboration in research and has shown its willingness to explore new approaches in conservation. These factors have provided the foundation for a number of globally significant large-scale ecological research projects in Sabah.

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Table 5-7: Selected On-Going Research Projects By the SFD

Research Area	Purpose/Description
Assessment of conservation areas	<ul style="list-style-type: none"> To document vegetation status as well as flora and fauna diversity in PAs such as Class I Protection Forest and Class VI Virgin Jungle Reserve in order to formulate forest conservation plans. This assessment was initiated during the SFD-ITTO in 2000–2002 but was put on hold for a few years before it was resumed under the HoB initiative in the 9th and 10th Malaysia Plans.
Assessment of forest conservation status	<ul style="list-style-type: none"> To complement the SFD's efforts in updating and refining the vegetation classification scheme for Sabah. Also to evaluate forest conservation status in Sabah.
Forest changes (long-term ecological research)	<ul style="list-style-type: none"> Involves the establishment and maintenance of a number of long-term ecological research plots or permanent forest plots of various sizes in order to monitor longitudinal change (including the impact of climate change on rainforest ecosystems). The forest plots are established in lowland dipterocarp forest in Kabil-Sepilok FR and freshwater swamp forest in the Sg. Pin - Supu FR and Kinabatangan Wildlife Sanctuary. Only two plots remain active.
Silviculture of dipterocarp forest	<ul style="list-style-type: none"> Aims to improve the effectiveness of silviculture practices in dipterocarp forest within Class II Commercial FRs, in order to promote potential timber crops in natural forest management areas without depleting the natural dipterocarp forest stock and regeneration.
Restoration of degraded high conservation value forests	<ul style="list-style-type: none"> Long-term research is still at the initial stages, involving establishment of demonstration plots and species-selection trials. Areas that are currently under investigation are: <ul style="list-style-type: none"> Burnt peat swamp vegetation in Klias FR Burnt freshwater swamp vegetation in Sg. Pin - Supu FR Burnt ultramafic vegetation in Tawai FR Degraded upper montane vegetation in the Crocker Range National Park. Degraded mangroves in Sibyte FR. Measures of success include improvements in forest structure, productivity, diversity, as well as other physical site characteristics, such as drainage and nutrient cycle.
Tree phenology	<ul style="list-style-type: none"> The availability of sufficient planting material has been a limiting factor in reforestation efforts in the tropical forests of Sabah, which are characterised by irregular mast fruiting events. There is a demand for phenology studies on tropical trees and their interactions with environment to support management of tropical forests. Moreover, tree phenology studies could indicate fruit fall season for seed or wilding collection to support conservation management in restoration, enrichment planting and timber plantations. This research focuses on documenting the general or localised flowering and fruiting events of some potential native tree species throughout Sabah.

Source: Sabah Forestry Department

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One is the Stability of Altered Forest Ecosystems (SAFE) project, which has been initiated to investigate the effects of logging, deforestation and forest fragmentation on the tropical rainforest ecology. The project, which will entail the establishment of research plots over some 7,000 ha within Yayasan Sabah's Benta Wawasan oil palm plantation. This globally significant forest study of altered tropical ecosystems is envisaged to lead to the improved design of plantation landscapes. Another ecosystem study is the Sabah Biodiversity Experiment, which makes use of 124 four-hectare plots (that add up to 500 ha in total), near Danum Valley. The study is to investigate the implications of forest rehabilitation on biodiversity.

5.6 PLANT CONSERVATION EFFORTS

Legal protection for wild plants in Sabah is provided through three main legislations – the Wildlife Conservation Enactment 1997, Forest Enactment 1968 and Parks Enactment 1984. While all of these legislations place restrictions on the removal or damage of plants from areas reserved under the respective enactments, the Wildlife Conservation Enactment 1997 regulates the collection and sale of Totally Protected Plants and Protected Plants listed under the enactment (Table 5-8).

Table 5-8: Totally Protected and Protected Plants under the Wildlife Conservation Enactment

Schedule	Plants
SCHEDULE I, PART II (Section 54(1)(a)), Totally Protected Plants	<ol style="list-style-type: none"> 1. Nephentes Rajah spp. – Periuk Kera 2. Paphiopedilum spp. – Orkid Selipar 3. Rafflesia spp. – Rafflesia 4. Tetrastigma spp. – Pokok Perumah Rafflesia
SCHEDULE II, PART II, Protected Plants	<ol style="list-style-type: none"> 1. Caryota spp. – Botu 2. Ceratolobus spp. – Rotan 3. Corypha – Gabang 4. Cycadaceae – Paku Laut 5. Cytoceae – Paku 6. Zingiberaceae – Halia Hutan 7. Nenga spp. Pinang Hutan 8. Orchidaceae – Anggerek Hutan 9. Podocarpus spp (Commercial spp) 10. Rhododendron spp. Mawar Hutan 11. Livistonia spp. Silad 12. Arengasp – Polod

The following institutions play a leading role in the research and conservation of the flora in Sabah, and have built up important collections of preserved and living plant collections.

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- The FRC of the SFD, which has a herbarium with about 253,725 specimens and an arboretum at Sepilok.
- Sabah Parks keeps a collection of living and herbarium plant specimens collected within the parks.
- Agriculture Department, whose research centre and stations maintain living and preserved specimens of fruit trees, orchids and agricultural crops.
- Sabah Museum, which has a collection of preserved and living plants that are of ethno-botanical interest
- Institute of Tropical Biology and Conservation of Universiti Malaysia Sabah (UMS), which has begun to build up the herbarium.

So far, the SFD's plant conservation and forest rehabilitation efforts have been focused almost entirely on the dipterocarp family as it contains species of commercial value and species threatened due to the pressure on lowland dipterocarp forests over the last half century. Some of the current efforts that have been carried out by SFD include plant inventory surveys to support the formulation of Forest Management Plans (FMPs), contributions to HCVF studies and Environmental Impact Assessments. The department also plans to monitor target species for plant conservation that have been identified in some of the FMPs.

The Agriculture Department, through its Agriculture Research Station in Tenom has assumed a key role in terms of ex-situ conservation. Its extensive collection of rare species from a number of plant groups, including orchids, fruit trees, gingers, and hoyas serve as a critical gene bank, especially for rare species that have limited distribution in the wild. For orchids, the centre has adopted a strategy of producing large quantities of seeds and seedlings of rare and desirable species for distribution to other institutions and onwards to orchid breeders. This is intended to depress the market value of such favoured species and make it less worthwhile for commercial collectors to smuggle them out of our forests.

The 1992 Sabah Conservation Strategy concluded that the then existing PAs system was not sufficient for plant conservation – relatively small sites that were important for plant conservation were still not legally protected. In order to address this gap, the Strategy proposed the establishment of a new form of PA designed for in-situ plant conservation i.e. Genetic Resource Areas, which would be managed by the Agriculture Department. So far, neither of the two areas proposed (Senengang and Ulu Dusun) have been gazetted.

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Sabah Parks also plays an important role in plant conservation through its Botany Unit which was established in 1994. This Unit handles various aspects of research and education that relate to flora within the Parks. This includes research related to flora, the management of in-situ conservation efforts such as the Rafflesia Conservation programme, and ex-situ herbaria such as the Orchid Conservation Centre, the Rafflesia Conservation Centre, the Mount Kinabalu Botanical Garden, and fernarium. The unit also manages and develops the herbarium collections and creates a central database of plants for use in research and education. Research activities include the use of cultures to propagate wild orchids and other threatened plants.

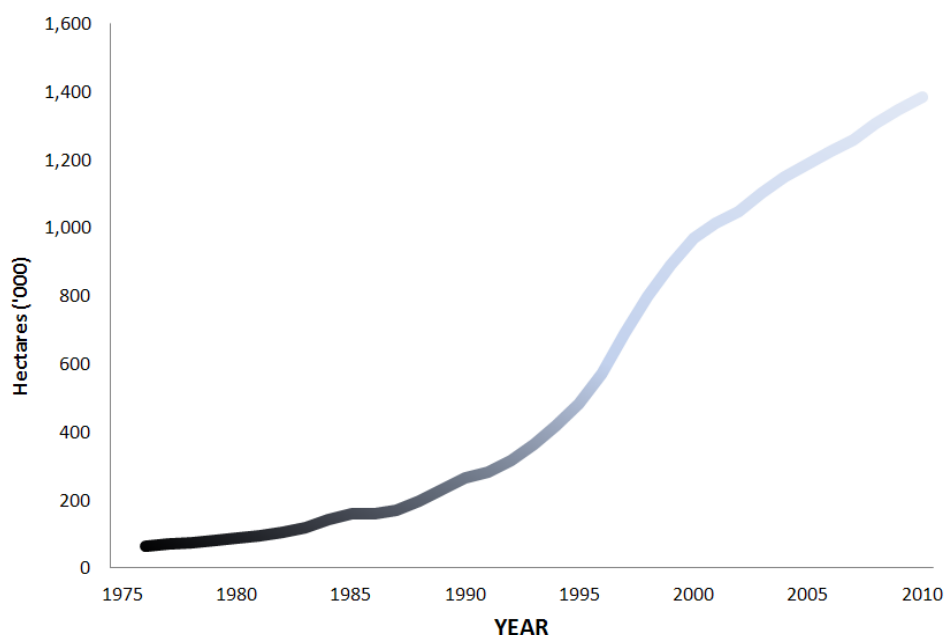
Sabah Parks has also played a significant role in documenting ethno-botanical knowledge from local communities. 'Projek Ethnobotani Kinabalu' has been a community-based project with the aim of documenting the traditional uses of plants and promoting the preservation of cultural heritage. Ethno-botanical studies have also been undertaken by FRC, UMS, and the Sabah Museum, however this information is poorly consolidated. Local communities are increasingly conducting their own research with the assistance of NGOs; while others are involved in maintaining their own in-situ and ex-situ plant conservation initiatives in their own areas.

5.7 THREATS TO TERRESTRIAL ECOSYSTEMS AND PLANTS

5.7.1 Habitat Conversion

The removal of forests has been the most damaging threat to biodiversity, although the conversion of forests for agricultural expansion over the last 20 years has slowed down (Figure 5-2), owing to a lack of suitable land and the strong SFM policy. However, as the financial divide between export incomes from agricultural as opposed to sustainable forestry/conservation possibly being as high as 50 times for the next 20 years, the threat of forest conversion for oil palm remains serious. The PFE may be expected to face increased uncertainties in coming years, particularly with the advent of external factors such as changes in government, or even individuals in government.

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Source: Malaysia Palm Oil Board

Figure 5-2: The Growth of Oil Palm in Sabah (1975-2010)

At present, the complex issue of habitat conversion arises in the form of Industrial Timber Plantations (ITPs) within forest reserves. Planted timber is, without a doubt an important substitute to make up for the current shortage of timber from natural forests. This is expected to continue for the next 20 years while the State's forest estate recovers its productivity. In 2004, more than 12% of the State's total timber output came from ITPs, a ten-fold increase from 1982 (SFD, 2005).

As such, as well as to overcome the lack of income from logging in natural forests faced by SFMLA holders, the SFD has allowed a certain percentage of each FMU converted to ITP. While at present SFMLA holders have planted a combined 11,000 ha, the total ITP zones will cover about 400,000 hectares of gross area over the total 2.55 million hectares, equivalent to 15% of the commercial forest reserve in Sabah⁷. While this strategy is sound from an economic standpoint, the downside is that the establishment of ITPs involves the conversion of degraded forests into monoculture plantations with low biodiversity value. In light of the difficulties faced by SFMLA in being certified due to the ITP issue, other solutions are needed to make SFM financially attractive.

⁷ This figure will be lower in terms of net area once sensitive zones within the ITPs are excised – e.g. riparian reserves, steep areas above 25° slopes, wildlife corridors, gullies etc. In the end, the available net area is envisaged to be around 300,000 hectares (12 % of the production forest).

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5.7.2 Illegal Encroachment by Local Communities

Another cause of habitat conversion and ecosystem degradation stems from illegal encroachment of FRs and PAs by local communities for shifting cultivation or permanent crops. In some case this issue stems from the historical problem that FRs were previously gazetted without taking into consideration native claims to land. As such, there are an estimated 20,000 people living within the boundaries of FRs throughout the State; many of whom still depend on shifting cultivation or rudimentary cultivation to meet their daily needs⁸ (UNDP, 2008). However, there are also serious cases of encroachment perpetrated by non-locals brought in to work in logging camps and oil palm plantations⁹.

5.7.3 Poaching of Valuable Plant Species

The poaching of rare and valuable plant species from the wild poses a real threat to Sabah's plant diversity. Of particular concern is the poaching of plants with high commercial value, especially ornamental species such as orchids and hoyas. In spite of adequate legal protection, enforcement is a problem due to difficulties in discovering and identifying illegally possessed plants. There is a lack of resources and botanical expertise within the Wildlife Department. The illegal collection of gaharu (*Aquilaria* spp.) is also a problem in spite of strong laws. An example of this is the arrest of five gaharu collectors deep within Kinabalu Park. When apprehended by the park rangers, the five collectors had already amassed about 10kg of gaharu from 12 trees (Lim and Noorainie, 2008).

5.7.4 Wildfires

Drought and forest fires are a proven threat to plants and ecosystems in Sabah, as certain forest types are not adapted to fire. Due to the drier conditions and higher amounts of ground biomass present, heavily disturbed forests are the most prone to fires and suffer the most serious fire damage. Drainage of peat swamp for agricultural use in adjacent lands has also made some forest reserves more vulnerable to being destroyed by fire, such as seen in Binsuluk FR in the Klias Peninsula. Additionally, forests close to plantations and local communities, as well as forests on ultrabasic and peat soils are most prone to fires. Historically, vast areas of Sabah's forests have been lost to fires – the most severe in recent times occurred during the El Nino periods in 1983 and 1997. It is estimated that the 1983 fires affected a minimum of 950,000 hectares of forests in Sabah, 85% of this being

⁸ The issue of native communities is discussed in detail in Section 10

⁹ SFD Press release on encroachment of Ulu Kalumpang FR.

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in logged areas (Wirawan, 1993). While fires are frequently associated with the effects of severe droughts caused by the El Niño phenomenon, minor droughts that would have been otherwise of little ecological significance are rendered very damaging if they lead to fire.

5.7.5 Invasive Alien Species

While they are not regarded as a major conservation problem in the state, a number of invasive alien plant species have become a familiar part of Sabah's landscape. Perhaps the most widespread and alarming is *Acacia mangium* which was first introduced as a fast growing plantation species for Sabah's pulp and paper mill in Sipitang industry in the 1980s. *A. mangium* can now be found growing wild almost in any open space in towns, rural areas, on the fringes of forests and within highly degraded forests. While relatively intact forests are unlikely to be invaded by Acacia trees (as they are poor competitors under these circumstances), Acacia trees can easily invade degraded forests, especially those prone to recurring drought and fire. This phenomenon represents a threat to the forest rehabilitation efforts currently being carried out by the SFD and SFMLA holders. Another case of invasive alien plant species that has received some measure of attention is the occurrence of the dandelion on Mount Kinabalu, which has displaced natural vegetation along parts of the trail. This fast growing species, which was first observed in 1998 in Panar Laban, has since spread to Mesilau and Layang Layang.

5.7.6 Climate Change

While the possible overall impacts of climate change on biodiversity are still unknown, changes in climatic conditions such as rainfall and temperature patterns are highly likely to have impacts on tree phenology, as flowering and fruiting of most species are closely linked to these environmental factors. In addition, it may be expected that a rise in mean temperatures will have impacts on montane and sub alpine species.

5.8 GAPS IN TERRESTRIAL ECOSYSTEM AND PLANT CONSERVATION

Some specific needs have been identified to fill gaps in ecosystem and plant conservation efforts in Sabah. These include:

5.8.1 Availability of Up-to-Date Spatial Information on the Current Distribution and Status of Terrestrial Ecosystems

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Although the SFD does have fairly detailed “strata maps” that provide information of timber stocking within FMUs, this does not capture all the information needed for biodiversity planning. At the ecosystem level, fairly accurate maps showing the present extent of each ecosystem will provide a clearer picture of the most threatened ecosystem types as well as the “representativeness” of PAs. A state-wide forest ecosystem inventory and remote sensing exercise may be required to produce this.

5.8.2 Access to Information on Threatened Plants

Many plant species, including trees, in Sabah are known to be rare and endangered. The list of species is expected to become longer as research on flora intensifies. A pre-requisite for effective plant conservation actions is the availability of sufficient information on the conservation status, habitat location, and phenology of threatened plants. There is a need for a common database of threatened plants for Sabah as much of this information is poorly consolidated and scattered across the different government agencies and research institutions.

5.8.3 Integrated Strategy for Plant Conservation

Although there are several initiatives are on-going, there is currently no overarching strategy for plant conservation in Sabah. As such, these efforts are dependent (to a certain extent) on the initiative of various individuals, and often hampered by a lack of (and intermittent) funds as well as duplications in efforts. In view of the limited human and other resources in Sabah, there is a need for better coordination of the work of the various government bodies involved in the management of tree flora of Sabah. A plant conservation strategy, based on the recently published Malaysian Plant Conservation Strategy would help to focus and streamline objectives and efforts, as well as optimise the resources of the various agencies involved.

5.8.4 Plant Conservation in Forest Restoration Efforts

Plant diversity is not currently a priority in restoration efforts. Most restoration projects currently focus on restoring the forest structure through the re-establishment of wildlife habitats and for future timber production) utilising planting material of common tree species such as kapur and laran. The next step in forest restoration efforts must be to establish more ex-situ collection (including non-dipterocarp species such as fruit trees) and subsequently re-introduce these threatened plants into the wild.

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5.8.5 Comprehensive Long Term Forest Monitoring

While forest monitoring projects are being undertaken by various agencies and research institutions, these efforts are still inadequate as they do not cover all the different climactic zones and forest types in Sabah. The need for long term monitoring is made even more urgent with the impending threat of climate change. In this, it is envisaged that collaboration needs to be enhanced, leveraging off the presence of SFD's ranger outposts throughout the PFE and in the network of Parks.

5.8.6 Enforcement of Plant Protection Provisions in the Wildlife Conservation Enactment 1997

While in general, the Wildlife Conservation Enactment 1997 provides strong regulations for plant protection, two gaps stand out. Firstly, entire plant families instead of specific species are listed under the enactment, even though not all of the species in each family are threatened (some are even abundant or widely used in horticulture). However, there are many threatened species not listed in the enactment. This listing needs to be reviewed. Secondly, SWD is empowered to enforce the enactment, but does not have the required expertise to do so effectively. A decision should be made whether (and how) to strengthen the department's capabilities, or to transfer the responsibilities for plant protection to another department that is more focused on plant conservation.

5.8.7 Innovative Approaches and Public Participation

Apart from conventional methods for plant conservation already being undertaken, due to the presence of private plant enthusiasts and special interest groups in Sabah, there is considerable scope for enhancing ecosystem and plant conservation by working with local partners. These may include working with individuals with important private gardens, tourism businesses wanting to establish in-situ plant collections at resorts, and local communities maintaining in-situ gardens featuring rare habitats and plant assemblages. There is also potential for developing a plant tourism industry together with local communities or SFMLA holders which deserves further exploration¹⁰.

5.8.8 Shortage of Botanical Expertise

Documenting and safeguarding biologically diverse tropical forests, including in-situ and ex-situ approaches, requires a wide range of expertise in the fields of plant

¹⁰ Anthony Lamb, pers. comm., 18 October 2011.

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taxonomy, forest ecology and many others. The shortage of skilled experts in these fields is a problem for all the key agencies in ecosystem and plant conservation. The integration of ecosystem and plant conservation into SFM will also require SFMLA holders to acquire this expertise. There is a need to develop programmes and incentives to produce graduates in these fields and to further explore how to leverage of Sabah's reputation as a hub of biodiversity and ecology research to attract professionals with relevant expertise to enhance training and mentoring opportunities.

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SECTION 6

WETLAND ECOSYSTEMS

SECTION 6: WETLAND ECOSYSTEMS

6.1 INTRODUCTION

Sabah has many wetlands including some of the largest protected wetland habitat in Malaysia. Wetland ecosystems are recognised for their roles as refuges for distinctive plant species, habitat for diverse wildlife populations and wintering spots for migrating birds. Coastal wetlands provide a buffer against flooding and erosion, and serve as a sink for pollutants and produce oxygen. They nurture fisheries resources which are a major food source for coastal communities. Sabah's wetlands sustain the livelihoods of communities, as well as plant and wildlife species associated with these diverse ecosystems. This chapter provides a special focus on Sabah's diverse wetland ecosystems, their biodiversity values and provides information on their current conservation status. This chapter supplements the overview of terrestrial ecosystems provided in Chapter 5 and some of the information on wildlife in Chapter 4. Information on coastal wetland habitats are also touched on in Chapter 8. It looks at some of the main threats and drivers of change, and identifies gaps to be addressed.

6.2 WETLAND ECOSYSTEMS OF SABAH

In Sabah, wetland ecosystems are classified under several categories – saline and brackish wetlands (mudflats and mangroves), brackish wetlands (nipah swamps), freshwater wetlands (coastal lagoons, freshwater swamp forest, peat swamp forest, river floodplains, oxbow lakes and other natural lakes, mud volcanoes, riverine bank vegetation, and highland swamp forests), and cultivated and artificial wetlands (such as open grasslands, sago, paddy, aquaculture ponds, dams and reservoirs). These ecosystems, both natural and man-made, all have important roles in sustaining wildlife, ecological services and supporting natural resources of value to human society. The Directory of Asian Wetlands published in 1989 describes wetland sites in Sabah which fulfil the Ramsar criteria as Wetlands of International Importance¹¹. The distribution, status and trends of the main wetland ecosystems and iconic wetland-dependent species found in Sabah are described below, and this is supplemented with more recent information, where available.

¹¹ Wetlands of International Importance (or 'Ramsar Sites') are wetlands that fulfill at least one of the nine criteria for inclusion in the List of Wetlands of International Importance (or the 'Ramsar List'). See www.ramsar.org for more details.

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Table 6-1: Types of Wetland Ecosystems in Sabah

Wetlands Types	Ecosystems
Saline and brackish wetlands	Mudflats; Mangroves
Brackish wetlands	Nipah swamps
Freshwater wetlands	Coastal (freshwater) lagoons; Freshwater swamp forest; Peat swamp forest; River floodplains; Oxbow lakes; Other natural lakes; Mud volcanoes; Riverine bank vegetation; Highland swamp forest
Cultivated and artificial wetlands	Open <i>padang</i> ; Sago; Paddy; Aquaculture ponds; Dams and reservoirs.

Source: Davison (2001)

6.2.1 Mangroves

Sabah's mangroves occur largely along the east coast, facing the Sulu and Sulawesi seas. Sabah has the most extensive coverage of mangroves in Malaysia with 59% or 326,000 ha. As at December 2008, a total of 320,521.56 ha of mangroves were classified as Permanent Forest Reserve (Class V) under the Forest Enactment 1968, which means that they are meant to be managed "for the supply of mangrove timber and other produce" and does not imply strict protection. Mangrove ecosystems in Sabah provide a multitude of services; they maintain the quality of the coastal environment by offering protection against strong winds and waves, coastline erosion, and assimilation of sediment wastes. They are important as breeding and nursery grounds for a variety of marine life such as fish and crustaceans, and play an important role as biological filters and carbon sinks. Today, apart from small scale extraction of mangroves for charcoal and piling poles, and mangrove clearance (for shrimp pond farming and oil palm cultivation), there is relatively little demand for mangrove timber in Sabah.

Sabah's mangroves support endangered wildlife species such as the Proboscis monkey, estuarine crocodile, and Lesser Adjutant stork, as well as other highly specialised species that are dependent on mangrove ecosystems for their survival. The main threat to swamps and mangroves is the complete clear felling of tracts of swamp especially along the coastline and along the river banks. Activities resulting in such clearing include (a) reclamation for property development; (b) aquaculture in earthen ponds; (c) the construction of bunds and draining of swamps for agriculture; and (d) resort development where construction is extended to the edge of the river bank.¹²

¹² Sabah Development Corridor Blueprint 2008-2025.

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In recent years, in line with growing recognition of the importance of mangroves for coastal protection, programs have been underway for mangrove replanting. Using a Federal grant of RM5 million, the SFD reported replanting 183 ha between 2006 and 2007, mainly in areas around Sibyte FR near Sandakan and Semporna FR in the east coast¹³. This work is expected to continue both within forest reserves and on State land, often with the participation of local communities.

6.2.2 Nipah Swamps

Nipah swamps are tidal, mono specific stands of the palm *Nypa fruticans*. Nipah occurs in association with mangroves, often lining the tidal reaches of rivers and forming huge swamps in delta areas such as the Klias Peninsula and the Kinabatangan floodplain. They are refuges for the estuarine crocodile and provide roosting areas for waterbirds, such as the egret roost at Padas Damit. Nipah provides leaves that are used to make traditional attap roofing.

6.2.3 Freshwater Swamp Forest

Freshwater swamp forest occurs on permanently or seasonally flooded soils with over 35% mineral content, normally in a zone along the lower reaches of certain rivers. It also occurs around freshwater lake systems. This forest type is species-rich compared to mangroves. As a result of biogeographic, microclimatic and soil factors, the species composition and relative dominance of the tree flora varies greatly between areas. These forests are of economic importance for their timber value and flood-mitigation function. They are also significant for conservation and have been found to be important for large mammal species including many of the iconic species associated with Borneo. Freshwater swamps have also been noted for the diversity of birdlife and flora. The main remaining freshwater swamp forests are located along Sabah's east coast, particularly in the Labuk-Sugut area and parts of the Kinabatangan Floodplain. This is one of the most threatened wetland ecosystems in Sabah as substantial sections have already been cleared and converted to oil palm plantations.

6.2.4 Peat Swamp Forest

In 1989, some two million ha remained in Malaysia, of which about 60,000 ha was found on the Klias Peninsula. Peat swamp forest is valuable as a sustainable timber resource and for flood-mitigation and water supply. Peat swamp forests are used by endangered mammals such as the Proboscis monkey and two subspecies of the

¹³ <http://www.forest.sabah.gov.my/download/2007/23.%20ii.%20Mangrove%20Restoration.pdf>

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Banded langur (*Presbytis melalophos*, *P.m. chrysomelas* and *P.m. cruciger*) both of which are endemic to the peat swamp forests of north western Borneo and are probably endangered.

Peat swamp forest is also a priority ecosystem for conservation particularly since substantial areas of this habitat were badly burnt in 1998, and again in 2003 including the two Class I Protection forest reserves in the Klias Peninsula – the northeast portion of Sungai Binsuluk FR (12,106 ha) was very badly damaged, while the Klias FR (3,630 ha) was only slightly affected. Researchers are not certain how this forest type will regenerate. The vulnerability to fires has been contributed to by canals constructed to access timber, as well as drainage for agricultural cultivation outside the forest reserve. These activities expose the peat swamp forest to further threat of fire damage¹⁴.

A unique highland peat swamp forest is found in the Upper Padas i.e. the Long Pasia Swamp Forest. This area is hardly explored but appears to be in no immediate danger due to its inaccessibility. Some of it is protected within the Maligan VJR (9,000 ha).

6.2.5 Oxbow Lakes

Oxbow lakes occur mainly along the meandering lower reaches of major rivers such as the Kinabatangan, Sugut and Segama. They support rich freshwater fish populations, and may be fringed with thick floating mats of vegetation. The more remote oxbows provide some of the last remaining suitable breeding habitat for estuarine crocodiles. They are also important for fisheries, waterbirds, and small mammals such as Oriental Small-clawed otter. Oxbow lakes are vulnerable to sedimentation and the invasion of water weeds.

6.2.6 River Systems

There are 78 river systems in Sabah. The largest rivers in terms of discharge are the Kinabatangan River, Padas River and Papar River. The Kinabatangan River is the longest river in the state and spans 560 km from its headwater to its outlet in the Sulu Sea, east of Sandakan. It is renowned for the wetland habitats along its floodplain such as riverine forest, freshwater swamp forest, oxbow lakes and mangrove swamps along the coast.

¹⁴ http://www.forest.sabah.gov.my/caims/Class%20I/A_FR1/klias.htm

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Sabah's rivers provide domestic and industrial water supply, sustain biodiversity, provide food sources, facilitate navigation, and some are important for tourism. Surface water quality in Sabah is adversely affected by various pollutants that enter the rivers, streams and other water bodies. Many of these open water bodies are polluted either by agricultural wastes, farm wastes or human wastes as well as soils from erosion and surface runoff. High turbidity has been a particular problem in Sg. Tuaran, Sg. Padas, and Sg. Kinabatangan (TRPD, 1998, DOE, 2009). Chemical pollutants have been reported to have been detected in the Ranau water supply (TRPD, 1998). Water quality in Sg. Liwagu is reportedly affected by pesticides and herbicides from the nearby vegetable growing areas and heavy metals (TRPD, 1998). Biological pollutants in the form of faecal coliform (*E-coli*) and algal spread (eutrophication) are other sources of pollution.

6.2.7 Marshes

There are relatively few open marsh areas in Malaysia. Kota Belud Bird Sanctuary on Tempasuk Plain in northwestern Sabah consists of freshwater marshes together with a complex of other wetland habitats. It is known to be of importance to resident and migratory waterbirds. Another marsh, Padas Damit, in the Klias Peninsula is also an important wintering site. Both sites have been identified as deserving some form of protection, but as these areas are also used by local residents for grazing, there has been little progress towards the gazette of these areas for protection. However, there may be opportunities to create conditions favourable to local participation in managing these wetland bird sites.

6.3 WETLAND-DEPENDENT SPECIES**6.3.1 Proboscis Monkeys**

Populations of Proboscis monkeys are known to exist mainly in the wetlands around Dewurst Bay, along the Kinabatangan, Segama and Sugut rivers in the eastern deltas and in the Klias Peninsula on the west coast (Davies and Payne, 1982). Sha *et al.* (2008) estimated a minimum population size of c. 5,907 individuals along major coastal river systems in Sabah. Although the estimate in this study is much higher than the previous estimates of 2,000 (Davies and Payne, 1982) and 3,000 individuals (IUCN, 1978), they authors note that their results should not be taken that the population has actually increased, but rather is a result of a more comprehensive review of the baseline population size in recent years.

They also noted that the distribution of Proboscis monkeys appeared highly fragmented, with only five major centres of continuous distribution and numerous

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small isolated populations. Existing Proboscis monkey habitats are increasingly threatened by human activities, particularly the clearing and conversion of important riparian and coastal mangrove habitats to plantations and human habitation, which result in fragmentation of otherwise continuous populations along rivers, and local extinction of remnant populations trapped in small forest fragments. Only 15.3% of the population estimated in their study was found within protected forest reserves, with major populations in the Segama, Sugut and Garama area in Klias not within forest reserve land. Riparian habitats necessary for Proboscis monkeys are not sufficiently protected, compounded by the fact that most human settlements are closely associated with river systems. Although the strip of 20 m of riparian forest perpendicular to the river is legally protected (Water Resources Enactment 1998), this is insufficient for proboscis monkeys. They typically range up to one km from the riverbank to forage for food in just a day.

The current distribution of Proboscis monkeys in Sabah is fragmented, with many isolated populations and large populations that are themselves fragmented into sub-populations by various forms of land conversion. Fragmentation of river systems is most severe along the Kinabatangan, Segama and Sugut rivers, where the remaining large populations exist. As far back as 1998, the strategic plan for forest resource development of the SFD recognised that extensive reforestation was necessary as a result of over-exploitation of natural forests. There has been renewed impetus by the state government in recent years to address the problem of riparian reserve encroachment along major rivers by plantations, and to establish plans to rehabilitate forest along rivers that have been converted to oil palm plantations. Information on wildlife of wetland ecosystems such as orang-utan, estuarine crocodiles, elephants, silvered langurs, and many others is presented in Chapter 4.

6.3.2 Waterbirds

Globally-threatened waterbird species known to occur in Sabah include Storm's stork, Lesser Adjutant stork, Chinese egret and the Christmas Island figatebird. The global conservation status of these species and their locations in Sabah are presented in Table 6-2 below. The Malaysian Wetland Directory (DWNP, 1987) contains some amount of information on waterbird species in the 20 listed sites for Sabah. However, there is a need to update this information with more waterbird surveys.

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Table 6-2: Globally-Threatened Waterbird Species Known To Occur In Sabah

Species	Conservation Status (IUCN Red List)	Site(s)
Storm's Stork (<i>Ciconia stormi</i>)	Endangered	Kinabatangan Floodplain; Klias Peninsula; Kulamba Wildlife Reserve; Tempasuk Plains
Lesser Adjutant (<i>Leptoptilos javanicus</i>)	Vulnerable	Kinabatangan Floodplain; Klias Peninsula; Kulamba Wildlife Reserve; Tempasuk Plains
Chinese Egret (<i>Egretta eulophotes</i>)	Vulnerable	Kinabatangan Floodplain; Klias Peninsula
Christmas Island Frigatebird (<i>Fregata andrewsi</i>)	Critically endangered	Mantanani Islands; Tempasuk Plains

6.4 PRIORITY WETLAND SITES IN SABAH

The Malaysian Wetland Directory is the most comprehensive listing of wetlands of importance in the state. The Ramsar Criteria was used as the basis for selecting these wetlands for inclusion in the national inventory. Each of the sites listed fulfil at least one of the eight criteria¹⁵ in use at that time for designation as a Ramsar Site. The detailed information on each listed site was drawn largely from desk reviews of existing literature, and personal communication with wetland researchers. For the purposes of this assessment, the 20 listed sites were evaluated and ranked in terms of their conservation value and, and more recent information where available, resulting in a revised list of 10 priority sites from the original 20, and the inclusion of two new marine sites i.e. Sipadan Island and Mantanani Islands – as examples of near shore island wetland ecosystems. For those sites with more information available from detailed studies, a reference has been made at the end of the site description (Table 6-3).

¹⁵ Criteria 9, which deals with taxa other than waterbirds and fish, was included in 2009.

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Table 6-3: Priority Wetland Sites for Conservation in Sabah

Name of Site	Size of Area	Location
Long Pasia Swamp Forests	c.800 ha of swamps; catchment area c.50,000 ha.	65 km south of Sipitang, in the highlands on the Sarawak border, Sabah.
Klias Peninsula	90,000 ha.	Southwestern coast of Sabah, forming the northeastern shore of Brunei Bay and southwestern shore of Kimanis Bay, and bounded on the inland side by the Crocker Range and on the western side by a ridge on higher ground, Sabah.
Tempasuk Plain	Over 13,000 ha	Northwest coast of Sabah
Marudu Bay & Sungei Tenga Swamps		
- Marudu Bay	c.150,000 ha.	Northernmost point of Sabah.
- Sungei Tenga Swamps	Over 6,500 ha.	East coast of Marudu Bay, 25 km southeast of Kudat, Sabah.
Labuk-Sugut Deltas	c.150,000 ha	Northeast coast of Sabah, northwest of Sandakan.
Sandakan-Tambisan Coastal Wetlands	c.320,000 ha	North coast of the Dent Peninsula, from Dent Haven (south of Tambisan) to Tanjung Pisau (NNW of Sandakan), eastern Sabah.
Kabili-Sepilok FR	4,295 ha	24 km west of Sandakan on the east coast of Sabah, with the southern boundary on the coast.
Kinabatangan Floodplain	c.280,000 ha	Adjacent to the Kinabatangan River in eastern Sabah.
Segama River Valley	c.140,000 ha; key areas about 8,500 ha	South of the Kinabatangan River in eastern Sabah
Cowie Bay	c.120,000 ha	Kalimantan border in the south to Tawau in the north

6.5 DRIVERS OF CHANGE IN WETLAND ECOSYSTEMS IN SABAH

The degradation and loss of wetland habitats in Sabah is being caused by a number of complex and related drivers. Increased human use of fresh water has reduced the amount of water available to maintain the ecological character of many inland wetland ecosystems.

Conversion of wetlands, that is drainage and clearing of vegetation, to make way for agricultural development has been the principal cause of inland wetland loss. In certain ecosystems, particularly peat swamp forest, lowering the water table has made the wetland more vulnerable to drought and fire. The most significant threat

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to coastal wetlands is development-related conversion of coastal ecosystems which is influenced by raising rates of urbanisation and the concentration of human populations in coastal areas coupled with growing economic activity. This has led to large-scale losses of habitats and services. Other direct drivers affecting coastal wetlands include the diversion of freshwater flows, nitrogen loading, overharvesting, siltation, changes in water temperature, and species invasions.

The degradation and loss of wetlands threatens human well-being. The loss and degradation of inland waters and floodplains has reduced their natural ability to buffer or ameliorate the impacts of floods; this threatens the security of individuals and entire communities. Pollution also puts coastal inhabitants at risk — directly by affecting human health, and indirectly, by degrading the resource base on which many people depend. Global climate change and nutrient loading are projected to become increasingly important drivers in the coming years.

6.6 CONSERVATION AND MANAGEMENT INTERVENTIONS

Management plans have been formulated for the Klias FR in 2007 and the LKSW Ramsar Site in 2010. The Kinabatangan Wildlife Sanctuary which comprises a network of FRs and adjacent lands has been the focus of considerable conservation activity for the last 30 years, which has included detailed wildlife ecology studies, forest and lake rehabilitation, as well as community-based conservation and tourism programmes. In order to promote complementary land use and wildlife passage in areas adjacent to the Wildlife Sanctuary, projects here have targeted multiple stakeholders including plantation owners, the tourism sector, government agencies, NGOs, and local CBOs. Many of these are still on-going.

In 2008, the LKSW in Sabah was designated as Sabah's first Ramsar site. This is the 6th Ramsar site in Malaysia, but the new listing will make the area Malaysia's largest, extending over 78,803 ha of mangrove forest and peat swamp on Sabah's east coast. The site comprises three forest reserves – Trusan Kinabatangan FR (40,471 ha), Kulamba Wildlife Reserve (20,682 ha), and Kuala Maruap and Kuala Segama FR (17,650 ha). The Sabah Biodiversity Centre has been appointed as the focal point for the implementation of the Ramsar Convention in the state. It is understood that preparations are underway to designate another Ramsar Site i.e the Kota Kinabalu Wetlands.

With funding from the federal government, the SFD has formulated a Strategic Guidelines and Framework for Sabah's Mangrove Master Plan, and devised a model for the Management of Mangrove Forest. In addition, SFD has rehabilitated a total of 736 ha of Mangrove Forest Reserves with funding under the 9th Malaysian Plan

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and the Sabah Development Corridor initiative. SFD is also partnering the International Society for Mangrove Ecosystems to implement a planting programme for mangrove rehabilitation over the period 2011-2014. A target of 50 ha is to be rehabilitated annually for three years.

6.7 GAPS IN THE CONSERVATION AND MANAGEMENT OF WETLAND ECOSYSTEMS IN SABAH

6.7.1 Updated Information on Wetland Ecosystems and their status

In the absence of a comprehensive inventory of wetlands in Sabah, it is impossible to adequately assess the status and trends for wetlands in the state and to formulate a comprehensive strategy for biodiversity and ecosystem. Much of the information which exists is more than 20 years old and urgently need to be updated. Historically, decisions concerning wetland management have favoured either wetland conversion or management for a single ecosystem service such as water supply, timber production, or food production. Very little information is available at present on the full range of benefits and values provided by different wetland ecosystem services to inform decision-making.

6.7.2 Institutional and Policy Framework for Wetland Conservation

Scale issues need to be dealt with in governance and institutional responses in order to deal in the most effective way with the drivers affecting wetlands and water. Strong governance arrangements and institutions favouring wetland ecosystem conservation and sustainable use are needed at multiple levels and across different sectors, as are mechanisms to enhance the participation of all wetland stakeholders in the planning and implementation processes. Additionally, resources for aspects such as monitoring and enforcement need to be made available.

6.7.3 Integrated Approach to Conservation and Management of Wetland Habitats and Species

Ideally, any action taken to conserve, manage and utilise wetlands should be considered within the larger basin context to ensure that vital wetland ecosystems services are safeguarded. The Management Plan for the LKSW Ramsar Site has adopted this approach; the same needs to be applied to the conservation and management of other priority wetlands and wetland-dependent species in Sabah.



SECTION 7 PROTECTED AREAS

SECTION 7: PROTECTED AREAS

7.1 INTRODUCTION

The establishment of a system of PAs is at the core of in-situ conservation requirements. Sabah has a long history of setting aside important natural areas for the conservation of its unique and rich biodiversity and today, a variety of categories of PAs form a crucial and visible part of nature conservation in the state (Figure 7-1). These PAs have been established under various state legislations, under different management agencies, with specific rationales and purposes. Over time, each of these agencies have developed their own character, unique experiences and specialised skills and networks.

However, while each agency might effectively manage a particular PA or management category under its authority, it is become increasingly important to explore mechanisms to promote greater interaction and coordination to effectively manage broader areas or ecosystems. This need also reflects the diverse and constantly evolving notions of what constitutes a 'protected area', some of these are contained in the IUCN PA categories. This Chapter captures the shift in conservation thinking beyond the limits of 'borders' and "pristine wilderness' to incorporating approaches that safeguard biodiversity at the ecosystem and landscape level while being actively utilised by resident communities and fulfilling many important functions to society at large. It also explores directions that can be taken to facilitate greater levels of integration and facilitating wider participation at a spatial level and in terms of expanding the diversity of partners.

7.2 THE NEED FOR GREATER INTEGRATION AND SYNTHESIS

In 2005 and 2006, consultations and workshops were undertaken under the BBEC programme (Park Management Component led by Sabah Parks and Habitat Management led by Sabah Wildlife Department) to feed into the development a common *Master List of Protected Areas* (WWF, in prep.). By organising the state's PAs according to IUCN criteria, a standard figure of PAs in Sabah could be established and updated regularly. In addition, the study focussed on identifying important and potential areas to boost connectivity and extend PAs in order to secure the continuity and integrity of ecosystems in Sabah. The outcome of these studies are contained in this Chapter.

In addition, the BBEC workshops also highlighted the need to consider the potential role of private land owners, holders of large concessions, and community-managed reserves in expanding the PA network. These would provide policy directions for greater integration of PA management. These recommendations are central to enhancing Sabah's PA system. They are briefly considered here but have been

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more thoroughly addressed for the preparation of this document and recommendations may be found in all chapters, in particular Chapter 9 on the Role of Communities.

7.3 THE MASTER LIST OF SABAH PROTECTED AREAS

In 2006, a Rapid Assessment was carried out to prepare and propose an official list of PAs for Sabah, based on IUCN categories (Table 7-1). This proved to be a landmark exercise, because for the first time, a general consensus was reached on the categories of reserved land (under various legislation) and consequently the total area in the Sabah that could, at the time of the assessment, be considered as PAs.

This master list of Sabah's PAs produced as a result of the assessment is summarised in Table 7-2. It included 93 named PAs covering about 1,174.398 ha of land, estimated to represent about 15.95 percent of Sabah's land area (Payne, 2006a). The majority of these areas, which are all owned by government and managed by a specified government authority (see Table 7-3), are reserves legislated or gazetted under either the Land Ordinance 1930 (as reserve for conservation purposes), or Parks Enactment 1984 (as a Park), or Wildlife Conservation Enactment 1997 (as Wildlife Sanctuary), or Forest Enactment 1968 and its subsequent amendments (as Forest Reserve).

This figure of 15.95% exceeds the target set by the 1992 Sabah Conservation Strategy, which was for at least "10% of Sabah's land area to be retained as totally-protected forest habitat". However, the master list is by no means a finished document, but a work in progress, requiring periodical updating and revision.

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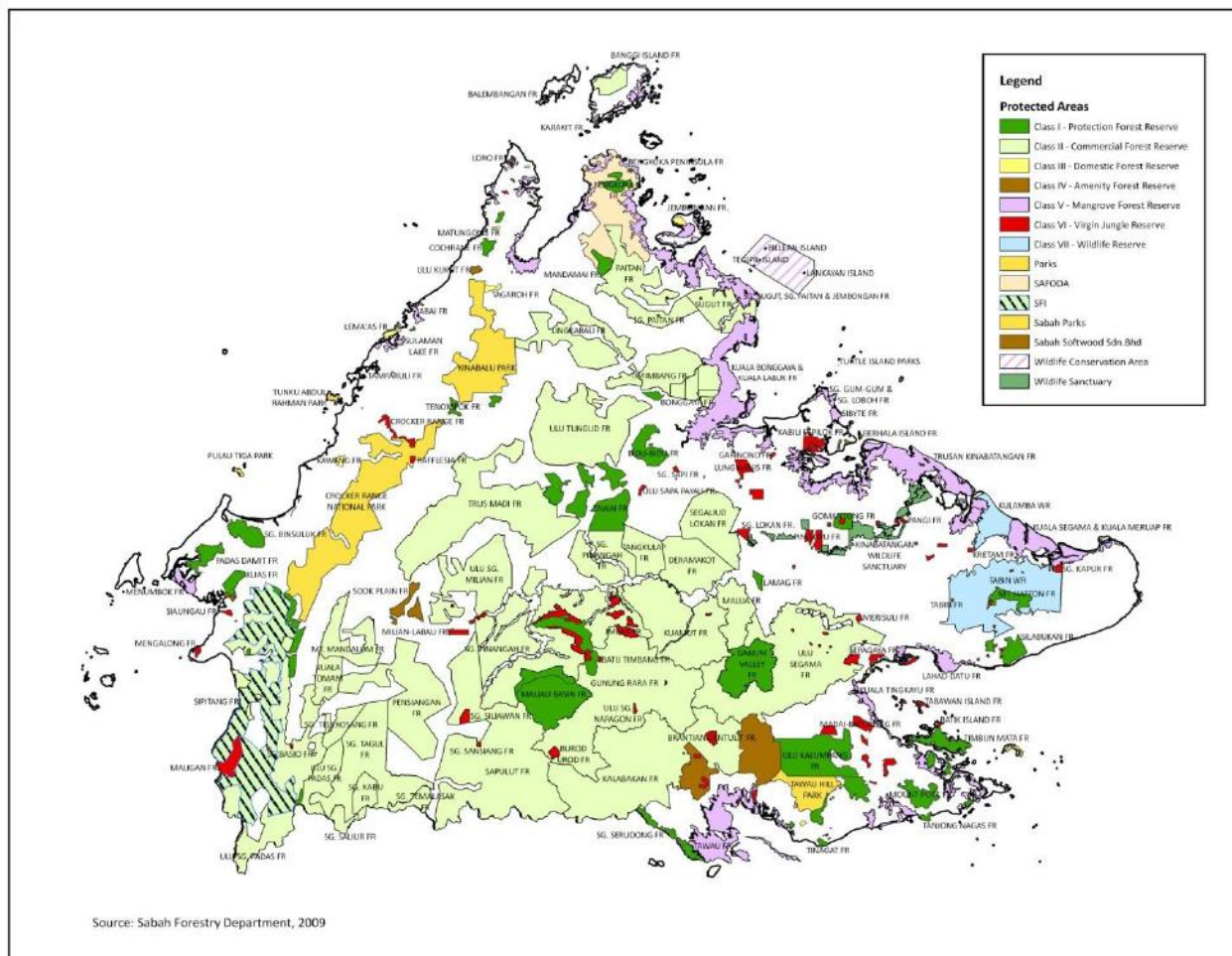


Figure 7-1: Protected Areas in Sabah

SECTION 7: PROTECTED AREAS**Table 7-1 : IUCN Categories of Protected Areas**

Category	Definition
Ia: Strict Nature Reserve: protected area managed mainly for science	Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring
Ib: Wilderness Area: protected area managed mainly for wilderness protection	Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition
II: National Park: protected area managed mainly for ecosystem protection and recreation	Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible
III: Natural Monument: protected area managed mainly for conservation of specific natural features	Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance
IV: Habitat/Species Management Area: protected area managed mainly for conservation through management intervention	Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species
V: Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation	Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area
VI: Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems	Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs

SECTION 7: PROTECTED AREAS**Table 7-2: Summary of the Master List of Sabah Protected Areas**

Protected Area Category	No. of PAs	Land area (ha)	Brief Description
Ia Strict Nature Reserve	10	5,016	All small VJRs
Ib Wilderness Area	0		
II National Park		409,003	5 State Parks (including 2 marine & islands), 4 Protection Forest Reserves/Conservation Areas
III Natural Monument	22	101,694	1 Wildlife Reserve, 1 Bird Sanctuary, 20 other Forest Reserves in three types
IV Habitat/Species Management Area	60	658,685	All Mangrove Forest Reserves (counted as one PA), 54 other Forest Reserves in four types, 1 Wetland Centre, Lower Kinabatangan (Wildlife Sanctuary + 3 other types of land status), 1 Wildlife Conservation Area, 1 Wildlife Reserve, 1 State Park
V Protected Landscape/Seascape	1		Tun Sakaran Marine Park
VI Managed Resource Protected Area	0		
TOTAL	93	1,174,398	

Table 7-3: Ten of the Largest Terrestrial Protected Areas In Sabah

Protected area	Area (hectares)	IUCN Category
Crocker Range Park	139,919	II
Tabin Wildlife Reserve	111,971	IV
Kinabalu Park	75,381	II
Maliau Basin Conservation Area	58,840	II
Ulu Kalumpang Protection FR	50,964	IV
Danum Valley Conservation Area	43,800	II
Tawau Hills Park	27,972	II
Lower Kinabatangan Wildlife Sanctuary	26,103	IV
Tawai Protection FR	22,697	II
Kulamba Wildlife Reserve	20,682	III

Source: Payne (2006a,b) and Sabah Forestry Department

7.4 EXPANSION OF THE PROTECTED AREAS NETWORK

The Sabah Conservation Strategy 1992 proposed for the establishment of 38 new PAs for the purpose of biodiversity conservation. It is testament to the commitment of the state government that almost all of the major or largest areas proposed have since been gazetted as protected reserves, although some in different forms from those envisaged in 1992. These include the Tabin Wildlife

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Reserve as well as the Maliau Basin and Danum Valley Conservation Areas. There is general consensus that the period of establishing new large PAs in Sabah has generally passed, at least in the 'traditional' paradigm of fencing off pristine uninhabited wilderness areas.

Nevertheless, there clearly still a need to expand parts of the system in order to enhance the effectiveness of its conservation functions as a whole. A high level of fragmentation makes individual areas vulnerable to the impacts of climate change, edge effects and degradation from illegal exploitation and land use change. Small areas are also more vulnerable to shocks. For example, many biodiversity significant habitats were destroyed in the fires that occurred following the protracted drought and fires experienced during the 1998 El Nino (Greer, 1998).

As has been noted in the Master List report, almost all of Sabah's PAs are ecologically separate pieces of forest, island or sea, the locations of which are the result of a long historical background, rather than from a single identification and planning process (Payne, 2006a). There is no certainty that any one PA is of sufficient size to maintain breeding populations of all or any of the native flora and fauna species that it contains. In Chapter 5, it was shown in the vegetation classification maps in the SFD's Conservation Assessment and Information System that many forest types occur outside the PA network. Hence, the idea of 16% of Sabah being within PAs is impressive, according to experts it is insufficient for the task.

In line with current thinking of the importance of ecological linkages and corridors to strengthen the integrity of the system, a second assessment was conducted under BBEC Phase II to identify important areas to connect and extend the PAs. These would have a role in securing the continuity and integrity of ecosystems in Sabah, and to identify feasible mechanisms for greater integration of PAs.

A total of nineteen areas were identified (Table 7-4 and Figure 7-1) based on review of, among others, the Master List of Protected Areas, the 1992 Sabah Conservation Strategy, as well as various documents from the Identification of Protected Areas Component of the Sabah Biodiversity Conservation Project¹⁶. The areas selected

¹⁶ The Identification of Potential Protected Areas (IPPA) component of the Sabah Biodiversity Conservation Project (SBCP) investigated through multi-disciplinary surveys, several terrestrial geographical zones and habitats that were deemed to be inadequately represented or not present within Sabah's Protected Area system, i.e. Ulu Padas, which contains unique forest types with a high floral diversity and endemism; the Nabawan kerangas forest, notably the last of its kind in Sabah; the Lower Segama, which forms an important corridor between the Tabin and Kulamba Wildlife Reserves (the establishment of which is now in progress); the Lower Sugut river area, a river corridor that supports a high diversity of forest ecosystems; as well as the Klias Peninsula, the largest extent of peat swamp forest in Sabah.

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were based on importance, feasibility and some assessment of the condition of vegetation or environment in the connecting area or proposed extension (Payne, 2006b).

While these 19 areas provide a useful starting point, there is scope for more detailed studies to be conducted of areas adjacent to existing PAs to identify additional extensions needed to ensure that the full spectrum of biodiversity is conserved, that vital ecological links are taken into account, and to identify potential risks as well as collaborative management with local stakeholders to bolster the protections of core biodiversity areas. Additionally, new PAs could result from forthcoming reviews of the Master List, as a number of reserve categories such as some Commercial Forest Reserves, private land, native reserves managed by local indigenous communities and future river reserves established under the Water Resources Enactment, are likely to merit being designated as PAs in the future.

Some specific directions were recommended for follow-up assessments (Payne, 2006a) are listed below. However, it should be noted that the provision of additional information pertaining to the quality of the ecosystems could also result in a downward revision of the total area if some areas are too severely degraded to warrant inclusion.

- Forest Reserves – The inclusion of all Protection Forest Reserves and VJRs within the Sabah PA Master List should be reviewed by the SFD. FRs that are significantly damaged by fire, encroachment or other causes may be excluded from the list. It is also possible that certain Commercial Forest Reserves may be added into the list if sustainable management, judged from all aspects, can be demonstrated.
- River and shore reserves – Certain stretches of river and shore reserves might be eligible for inclusion in the Sabah PA Master List if they retain natural vegetation and are actively protected or managed. A special study would be required to investigate and make recommendations.

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Table 7-4: Proposed Connections and Extensions to Protected Areas in Sabah

Name	Location	Areas (ha.)	Main purpose	Lead agency	Priority
Areas where local consultation is the first step					
Balat Dami	Lower Kinabatangan, between mangrove and freshwater	4,000	Critical refuge habitat for elephants & orang-utans	SWD + NRO & DO	1
Crocker Range foothills	Adjacent to Crocker Range Park	-	Forest for local community use and for water protection	Sabah Parks, NRO + DO's	1
Areas where restriction on land alienation is adequate pending completion of ongoing establishment plans and/or changes in socio-economic conditions					
Klias	Adjacent to Klias PFR	500	To sustain last Sabah peat swamp forest	SFD + NRO & DO	1
Kinabatangan (Upper)	Between main river and Commercial Forest Reserves	-	To prevent undesirable conversion of riverside land to plantations	NRO + DO	1
Nabawan heath forests	Adjacent and near to Milian-Labau VJR	1,000	To protect endangered heath forest on infertile soils	SFD + NRO & DO's	1
Padang Teratak	Near to Padas Damit Amenity FR	800	To maintain waterbird habitat	SWD + NRO & DO	2
Tempasuk Plain	Tempasuk Plain	1,500	To maintain waterbird habitat	SWD + NRO & DO	2
Areas where forest management plans can make recommendations for the future					
Baturong-Kalumpang corridor	Between Baturong VJR & Ulu Kalumpang PFR	50	To reconnect 2 Forest Reserves	SFD	3
Bilong	North side of Ulu Segama CFR	4,000	To extend habitat for large mammals	SFD & Sabah Foundation	3
K. Kinabatangan – K. Segama connection	Dry land, from mangrove to a distance of at least 100 metres	Less than 1,000	To provide habitat connection for wildlife & genetic flow	SFD	2
Middle Segama valley	"Enclave" within Ulu Segama CFR	4,000	To restore habitat for orang-utan	SFD	3
Areas where local consultation is the first step					
Danum upper catchment	Immediately west of Danum Valley Conservation Area	9,200	To protect the entire Danum River catchment	SFD & Sabah Foundation	2

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Name	Location	Areas (ha.)	Main purpose	Lead agency	Priority
Malubuk Valley	Part of Kuamut CFR	-	To ensure maintenance of important orang-utan habitat	SFD & Sabah Foundation	2
Ulu Padas	Surrounds Maligan VJR	-	Plant biodiversity & water protection	SFD with DO	1
Areas where gazettelement of "wildlife conservation area" is the most appropriate method					
Kulamba-Kretam corridor	Between Kulamba Wildlife Reserve & Kretam VJR	210	Habitat corridor for endangered Sumatran rhinoceros	SWD + SFD & DO	1
Lower Segama	Between Tabin & Kulamba Wildlife Reserves	2,500	To maintain a forest link between 2 Wildlife Reserves	SWD	1
Kinabatangan (Middle)	Between Deramakot & Malua CFRs	100	Elephant "corridors"	SWD	1
New Forest Reserve or Park					
Weston – Menumbuk mangroves	Between Menumbok Mangrove FR & Nabahan Amenity FR	-	To protect mangroves of the north side of Brunei Bay	SFD or Sabah Parks with DO's	2
Unique case, involving land purchase / acquisition					
Kinabatangan (Lower)	Adjacent to Kinabatangan Wildlife Sanctuary	4,000	Habitat connectivity	SWD + NRO & DO	2

Source: Payne, 2006b

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- Water catchment area – With the future use and implementation of the provisions of the Water Resources Enactment 1998, specific land areas will come under the protective measures to secure water protection. In many areas, it is envisaged that the appropriate land use will be natural forest (thus allowing for conservation of biological diversity). Developments in use of the Enactment need to be monitored, as new areas may qualify as category IV or VI PAs.
- Alienated land – While the Master List report argued that based on past experiences, “alienated land normally would not be suitable for protection or maintenance of biological diversity, and only in exceptional and specific circumstances could alienated land be designated as a PA in Sabah”, it conceded that emerging trends may warrant a review of this stance. Such areas of alienated land that may in future be considered as PA include new river and shore reserves established under the Water Resources Enactment 1998 as well as land acquired by non-governmental parties for conservation purposes.
- Newly-legislated PAs – Newly legislated areas may be added to the Master List from time to time. An example would be the Tun Mustapha Marine Park.

7.5 EXPANDING DEFINITIONS OF PROTECTED AREAS

It is important to note that most of the corridors and extensions considered to be important to link fragmented PAs the BBEC Phase II Report, *Protected Areas in Sabah: Proposed Ecosystem Connections and Extensions* (Payne, 2006b), are areas of alienated land or customary lands occupied by local communities. It is clear that in order to advance biodiversity conservation in these areas, a level of community participation will be important if not essential to the successful establishment of these corridors.

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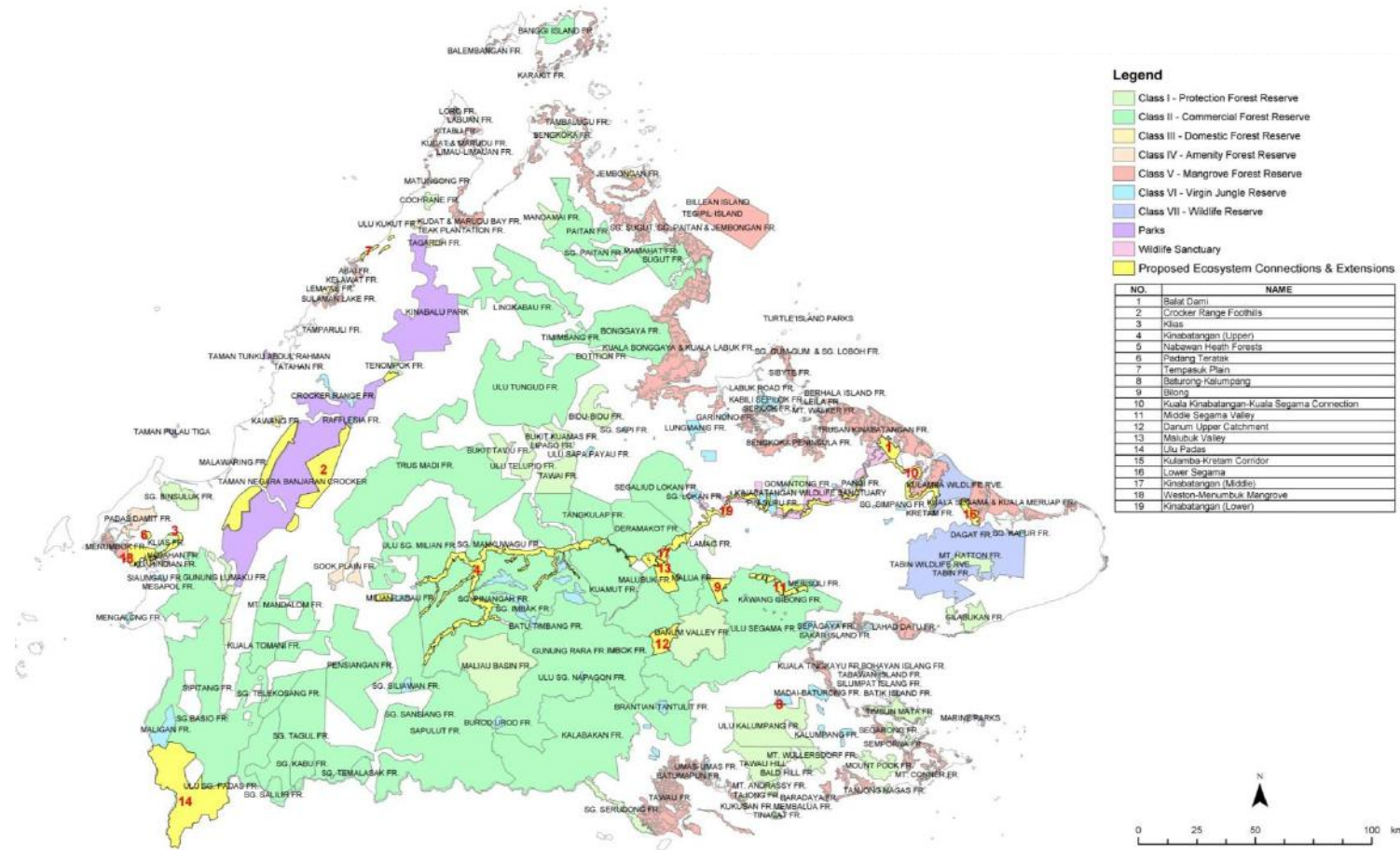


Figure 7-1: Proposed Protected Area Connections and Extensions

Source: Payne, 2006b

SECTION 7: PROTECTED AREAS**7.5.1 The Ecosystem Approach or Landscape Level Conservation**

In recent years, scientists have been advocating the Ecosystem Approach to environmental conservation. This approach encompasses strategies “for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way”. Implicit within it is the realisation that even strict PAs need to be integrated with those in their immediate surroundings which serve as a buffer against climate change or permit the movement of wildlife throughout their natural range. Ecosystem-based approaches have also broadened perceptions of ‘conservation’ beyond the notion of preserving pristine natural areas to include the renewable use of natural resources by resident communities.

The addition of the proposed Tun Mustapha Park, a marine PA under Sabah Parks in the Sulu Sulawesi Marine ecoregion adds a new dimension to PA management in Sabah. Once gazetted, this will be the first IUCN Category VI Managed Resource Protected Area in the state. It encompasses the coastal zone and over 50 islands covering an area of over one million hectares occupied by tens of thousands of people partly or wholly dependent on the marine environment. This is the challenge for conservation in the new millennium.

7.5.2 Communities, Diversity and Conservation

The need for new approaches to working beyond the strict PA paradigm and working with local communities toward conservation objectives has coincided with more enlightened ways of viewing how human societies are connected with nature. Biocultural diversity is a new conceptualisation of this relationship and is based on the premise that the full diversity of life includes human cultures and languages that have co-evolved with nature over time (Maffi, 2007). Forests, for example, bear the cultural imprint of a community’s history and identity in the same way that a community’s way of life and culture is shaped by natural resources and the distinctive landscapes in which they live. Sabah contains many exceptional examples of this as many of Sabah’s ethnic communities have long associations with their living environments and continue to reside in these ancestral lands. Over generations, people have accumulated knowledge of plant and animal diversity, ecological relationships, and seasonal rhythms. They have modified landscapes and also influenced the selection and preservation of a range of crop varieties. Indigenous communities have long drawn upon this archive of knowledge to extract food, materials and medicines from their surrounds. Biocultural diversity also richly infuses cultural traditions and spiritual beliefs and is inextricably linked to community identity.

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This evolving discourse is, in part, captured through the concept of ICCAs which recognises the work carried out by communities that protect and manage landscapes, seascapes and the resources within them (Borrini-Feyerabend and Kothari, 2008). The definition of ICCAs applies equally to ecosystems with minimal or substantial human influence as well as cases of continuation, revival or modification of traditional practices. In 2006, ICCAs were recognised as an important and legitimate PA category. Further, governance by communities became an acknowledged as a legitimate governance category (see Table 7-5 below).

The notion of governance is also another concept which offers elements of flexibility, as it is focussed on the practical day to day management of a resource area, and it is less tied to tenure or titled ownership. It is possible for an area therefore to be located within a designated State Park or Forest Reserve but governed by local managers in accordance with mutually acceptable agreements between the community managers and the relevant government authority. Such a concept could be useful in negotiating progressive strategies in cases where the imposition of PA boundaries has created conflict and gridlock with local people, although there are no specific examples of its use for this purpose as yet. A Review of Sabah ICCAs was completed under BBEC Phase II in 2011 and the specific areas identified, and related recommendation may be found in Chapter 9: A role for communities.

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Table 7-5: “The IUCN Protected Area Matrix”: A Classification System for Protected Areas Comprising Both Management Category and Governance Type¹⁷

Governance types	A. Governance by government	B. Shared governance	C. Private governance	D. Governance by indigenous peoples & local communities
Protected area categories	<ul style="list-style-type: none"> - Federal or national ministry or agency in charge - Sub-national ministry or agency in charge - Government-delegated management (e.g. to an NGO) 	<ul style="list-style-type: none"> - Trans-boundary management - Collaborative management (various forms of pluralist influence) - Joint management (pluralist management board) 	<ul style="list-style-type: none"> - Declared and run by individual land-owner - ...by non-profit organisations (e.g. NGOs, universities, co-operatives) - ...by for profit organisations (e.g. individual or corporate land-owners) 	<ul style="list-style-type: none"> - Indigenous bio-cultural areas and territories declared and run by indigenous peoples - Community conserved areas declared and run by local communities
I a. Strict Nature Reserve				
Ib. Wilderness Area				
II. National Park				
III. Natural Monument				
IV. Habitat/Species Management				
V. Protected Landscape/Seascape				
VI. Managed Resource Protected Area				

¹⁷ Dudley, 2008

SECTION 7: PROTECTED AREAS**7.6 INTEGRATED COORDINATION ACROSS INSTITUTIONS, AGENCIES AND STAKEHOLDERS**

At present, the various PAs in Sabah are managed by three main agencies – the SFD, Sabah Parks and the SWD, the latter two coming under the auspices of the Ministry of Tourism, Culture and Environment. In other chapters, various suggestions have been made for improvements in institutional coordination in areas such as information sharing, communication and coordination of efforts to reduce duplication of efforts, streamline stakeholder participation, coordinate research and donor involvement, and optimise funding and resources for greater conservation impact.

It is also highly likely that there will be more conservation players in the future as the number of protected and managed areas increases as new approaches to conservation become integrated into the master list. These could be private landholders, ICCA managers, NGOs and special interest groups, and so on. As such, it is necessary to plan for this likelihood by establishing good mechanisms for improved communication and coordination across and between different groups to manage broader areas or ecosystems effectively.

The Sabah Biodiversity Council is well placed to fulfill this role as it comprises all major resource management agencies and there is also sufficient scope for it to establish advisory groups comprising NGOs, academics and community-based organisations. In addition, the Sabah Biodiversity Centre has already made progress in important areas such as the Clearing House Mechanism for biodiversity data and research.

It is well placed to maintain the Master List of Sabah Protected Areas which is an important conservation benchmark which should be subject to continuous review and updating to ensure relevance. An important additional role for the Sabah Biodiversity Council with the assistance of the Sabah Biodiversity Centre is also to institute effective systems for regular monitoring and status assessments of areas within designated PAs so that resource managers and related stakeholders can attempt to address issues arising in a timely fashion.

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SECTION 8

MARINE ECOSYSTEMS

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8.1 INTRODUCTION

The coastal waters of Sabah harbour a diversity of marine ecosystems, which include many unique and biologically important habitats and species. Sabah's coastal and marine areas fall within the Sulu-Sulawesi Marine Ecoregion (SSME) which lies off its north-eastern and eastern coastline which is a globally significant centre of marine biodiversity. These areas are also important for human populations who rely on the resources and services provided by healthy marine ecosystems. Increasing pressures from population growth and resource exploitation pose a serious threat to the functionality and productivity of marine ecosystems, while the impacts of anthropogenic climate change need to be monitored closely.

Sabah's coastal waters cover an estimated area of 51,360 km² (up to the Exclusive Economic Zone limit of 200 nautical miles from the coast) and currently only 2.0% (about 1,000 km²) of this areas is designated within a PA (Table 8-1). This figure is expected to increase substantially once the proposed Tun Mustapha Park (1.02 million ha) is gazetted under the management of Sabah Parks. Presently, Sabah has five marine PAs gazetted under the Parks Enactment 1984. One area, the Sugud Islands Marine Conservation Area, was gazetted under the Wildlife Conservation Enactment 1997. Sabah's marine PA legislation includes both land and surrounding marine waters within marine PAs. This provides stronger protection than some of the other Malaysian states and creates a basis for better planning and management of developments within the PAs.

Table 8-1: Protected Sea Area in Sabah

Name	Management Authority	Area of Sea Protected (ha)
Pulau Tiga Park	Sabah Parks	15,193
Tunku Abdul Rahman Park	Sabah Parks	3,711
Turtle Islands Park	Sabah Parks	1,725
Tun Sakaran Marine Park	Sabah Parks	35,000
Pulau Sipadan Park	Sabah Parks	60
Sugud Islands Marine Conservation Area	Sabah Wildlife Department	46,312
Total		102,001

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8.2 MARINE HABITATS**8.2.1 Coral Reefs**

Sabah supports over 75% of the coral reefs in Malaysia. There are about 252 species of hard corals from 71 genera recorded in the coastal waters of Sabah. Some of the significant genera recorded include *Acropora*, *Montipora*, *Fungia*, *Porites*, *Pavona*, *Leptoseris*, and *Lobophyllia*. The most extensive reefs occur around Sipadan Island and the eight Semporna islands within Tun Sakaran Marine Park in Darvel Bay in the east coast of Sabah.

In addition to the high diversity of coral species, coral reefs in Sabah also support a rich assemblage of marine life including reef fish, molluscs, echinoderms, and bivalves. The 2010 Semporna Ecological Expedition organised by WWF-Malaysia with the participation of local and international universities recorded over 756 species of reef fish and 90 species of coral shrimps in the coral reefs. A diversity of food fish such as groupers, snappers and parrotfish were also recorded in a 2008 survey of coral reefs in the Semporna Islands during a survey conducted by Reef Check.

8.2.2 Seagrass

Seagrass beds are found in the shallow water fringing mangrove swamps or interspersed between coral reefs. They provide habitat and nursery grounds for fish and invertebrates including shrimps, shellfish, and crabs. Seagrass beds are important foraging grounds for Dugong (*Dugong dugon*) and sea turtles particularly Green turtle (*Chelonia mydas*) and Olive Ridley turtle (*Lepidochelys olivacea*).

In Sabah, seagrass beds are mainly distributed along the western and south eastern coasts. Seagrass usually grow on substrate such as sand, muddy sand and coral rubble. They can be found in semi-enclosed lagoons, sub-tidal and inter-tidal areas up to a depth of 2.5m. In the west coast of Sabah, seagrass are found among coral reefs in the sub-tidal area of the islands in Tunku Abdul Rahman Park, Pulau Mantanani, Pulau Labuan and Pulau Mengayau. Patches of seagrass are also recorded in the semi-enclosed lagoon at Sepanggar Bay, Sungai Salut, Sulaman Lake, Tanjung Mengayau and Bak-Bak.

In the north, seagrass are recorded the coasts of Pulau Banggi and Pulau Balambangan. The islands of Selingan, Maganting, Tabawan, Bohey Dulang, Mabal and Sipadan in Sabah's east coast of Sabah have sub-tidal seagrass growing on

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coral rubble (Green and Short, 2003, Japar *et al.*, 2006). The distribution of seagrass species is shown in Table 8-2.

Table 8-2: Distribution of Seagrass Species in the Coastal Waters of Sabah

Location	Species
Pulau Labuan	<i>Cymodocea rotundata</i> ; <i>Enhalus acoroides</i> ; <i>Thalassia hemprichii</i>
Tunku Abdul Rahman Park	<i>Cymodocea rotundata</i> ; <i>Cymodocea serrulata</i> ; <i>Enhalus acoroides</i> ; <i>Halodule pinifolia</i> ; <i>Halodule uninervis</i> ; <i>Halophila decipiens</i> ; <i>Halophila minor</i> ; <i>Halophila ovalis</i> ; <i>Halophila spinulosa</i> ; <i>Syringodium isoetifolium</i> ; <i>Thalassia hemprichii</i>
Sepanggar Bay	<i>Cymodocea rotundata</i> ; <i>Cymodocea serrulata</i> ; <i>Enhalus acoroides</i> ; <i>Halodule pinifolia</i> ; <i>Halodule uninervis</i> ; <i>Halophila decipiens</i> ; <i>Halophila ovalis</i> ; <i>Halophila spinulosa</i> ; <i>Thalassia hemprichii</i>
Tanjung Kaitan	<i>Thalassodendron ciliatum</i> ; <i>Thalassia hemprichii</i>
Sulaman Lake	<i>Enhalus acoroides</i> ; <i>Cymodocea rotundata</i> ; <i>Cymodocea serrulata</i>
Pulau Mantanani	<i>Halophila decipiens</i> ; <i>Halophila ovalis</i> ; <i>Halodule pinifolia</i>
Tanjung Mengayau	<i>Cymodocea rotundata</i> ; <i>Cymodocea serrulata</i> ; <i>Enhalus acoroides</i>
Pulau Mengayau	<i>Halodule uninervis</i> ; <i>Halophila ovalis</i>
Bak-Bak	<i>Cymodocea rotundata</i> ; <i>Cymodocea serrulata</i> ; <i>Enhalus acoroides</i> ; <i>Halodule pinifolia</i> ; <i>Halodule uninervis</i> ; <i>Halophila ovalis</i> ; <i>Syringodium isoetifolium</i> ; <i>Thalassia hemprichii</i>
Pulau Banggi	<i>Cymodocea rotundata</i> ; <i>Cymodocea serrulata</i> ; <i>Enhalus acoroides</i> ; <i>Syringodium isoetifolium</i> ; <i>Syringodium sp.</i> ; <i>Halophila decipiens</i> ; <i>Halophila ovalis</i> ; <i>Thalassia hemprichii</i>
Pulau Jambongan	<i>Halophila ovalis</i> ; <i>Halophila minor</i> ; <i>Halodule uninervis</i>
Pulau Selangan	<i>Syringodium isoetifolium</i> ; <i>Halophila minor</i>
Sandakan	<i>Enhalus acoroides</i>
Nunuyan Laut	<i>Thalassia hemprichii</i>
Pulau Bai	<i>Halophila spinulosa</i>
Bagahak	<i>Enhalus acoroides</i> ; <i>Halophila ovalis</i> ; <i>Thalassia hemprichii</i>
Pula Maganting	<i>Halodule uninervis</i> ; <i>Halophila minor</i> ; <i>Halophila ovalis</i> ; <i>Thalassia hemprichii</i>
Pulau Tabawan	<i>Cymodocea rotundata</i> ; <i>Halodule uninervis</i> ; <i>Halophila minor</i> ; <i>Halophila ovalis</i>
Pulau Sibuan	<i>Halophila ovalis</i>
Pulau Bohey Dulang	<i>Enhalus acoroides</i> ; <i>Halodule uninervis</i> ; <i>Halophila ovalis</i> ; <i>Thalassia hemprichii</i>
Pulau Bum Bum	<i>Halodule uninervis</i>
Semporna	<i>Thalassia hemprichii</i> ; <i>Enhalus acoroides</i>
Pulau Mabul	<i>Halodule uninervis</i> ; <i>Halophila ovalis</i> ; <i>Thalassia hemprichii</i>
Pulau Sipadan	<i>Cymodocea rotundata</i> ; <i>Halodule pinifolia</i> ; <i>Halodule uninervis</i> ; <i>Halophila ovalis</i> ; <i>Thalassia hemprichii</i>

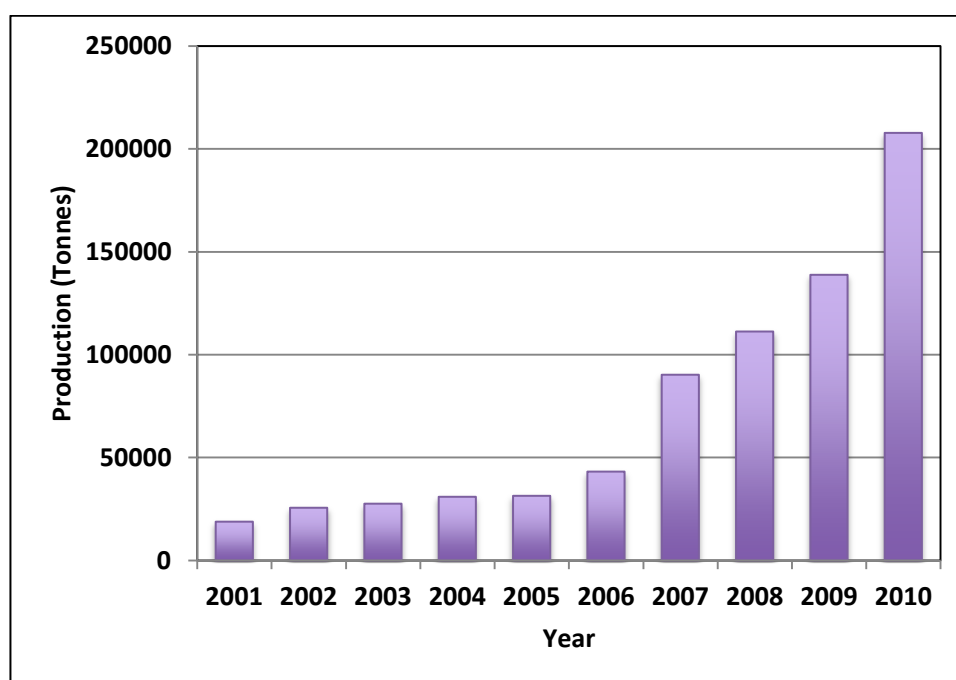
Source: Green and Short (2003); Japar *et al.* (2006)

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8.2.3 Seaweeds

There are about 85 species of seaweeds recorded along the coastline of Sabah. The red seaweeds (Rhodophyta) comprise the highest number of species (51 species), followed by brown seaweeds (Phaeophyta) about 22 species, and green seaweeds (Chlorophyta) about 12 species. These seaweeds are commonly found in coral reefs, rocky shores, mudflats, mangroves or as epiphytes. In Sabah, seaweeds such as *Gracilaria changii*, *Gracilaria tenuispitata*, *Eucheuma* and *Caulerpa* spp. are eaten either raw or blanched by coastal communities. Seaweeds have also been used as traditional medicine. Seaweeds in Sabah are extracted for their agar and carrageenan content which is widely used as thickening and gelling agents (Phang, 2006).

Commercial cultivation of seaweeds has been carried out in the coastal water of Sabah since 1978 and the industry has become an important economic resource for Sabah. In 2007, 90,289 tonnes of seaweeds was produced, doubling the production in 2006. In 2010, Sabah produced about 207,850 tonnes of seaweeds with an estimated value of RM83,140 (Figure 8-1). Demand is expected to increase with the surge in global demand projected to be 400,000 tonnes in 2012. Currently, seaweed is carried out by coastal communities around Semporna, Lahad Datu, Kunak and Kudat.



Source: Department of Fisheries

Figure 8-1: Estimated Production of Seaweeds in Sabah

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8.2.4 Mudflats

Mudflats are a dominant feature of the coastline of Sabah and are usually associated with mangrove forest. Most of the mudflats are found on the east coast of Sabah. Extensive mudflats are recorded in Marudu Bay, the mouth of the Kinabatangan River, and Cowie Bay. Mudflats in Sabah support a diversity of resident and migratory waterbirds. Many of these mudflats have been recognised as IBAs by BirdLife International. Padang Teratak, for example, annually winters between 2,000 and 5,000 migratory ducks (mainly *Anas querquedula*), while the Tempasuk Plain also winters more than 50 waterbird species including some that are globally threatened. Mudflats provide important habitat and feeding ground for shellfish and crustaceans. Cockles are usually collected by the local communities at the mudflats during low tide for their own consumption. Although mudflats have an important role to play in the marine ecosystem, they have not been widely studied. To date, there is no comprehensive survey of mudflats in Sabah.

8.2.5 Threats to the Marine Habitats

Sabah coastline has undergone rapid development which has severely impacted some marine ecosystems. There is a high level of dependence on marine resources among coastal communities. Unsustainable levels of exploitation by commercial fishing vessels and the use of destructive fishing methods are among the most serious threats to marine habitats.

Destructive fishing methods - Illegal fishing using dynamite and fish poisoning using cyanide have caused serious damage to marine habitats such as coral reefs and seagrass beds. It is estimated that about 10% of coral reefs in Sabah have been damaged by destructive fishing methods. The once pristine coral reefs surrounding the islands off Semporna have been particularly badly affected. Surveys undertaken by WWF-Malaysia between 2008 and 2009 at 11 sites in Semporna found the reefs to be in poor condition with less than 29% live coral cover (Ho and Kassem, 2009). Fish poisoning using cyanide is threatening the stability of the coral reef by reducing the number of small fishes and removing large predators; this allows for colonisation by grazing invertebrates such as echinoderms and molluscs. The use of certain kinds of fishing gear can also have a negative impact on marine habitats. Push nets which are pushed over the seafloor in shallow waters to catch shrimp and shrimp larvae can uproot and damage seagrass beds. Trawlers that encroach into the fishing grounds of traditional fishermen near the sub-tidal area also cause major impact to seagrass beds and seaweeds.

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Live reef food fish trade - Live reef food fish trade or LRFFT, the capture of live reef fish for sale and consumption is a lucrative industry. There is a high demand for coral reef fish from countries such as Hong Kong and China. The growing live reef food fish trade in Malaysia has raised concern over the overexploitation of coral reef fish, particularly in Sabah. Based on the IUCN Red List of Threatened Species, 20 out of 47 fish species targeted for the live reef food fish trade in Sabah have declining populations. The Humphead wrasse (*Cheilinus undulates*), the most prized fish species in the live reef food fish trade, is now classified as Endangered on the IUCN Red List. Researchers have documented a significant decline in total monthly catch of coral reef fish species in Sabah between 1995 and 2005. The decline was significant for three coral reef fish species, which included the Humphead wrasse, and two species of grouper. Viable populations of Humphead wrasse are now thought to be found only near Pulau Layang Layang and Pulau Sipadan (Scales *et al.*, 2007).

Coastal developments - Rapid development along the coastline has affected the resilience of marine habitats. Coastal reclamation, sand-mining, inland pollution such as run-off from agricultural areas, sedimentation from land development cause changes in water quality and turbidity and affect the growth of seaweed and seagrass by limiting light availability and hindering photosynthesis by marine flora.

Traditional harvesting of fisheries resources - In Sabah, seagrass beds and coral reefs are ideal sites for food collection. Marine flora such as seaweeds (*Caulerpa* spp. and *Gracilaria* spp.) and fauna such sea cucumbers, gastropods and bivalves are collected by coastal communities either for consumption or sale. However, uncontrolled and excessive harvesting of these food resources can bring about population decline and damage marine ecosystems.

8.2.6 Gaps in Marine Habitat Conservation

Strengthening the marine protected area network

A well-planned marine PA network would have the potential to provide the connectivity needed to maintain ecosystem processes and improve resilience by spreading risk thereby helping to ensure the long term sustainability of marine populations. Critical habitats and foraging grounds for marine species need to be identified so that they can be afforded protection and be avoided in future development plans. An expanded marine PA network would accommodate the ecology and lifecycles of commercially important species as well as marine species of conservation significance.

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Protecting important seagrass beds

Important seagrass beds which are foraging grounds for marine turtles such as the Mantanani Islands, Sandakan Bay and Banggi Island are vulnerable to further damage from fishing and coastal development. Presently none of these areas are afforded protected. Protecting these seagrass beds will help ensure sustainability of the marine food chain and equilibrium of the marine ecosystem.

Enhancing resources for monitoring and enforcement

Sabah's Department of Fisheries is not adequately equipped to police its coastal waters of approximately 51,360km². It has need of additional personnel, monitoring vessels and equipment and enforce legislation pertaining to environmental protection and sustainable fishing. There is also scope for greater interagency collaboration to strengthen enforcement. The introduction of the Malaysian Maritime Enforcement Agency (MMEA) in 2005 was expected to boost monitoring and law enforcement in the state's coastal waters, however it is not yet known whether these additional monitoring efforts are sufficient for the task.

8.3 MARINE MAMMALS

A high diversity of marine mammal species occurs in Sabah's seas, largely due its location in the geologically stable Sundaland biogeographical region, its warm tropical climate and biologically productive tropical marine waters. There are approximately 27 species of marine mammals belonging to 20 genera known to be present in the Malaysian waters. In Sabah, a total of 18 species marine mammals including sirenians (dugongs) and cetaceans (whales and dolphins) are resident and transient in the state's coastal waters.

The two most common species found here are the Irrawaddy dolphin (*Orcaella brevirostris*) and Indo-Pacific Humpbacked dolphin (*Sousa chinensis*) (Jaaman, 2004). These mammals can be found in bays such as Sandakan Bay, Labuk Bay and Cowie Bay as well as the estuary of the Kinabatangan River. The Indo-Pacific Bottlenose dolphin (*Tursiops aduncus*), Spinner dolphin (*Stenella longirostris*) and Pantropical Spotted dolphin (*Stenella attenuate*) are the most abundant cetaceans recorded in the open water. Dugongs (*Dugong dugon*) are found in Brunei Bay, Sandakan Bay, Labuan Island, the Mantanani Islands and Banggi Island. Marine mammal species that have been recorded in Sabah's waters are listed in Table 8-3.

Studies of marine mammals in Sabah have been carried out by UMS under the Marine Mammals and Whale Shark Research and Conservation Programme as well

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as various NGOs. Research by UMS has focussed on the distribution and abundance of dugongs and inshore cetaceans and their interaction with humans. In addition, LEAP has initiated a study to evaluate the status of the Irrawaddy dolphin population in the Kinabatangan. Though research has intensified since the establishment of the Marine Mammals and Whale Shark Research and Conservation Programme in 1996, the ecology of these species that is still poorly known such as approximate numbers, home ranges, migration patterns, and reproductive behaviour.

8.3.1 Legal Status of Marine Mammals in Sabah

Marine mammals in Sabah are protected under Federal and State Laws which apply within the Economic Exclusive Zone of 200 nautical miles. The marine mammals are protected under three laws:-

- Fisheries Act 1985 (Part VI – Aquatic Mammals or Turtles in Malaysian waters)
- Fisheries Regulation 1999 (Control of Endangered Species of Fish)
- Wildlife Conservation Enactment 1997

In general, these regulations prohibit any person from fishing, catching, harassing, possessing, trading, killing, consuming or transporting any marine mammal that is found in Malaysian waters. Dugongs are the only marine mammal that is totally protected under the Wildlife Conservation Enactment 1997. The main governing authority for the management of marine mammals in Malaysia is the Department of Fisheries Malaysia. Other government agencies that have direct and indirect responsibility for protecting marine mammals include the Department of Fisheries Sabah, Sabah Parks and the Malaysian Maritime Enforcement Agency.

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Table 8-3: Marine mammals found in the coastal waters of Sabah

Marine Mammals	Coastal Area	IUCN Red List Status
Irrawaddy dolphin (<i>Orcaella brevirostris</i>)	Sandakan Bay; Labuk Bay; Cowie Bay; Kinabatangan River; Jambongan Island; Berhala Island; Silumpat Island	Vulnerable
Indo-Pacific Humpback Dolphin (<i>Sousa chinensis</i>)	Jambongan Island; Sipadan Island; Cowie Bay	Near Threatened
Dugong (<i>Dugong dugon</i>)	Brunei Bay; Labuan Island; Sandakan Bay; Mantanani Island; Banggi Island	Vulnerable
Bryde's Whale (<i>Balaenopteridae edeni</i>)	Tunku Abdul Rahman Marine Park	Data deficient
Fin Whale (<i>Balaenoptera physalus</i>)	Continental shelf waters of the South China Sea	Endangered
Cuvier's beaked Whale (<i>Ziphius cavirostris</i>)	Continental shelf waters of the South China Sea; Mapun Island	Least Concern
Sperm Whale (<i>Physeter macrocephalus</i>)	Pandan Island; Bohey Dulang Island; Sulu-Sulawesi Sea; Continental shelf waters of the South China Sea; Layang-layang Island	Vulnerable
Indo-Pacific Bottlenose Dolphin (<i>Tursiops aduncus</i>)	Gulisan Island; Kota Marudu	Data Deficient
Common Bottlenose Dolphin (<i>Tursiops truncatus</i>)	Layang-layang Island; Southern Sulu Sea	Least Concern
Spinner Dolphin (<i>Stenella longirostris</i>)	Layang-layang Island; Kuala Kinabatangan; Ligitan Island; Boheyan Island; Lakayan Island; Balak Island	Data Deficient
Pantropical Spotted Dolphin (<i>Stenella attenuate</i>)	Layang-layang Island; Southern Sulu Sea	Least Concern
Fraser's Dolphin (<i>Lagenodelphis hosei</i>)	Mapun Island	Least Concern
False Killer Whale (<i>Pseudorca crassidens</i>)	Teringai Beach; Nagus Bay; South China Sea	Data Deficient
Melon-headed Whale (<i>Peponocephala electra</i>)	Layang-layang Island	Least Concern
Short-finned Pilot Whale (<i>Globicephala macrorhynchus</i>)	Kota Kinabalu; Sipadan Island; Ligitan Island; Terumbu Siput; Mapun Island	Data Deficient
Finless Porpoise (<i>Neophocaena phocaenoides</i>)	Sandakan Bay	Vulnerable

Source: UMS (2009)

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8.3.2 Threats to Marine Mammals

In general, marine mammals in Sabah are threatened by the degradation and loss of habitat, incidental catch, indigenous hunting and other anthropogenic factors.

Degradation or loss of habitat

Economic growth and increasing population density have contributed to rapid urban expansion along the Sabah coastline, particularly close to major urban centres. This has contributed to the alteration of coastal ecosystems, particularly through the clearing of mangroves, dredging and reclamation work. These activities and the pressures of urban settlement have also resulted in environmental degradation through water pollution, sedimentation, siltation and the destruction of habitat. As marine mammals are highly dependent on coastal habitats for food, shelter, nursing and breeding grounds, any deterioration of the coastal environment will jeopardise the survival of these mammals. According to Jaaman (2000), rapid urban, port and industrial development in the coastal towns of Sandakan and Tawau has negatively affected Irrawaddy dolphin populations.

Incidental catch

Sabah is the third highest coastal fisheries producer in Malaysia. It also has the largest fleet of registered fishing vessels, about 11,906 in 2008 (DOF, 2009). The heavy concentration of fishing vessels operating within the coastal zone considerably increases the impact of *incidental catch*, which is defined as the capture on non-target species during fishing operations which may be discarded or retained.

Marine mammals are at risk of being entangled in fishing gear used by artisanal fishermen. The use of gillnets (including drift nets, monofilament nets, trammel nets and set nets) and fish corrals (*kelong*) were found to be the main factors leading to the incidental catch of dugongs and inshore cetaceans, particularly Irrawaddy dolphins and finless porpoises (Jaaman *et al.*, 2009). Gillnets, trawlers and fish stakes were reported to trap cetaceans and dugongs while purse seines only caught cetaceans. The magnitude of incidental catch in Sabah is considered to be relatively high. A survey carried out between 1997 and 2004 estimated that as many as 306 cetaceans and 49 dugongs are accidentally caught by fishing fleets each year (Jaaman *et al.*, 2008).

To reduce the impact of incidental catch, certain kinds of fishing gear need to be completely restricted in the vicinity of known marine mammal habitats. In addition,

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fishing gear that excludes entangled marine mammals needs to be used more widely. These initiatives need to be supported by programmes to raise awareness and train fishers to use them effectively.

Indigenous hunting

Indigenous hunting of marine mammals still occurs in Sabah despite the legal protection afforded by the Federal and State legislation. Dugongs and dolphins are hunted particularly by the Bajau ethnic group for their own consumption and for use in cultural ceremonies. Dolphins have traditionally been hunted by the Bajau Pelauh as a rite of passage for young men of the community. The sale of dugongs and dolphins within the community and to neighbouring Philippines is known to be very profitable and an on-going business activity. Based on the survey conducted between 1997 and 2004, it was estimated that 326 dolphins and 796 dugongs were hunted annually, with a mean catch of 5.2 dolphins and 2.8 dugongs per hunter (Jaaman *et al.*, 2008). These figures show that the magnitude of catch is high and unsustainable.

Other human-related impacts

One of the main issues in fisheries in Sabah is the illegal use of dynamite and cyanide. Fish bombing is also harmful to marine mammals in the vicinity of the blast. These same explosive materials have also been used by local people to hunt marine mammals. Marine mammals, particularly dugongs, are frequently injured by strikes from boat propellers. Excessive disruption near its feeding habitat along the coastline will force these marine mammals retreat to other areas or change its feeding habits.

8.3.3 Gaps in Marine Mammal Conservation

Enhancing resources for monitoring and enforcement

The Department of Fisheries Sabah and supporting agencies such as the SWD, Sabah Parks and the marine police need to have their capacity enhanced to better play this role.

Establishment of Special Marine Conservation Area

The Malaysia Ocean Policy 2011-2020 recommends that Special Marine Conservation Areas be gazetted to protect habitats or areas critical to the survival of marine mammal populations (MOSTI, 2010). Currently, only 2% (about 1,000

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km²) of Sabah's coastal waters falls within designated marine PAs. Although this figure is expected to increase once the proposed Tun Mustapha Park (1.02 million ha) is gazetted, the fact remains that many important habitats continue to be vulnerable to degradation and overexploitation. The establishment of Special Marine Conservation Areas could incorporate management regulations that ban of all fishing activities, enforce reduced boat speeds, and restrict the movement of large vessels. These steps should be complemented by research and education programme to promote awareness and understanding of aquatic mammals.

Marine mammal education and awareness programmes

There is a need to boost education and awareness programmes on marine mammal conservation to supplement current programmes conducted by Sabah Parks and WWF-Malaysia that focus on the conservation of marine ecosystems, such as in the Semporna islands.

8.4 MARINE TURTLES

Marine turtles play an important role in the ecology and well-being of the coastal environment throughout their life-cycle. Grazing by the green turtle helps maintain the health and growth rate of seagrass beds. Hawksbill turtles are associated with the health of coral reefs as they graze on overgrown sponges (WWF, 2005). Marine turtles travel considerable distances across the maritime borders of many nations and are exposed to a wide range of threats at all stages of their life-cycle. Hatchlings and juveniles have high mortality rates and are vulnerable to predation. These threats make it difficult to recover from any sustained pressures on their numbers.

8.4.1 Status and Distribution of Marine Turtles

Three species of marine turtles have been recorded in Sabah, namely the Green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochelys imbricata*) and Olive Ridley turtle (*Lepidochelys olivacea*). All three species are found at the Turtle Islands Park (of Pulau Gulisan, Pulau Selingan and Bakungan Kechil). Marine turtles can also be found foraging near the Mantanani Islands, Sipadan Island and Brunei Bay (UMS, 2009).

Sabah has the largest nesting population of endangered Green turtles in Malaysia, apart from Sarawak and Terengganu. An estimated 2,000 Green turtles nest in Sabah each year. Pulau Gulisan in the Turtle Islands Park has the highest recorded nesting rates of the critically endangered Hawksbill turtle in Malaysia. Between 400

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and 450 Hawksbill turtles nest here each year. The Olive Ridley turtle, which are listed as Vulnerable in the IUCN Red List, is now virtually absent from Malaysian beaches. Less than one Olive Ridley turtle nesting is recorded in Sabah in a year (UMS, 2009).

8.4.2 Legal Status of Marine Turtles in Sabah

Marine turtles in the Malaysian waters are protected under the Fisheries Act 1985 (Part VI – Aquatic Mammals or Turtles in Malaysian waters). In Sabah, marine turtle are protected under the following legislations:

- Fauna Conservation Ordinance 1983
- Parks Enactment 1984 (Amendment 2002)
- Wildlife Conservation Enactment 1997
- Customs Act 1967

Sabah's PA legislation is stronger for marine turtle conservation compared to other states in Malaysia as both land and surrounding marine waters are included within its entire marine PAs. Turtle nesting sites and (part of) their foraging habitat are protected. In addition, Malaysia is involved in a number of regional initiatives to enhance cross-boundary cooperation for marine turtle conservation (Box 8-1).

8.4.3 Threats to Marine Turtles

The threats to marine turtles are similar to those for marine mammals, with one addition – the illegal harvesting of turtle eggs for sale.

Incidental capture

Marine turtle populations are threatened by incidental capture (also known as by-catch) in major fishing gears such as trawl nets, gill nets and long lines. Most turtles entangled in conventional fishing gear suffocate and die. Female marine turtles are more vulnerable to capture during nesting season as they spend more time near the shore. Newly emerged hatchlings are also vulnerable to near shore fishing activities particularly those carried out at night as hatchlings are attracted to lights.

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Box 8-1: Regional agreements relating to turtle conservation*Turtle Islands Heritage Protected Area (TIHPA) (1996)*

Arising from the 1996 bilateral agreement between the Governments of the Philippines and Malaysia, a transfrontier protected area for marine turtles was established in the Turtle Islands. TIHPA is co-managed by both countries and the collaboration makes it possible to conserve the habitats and sea turtles over a large area independent of territorial boundaries. The Philippines-Sabah Turtle Islands group is located in the Sulu Sea, at the southwestern tip of the Philippines, about 1,000 km southwest of Manila and some 40 km north of Sandakan. These nine islands (six in the Philippines and three in Malaysia) lie adjacent to the international treaty limits that separate the two countries. The Philippine Turtle Islands include Boan, Langaan, Lihiman, Great Bakungan, Taganak and Baguan. Of the six islands, only Baguan is fully protected, having been declared a marine sanctuary through legislation in 1982. The Turtle Islands Park of Sabah is composed of Pulau Selingan, Pulau Bakungan Kechil and Pulau Gulisan.

Memorandum of Understanding on ASEAN Sea turtle Conservation and Protection (1997)

To promote the protection, conservation, replenishing and recovery of sea turtles and of their habitats based on the best available scientific evidence, taking into account the environmental, socio-economic and cultural characteristics of the Parties.

Memorandum of Understanding on the Conservation and Management of Marine Turtles and their habitats within the Indian Ocean and South-East Asia (IOSEA) region (2001) under the auspices of the Convention on Migratory Species

Although not yet a party to the Convention on Migratory Species, in September 2011, Malaysia became the 33rd state to sign the IOSEA MoU that aims to protect, conserve, replenish and recover marine turtles and their habitats within the IOSEA region. The agreement will come into effect in Malaysia on 1 December 2011. The MoU entails the implementation of the *IOSEA Conservation and Management Plan* containing 24 programmes and 105 specific activities focused on reducing threats, conserving critical habitat, exchanging scientific data, increasing public awareness and participation, promoting regional cooperation and seeking resources for implementation. This development is in line with the priorities set by the government in its 2008 National Plan of Action for Conservation and Management of Sea Turtles.

Degradation or loss of habitats

A phenomenon termed as “natal beach olfactory imprinting” is thought to cause turtles to return to nest at the same beaches where they first hatched. As such, a key prerequisite for the effective conservation of marine turtles is to maintain nesting beaches in a pristine state. Consequently, urban development along the nesting beaches is therefore a major threat. The development of resorts and public recreational facilities on the backshore of nesting beaches has destroyed the once serene beaches and impeded turtle landings. Light pollution is another factor that

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prevents turtles from landing on their intended nesting beaches. In addition, pollution in the form of nutrients and sediment from agriculture areas, sand-mining and earthworks are also known to have damaged the near-shore foraging habitats of marine turtles such as coral reefs and seagrass beds.

Egg Harvesting

The gazette of Turtle Islands as a PA has significantly reduced the harvesting of marine turtle eggs by local communities in Sabah. However, there are still a few local people selling turtle eggs illegally at markets in Sandakan and Tawau.

8.4.4 Addressing Gaps in Marine Turtle Conservation

Immediate Implementation of the Turtle Excluder Device

In the effort to reduce incidental capture of marine turtles, the Marine Research Foundation together with Department of Fisheries Sabah has conducted trials on the use of the Turtle Excluder Device (TED). The trials have shown the devices to be effective in reducing incidental capture, while having negligible impact on fishing activities. Despite this, the adoption of TEDs has been limited and it has not been officially introduced or made compulsory to all trawlers.

Protect foraging grounds

Marine turtle nesting beaches in Sabah are relatively well protected. However, important foraging grounds such as coral reefs around the Mantanani Islands, Sipadan and Brunei Bay are not protected. Many of these ecosystems are being degraded by harmful fishing activities and land-based pollution. These important feeding grounds will need to be conserved to ensure the survival of marine turtles.

8.5 MARINE FISHERIES

The fisheries sector is a major contributor to Sabah's economy. It provides employment, export revenue and food security. Most of the fishing activities in Sabah, including both traditional and commercial fisheries are concentrated within 30 nautical miles of the shoreline.

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8.5.1 Status of Marine Fisheries in Sabah

Marine fisheries and aquaculture are the main contributors to the fisheries industry in Sabah. Marine fish landings in Sabah in 2009 totalled 172,584 tonnes. Of this, coastal fisheries contributed about 95% of marine landings compared to deep-sea fishing which only contributed 5% in 2008 (DOF, 2009). For administration purposes, the state is divided into 16 marine fishing districts. Of these, Kota Kinabalu recorded the highest fish landings in 2008, followed by Kunak and Sandakan (Table 8-4).

Sabah has the highest number of fishermen among all the Malaysian states. This number has increased since 2007. In 2009, there were a total of 24,691 fishermen in Sabah, representing 20% of all the fishermen in the country (DOF, 2009), an 18% increase from 2007. The number of licensed fishing vessels has also increased since 2007. The majority of these use gill nets, followed by boats using hook and line and those using trawl nets.

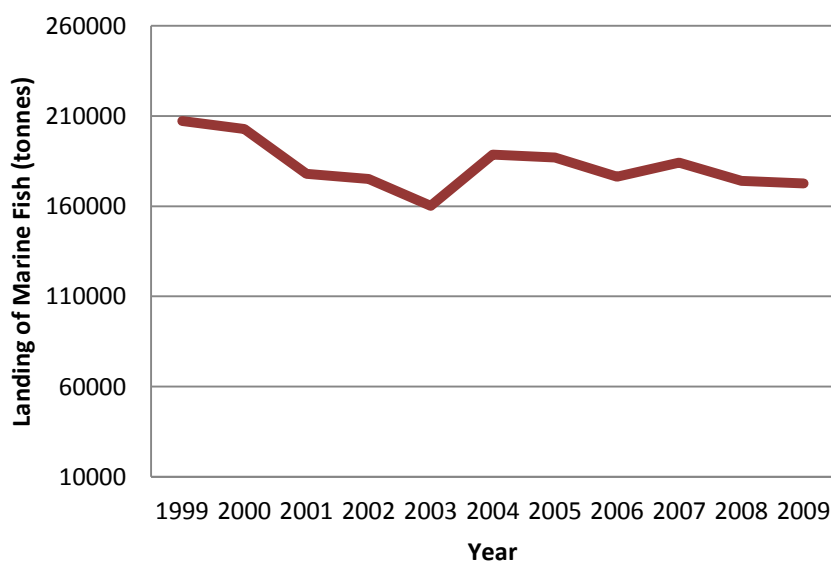
In terms of long term trends however, figures from the Department of Fisheries, Malaysia show that marine fish landings in Sabah have been declining steadily over the last 20 years (Figure 8-1). A combination of overharvesting as well as widespread use of destructive fishing methods (such as fish bombing) may have contributed to the decline in fish landings. This is in direct contrast to the increasing number of fishermen (and presumably, fishing effort).

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Table 8-4: Marine fish landings in the various fishing districts in Sabah (2008)

Districts	Fish Landing (tonnes)
Kota Kinabalu	45,429
Kunak	40,060
Sandakan	22,090
Kudat	13,847
Tawau	12,286
Semporna	11,675
Lahad Datu	10,437
Papar	7,015
Kuala Penyu	3,614
Kota Belud	2,817
Pitas	2,447
Beluran	765
Beaufort	517
Sipitang	512
Tuaran	315
Kota Marudu	274

Source: DOF (2009)



Source: DOF (2009)

Figure 8-1: Annual Marine Fish Landing for Sabah (2000-2009)

8.5.2 Threats to Fisheries

In general, there are few common threats that can lead to a decline in fish stock, including degradation of coastal habitats due to development, overfishing, destructive fishing practices, land-based pollution, and climate change.

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Nevertheless, the two major threats to the marine fish stock in Sabah are overfishing and use of destructive fishing methods.

Destructive fishing methods

Fishing bombing using dynamite and fish poisoning using cyanide are the most destructive and unsustainable fishing methods carried out along Sabah's coastline. To date, about 10% of coral reefs in Sabah have been destroyed due to illegal fishing methods. Bombing with dynamite can destroy over 5 m² of coral reef with one blast and the damaged coral reef can take years to recover. Fish poisoning using cyanide harms the stability of the coral reef by reducing the number of small fishes and removing large predators, allowing colonisation by grazing invertebrates.

Overfishing

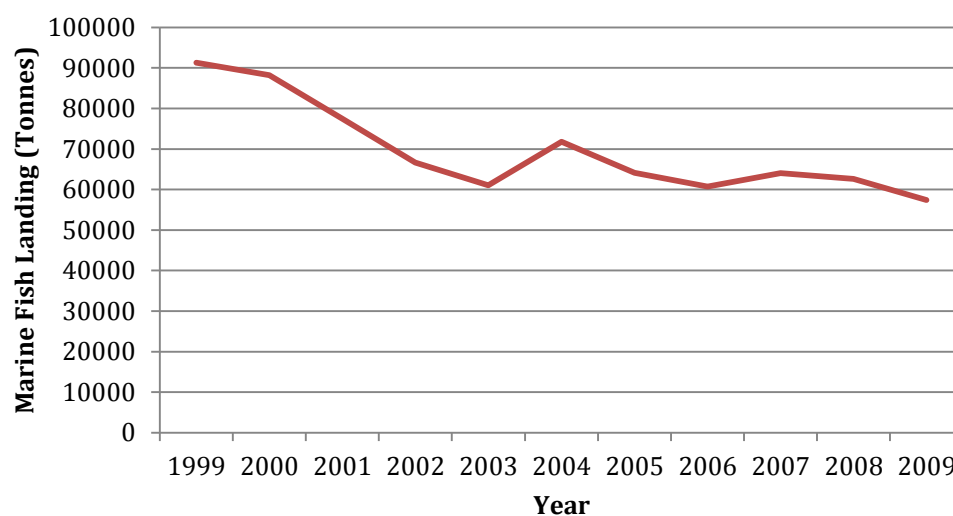
Most fishing activities are carried out within the inshore coastal waters, with both traditional and commercial fishermen competing for the same resources. The pressure on marine fisheries has become deeply unsustainable as the number of fishermen and fishing vessels increase each year.

Figure 8-2 shows the decline in trawl catch from 2000 to 2009. This is an indication of overfishing, as it contrasts sharply with the increasing number of trawlers, and the move by the Fisheries Department Sabah to legalise trawlers in the hope of controlling unsustainable trawling practices. The encroachment of trawlers into the restricted grounds of traditional fishing communities is also contributing to the worrying decline in fish catch.

Based on the Marine Trophic Index, an indicator of marine ecosystem integrity and sustainability of fisheries that is calculated by the Sea Around Us Project¹⁸, Sabah has been "fishing down the marine food web". The Marine Trophic Index of 3.4 (out of 5.0) for Sabah indicates that the larger fishes at the top of the food chain are declining, and consequently fisheries can be expected to target smaller fishes lower down the chain.

¹⁸The marine trophic index measures the change in mean trophic level of fisheries landings by region and globally. Trophic level is defined as the position of an organism in the food chain, and ranges from a value of 1 for primary producers up to a level of 5 for marine mammals and humans. See: <http://www.seaaroundus.org/eez/461/200.aspx>

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Source: DOF (2009)

Figure 8-2: Annual Marine Fish Landing Using Trawl Nets

8.5.3 Addressing Gaps in the Sustainable Management of Fish Stocks

Tackling Roadblocks in implementing the Ecosystem Approach to Fisheries Management

The Department of Fisheries, Sabah is committed to the Coral Triangle Initiative (CTI), which promotes the implementation of the Ecosystem Approach to Fisheries Management (EAFM). The CTI set targets for formulating suitable legislation and policies, and implementing effective measures to improve sustainability and safeguard the livelihood and income of coastal communities. However, the current emphasis of the Department is mainly on improving local livelihoods and income, and this is achieved by encouraging the involvement of coastal communities in fisheries and giving out more boat and gear licenses. The increase in the numbers of fishermen is contributing to overexploitation of marine fisheries resources. However, there is insufficient scientific data to elaborate sustainable harvesting levels.

In order to effectively implement EAFM, there is a need for a greater collaboration between the department, scientific organisations and NGOs to incorporate a robust scientific method for measuring ecosystem stability and sustainable fishing levels, and to re-strategise efforts as well as review and revise existing policies and regulatory frameworks.

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Boost Capacity of Enforcement Agencies

While the Department of Fisheries, Sabah is aware of the major threats to fisheries, it is hampered in its role by limited trained staff and resources for monitoring and enforcement. Although MMEA now helps to carry out monitoring activities, this is not likely to be sufficient.



SECTION 9

A ROLE FOR COMMUNITIES

SECTION 9: A ROLE FOR COMMUNITIES

9.1 INTRODUCTION

In recent years, there has been concerted shift toward mainstreaming biodiversity conservation – this is particularly well-emphasised in the CBD Strategic Plan 2011-2020, which is based on the recognition that “biological diversity underpins ecosystem functioning and the provision of ecosystem services essential for human well-being”. Biodiversity and biodiversity-rich areas are acknowledged for the way they sustain our living environment, local livelihoods and support economic development.

Among the 20 Aichi Biodiversity Targets designed to achieve this, Target 18 states that “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”.

This target is especially relevant to Sabah as it provides the opportunity to actively engage indigenous and local communities in safeguarding the state’s irreplaceable biodiversity heritage. This chapter draws on the findings of the 2011 Review of Sabah ICCAs, implemented under BBEC Phase II to outline some of the specific ways local communities can provide vital elements missing from Sabah’s PA framework.

9.2 COMMUNITY INITIATIVES FOR WILDLIFE AND HABITAT CONSERVATION

A number of community initiatives for wildlife and habitat conservation are now on-going in Sabah (Table 9-1). The IUCN-endorsed concept of ICCAs is one that resonates strongly with the customs of many communities in Sabah that have long used traditional resource management systems. The Tagal system for instance, is still in use today. According to the Sabah Department of Fisheries, it is currently being practised in 212 communities covering 107 rivers in Sabah to regulate the sustainable use of fisheries. In many cases however, traditional resource management systems have been abandoned following large-scale shifts in land custody and easier access to commercialised resources.

During the past decade, however, an increasing range of initiatives have engaged Sabah communities to resume active roles in the sustainable management of rivers, forests and wildlife. Government agencies and NGOs have supported a growing number of community forest restoration projects throughout Sabah.

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Communities have also created their own community-based organisations (CBOs) to develop alternative socio-economic activities compatible with the long-term conservation of their natural heritage.

Community-based ecotourism has become an excellent example of how communities can derive direct benefits from wildlife conservation. Community-run homestays and bed & breakfasts are now found in many rural areas of Sabah. In addition to proposing a cultural experience to tourists, many homestays are located near PAs and offer nature-based activities such as trekking and wildlife viewing. In the Lower Kinabatangan, homestay programmes in the villages of Batu Putih, Bilit, Sukau and Abai have become quite well-established, providing important supplementary income to local people.

Concurrently, the levels of awareness and engagement of these communities in the protection of the Lower Kinabatangan Wildlife Sanctuary and adjacent forest reserves have increased with the implementation of the Honorary Wildlife Wardens program, and the establishment of tree nursery and reforestation projects, among others. Another good example of community-based ecotourism is the Kinabatangan Orang-Utan Conservation Programme (KOCP), which encourages community participation in protecting and managing the natural and cultural resources of the Kinabatangan while generating alternative sustainable financial income for the villagers (see Box 9-1).

There is a need however for the relevant government agencies to ensure that community-based ecotourism initiatives in Sabah are sustainably managed and regulated to prevent negative and undesired impacts of tourism development on the wildlife and habitat, as well as on the communities themselves.

SECTION 9: A ROLE FOR COMMUNITIES**Box 9-1: Community involvement in wildlife conservation: HUTAN-KOCP**

In 1998, the Kinabatangan Orang-Utan Conservation Programme (KOCP), a partnership between HUTAN, a grassroots non-profit organisation, the SWD and the Lower Kinabatangan community was established. KOCP places priority on training its local staff to conduct high quality research and conservation activities. Today, the KOCP team has 40 highly skilled personnel hailing from the local Kinabatangan community. They focus on promoting the sustainable use of natural resources which supports the conservation of wildlife and its habitat. Over the past 15 years KOCP has achieved many successes. Numerous discoveries have been made of the ecology of the orang-utan and other wildlife species.

Assessments and monitoring of wildlife populations have contributed to the management of the Lower Kinabatangan Wildlife Sanctuary and the development of sound State-wide wildlife conservation policies. In the Kinabatangan floodplain, HUTAN-KOCP actively participates in efforts to recreate a forest corridor along the river by engaging with oil palm plantations. It also involves local communities in the protection and management of wildlife through the Honorary Wildlife Warden scheme and community-based forest restoration programme. Solutions are also implemented to mitigate human-wildlife conflicts (such crop raiding by elephants in oil palm plantations) through landscape planning and other non-harmful conflict mitigation methods.

HUTAN-KOCP supports initiatives by the local community to provide alternative sustainable economic development opportunities while maintaining viable habitat for wildlife. Projects are conducted with local fishermen, farmers and bird nest collectors to wisely manage the natural resources they depend on. A successful village homestay programme has been established in Sukau and HUTAN-KOCP is also involved in a community-based ecotourism tour venture which enables local families to derive direct and tangible benefits from the conservation of the Lower Kinabatangan Wildlife Sanctuary and its unique wildlife.

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Table 9-1: Main Community-Based Conservation Initiatives in Sabah (since 2000)

Name of Initiative	Facilitating Agency	Dates	Location	Brief Description
Indigenous and Community Conserved Areas	Various agencies CBOs	-	8 sites recorded by Cooke and Vaz (2011), Bundu Tuhan, Kiau Nuluh, Pulau Banggi, Batu Balos, Lumuyu, Ulu Papar, Ulu Padas	Ecosystems voluntarily conserved by indigenous peoples through customary laws or other effective means
Partners for Community Organisations (PACOS) Trust facilitated projects	PACOS Trust and communities in more than 14 areas in Sabah	1987 - present	Sabah	Resource management, socio-economic development, community education, land rights, community organising training, land rights, community organising training
Model for Environmentally Sustainable Community Tourism (MESCOT)	WWF, LEAP, SFD	1996 - present	Batu Putih, Lower Kinabatangan	Miso Walai Homestay Program, Wayon Tokou Nature Guide Association; Mayo do Talud Boat Service MESCOT Culture Group; and the Tungog Rainforest Eco Camp
GOMPITO	PACOS Trust, WWF	1999 - present	Kg. Kiau	Preservation of natural, traditional and cultural heritage
Red Ape Encounters	HUTAN, SWD	2001 - present	Sukau, Lower Kinabatangan	Community-based ecotourism initiative funding conservation activities
Tagal System	Fisheries Department	2001 - present	250 river sites in Sabah	Community-based fisheries resource management system
Elephant Conservation Unit	HUTAN, SWD	2002 - present	Sukau, Lower Kinabatangan	Elephant conflict mitigation, education and awareness, training
Batu Puteh Community Ecotourism Co-operative (KOPEL)	LEAP	2003 - present	Batu Putih, Lower Kinabatangan	Community cooperative supporting sustainable alternative livelihoods for local people, the conservation of forests and biodiversity, ecotourism, reforestation, lake restoration
Fishermen for Conservation	HUTAN	2004 - present	Lower Kinabatangan	Use of non-wood materials to build fish and prawn traps to reduce illegal logging in PAs
HABITAT	WWF	2004 until	Bilit, Lower Kinabatangan	Contractor for reforestation projects and seedling

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Name of Initiative	Facilitating Agency	Dates	Location	Brief Description
		now		supplier
Nature Heritage Conservancy	HUTAN	2005 - present	Lower Kinabatangan	Purchase of strategic forested land parcels for conservation
Sukau Honorary Wildlife Wardens	HUTAN, SWD	2005 - present	Lower Kinabatangan	Protection of wildlife and PAs, education and awareness
PWET Project Women Empowerment Trees	LEAP	2007-2009	Pitas district	Empowers women for the purpose of rehabilitating degraded forests
Collaborative Management of Protected Areas: Biodiversity	JOAS (Jaringan Orang Asal SeMalaysia), Danida	2008 - 2009	Kg. Ulu Senagang, (Keningau), Kg.Tiga,(Tambunan), Kg. Buayan, (Penampang), Kg.Mangkawagu (Tongod)	Integrated watershed conservation and management, community mapping and zoning of community forestry area.
Community-Based Watershed Conservation and Promotion of Biodiversity Protection	Tonibung, Danida	2008 - 2009	Kg.Tinangol (Kudat), Kg.Gana (Kota Marudu), Liu (Pitas)	Protection of community watersheds and promotion of sustainable use of natural resources
Sukau Tree Nursery	HUTAN	2008 - present	Sukau, Lower Kinabatangan	Home tree nurseries as alternative source of income
Pangi swiftlet population recovery	HUTAN, SWD	2009 - present	Pangi Virgin Jungle Reserve, Lower Kinabatangan	Local community ensures the protection and management of the swiftlet population
KAPOK, (Komuniti Anak Pokok Kinabatangan)	WWF	2009 to 2010	4 Villages (Abai, Bilit, Perpaduan, Sentosa Jaya) in Lower Kinabatangan	Tree nursery
Community Abai Project (CAP)	LEAP, HUTAN	2010 - present	Abai, Lower Kinabatangan	Sustainable development, reforestation, ecotourism

Note: SWD: Sabah Wildlife Department; SFD: Sabah Forestry Department; SF: Sabah Foundation

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9.3 BROADENING CONSERVATION APPROACHES

The preceding sections provide a compelling overview of Sabah's special importance as a centre of biodiversity conservation. They also provide a truthful appraisal of how human activities are threatening key habitats and species, and a projection that these stand to be lost unless a comprehensive approach can be instituted to strengthen biodiversity conservation in Sabah. It has already been established that the current PA network is inadequate to conserve biodiversity, and government agencies alone do not have sufficient resources and enough capacity to reach or steward these areas. Experts and resource managers have also highlighted that considerable biodiversity occurs outside the PA network.

To lead this campaign, the new Sabah Biodiversity Strategy must take into account the urgency of this mission and recognise the need to innovate beyond conventional practice; this includes: (1) broadening conservation approaches beyond the boundaries of strict PAs; and (2) expanding participation to include new conservation partners. This is in keeping with international moves to broaden conventional views which constrain where biodiversity is conserved, and who should conserve biodiversity.

9.3.1 Biocultural Diversity and the Sabah's Cultural Landscape

"The diversity of life is made up not only of the diversity of plants and animal species, habitats and ecosystems found on the planet, but also of the diversity of human cultures and languages. These diversities do not exist in separate and parallel realms, but rather as different manifestations of a single, complex whole."

(Maffi and Woodley, 2010)

Sabah's endowment of natural wealth is not limited to the diversity of species in its forest but also the diverse ethnic communities that carry with them knowledge of the natural environment. This added component of 'biocultural diversity' is an asset which has not been fully appreciated and potentially a key component in reversing the decline in biodiversity in the state. Internationally, countries are now recognising and better representing the role that has been historically played by traditional communities in conserving biodiversity and also nurturing it.

Biocultural diversity encapsulates a holistic representation of biodiversity beyond the enumeration of plant, animal and genetic diversity, but expanding to encompass complex location specific systems. Such systems are particularly well-developed among indigenous people with close associations to particular environments and this is often reflected in highly-developed Traditional Ecological Knowledge (TEK) comprising language, spiritual and cultural values and community-

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based resource management systems that are now viewed as unique and valuable expressions of biodiversity (Blythe and McKenna Brown, 2003, Raygorodetsky, 2011).

Local communities in Sabah have long engaged in community-based natural resource management (CBNRM) in fulfilment of their cultural practices. Information from the recent ICCA Review shows that community-managed reserves harbour important biodiversity and are an integral part of Sabah's PA landscape. Although unrecognised and undervalued, many of these areas provide valuable ecosystem services such as water catchment protection, and serve to buffer existing PAs and provide connectivity between natural areas, while serving as a renewable resource area that supplies many of the daily needs of rural people.

9.3.2 The Role of Indigenous and Community-Conserved Areas

Sabah is the first state in Malaysia to have conducted a study of its ICCAs which is a spatial representation of the principle of Access and Benefit Sharing. ICCAs are defined by the IUCN as "natural and/or modified ecosystems containing significant biodiversity values, ecological services and cultural values voluntarily conserved by indigenous peoples and local communities, both sedentary and mobile, through customary laws or other effective means". ICCAs are also seen as being highly compatible with the ecosystem approach to conservation which is defined as "a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way" (Dudley, 2008).

In 2004, ICCAs were recognised as a legitimate governance category by the World Commission on Protected Areas which acknowledges local communities as resource managers for biodiversity areas within national PA systems. Therefore, documenting and giving recognition to ICCAs is in keeping with Malaysia's obligations to CBD. Article 8(j) acknowledges a symbiotic relationship between "*in situ* conservation" of biodiversity and the "traditional lifestyles" of indigenous peoples and local communities manifested through the knowledge, innovations and practices (collectively referred to as traditional knowledge, or TEK) of communities.

States are asked to respect, preserve and maintain TEK and promote its wider application. Article 8(j) also states that any use of such TEK should be based on the approval and involvement of the holders of such knowledge and that they should be entitled to a fair and equitable share of the benefits arising from the utilisation of their knowledge. Further, Article 10(c) calls on parties to "protect and encourage

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customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements”.

9.4 FINDINGS OF THE SABAH ICCA REVIEW

The Review of ICCAs in Sabah was implemented under the BBEC Phase II Programme to explore the potential role community-conserved areas in strengthening biodiversity conservation in Sabah. With over 28 recognised ethnic groups and many more sub-groups, Sabah’s ethnic diversity is matched by the diversity of ecosystems in which they live (Lasimbang, 1996). The concept of conserving natural areas and resources resonates strongly with most ethnic communities and takes on diverse forms.

Historical and anthropological writing provides a valuable record of the ways in which local people interact with land and forest, rivers and coasts, in order to supply their daily needs for food, medicine, building materials, recreation and spiritual practices. Another significant finding is that communities interested in conserving ancestral territories do so not purely for the biodiversity values, but also (and sometimes, more so) for the cultural values of these lands as places of common ancestry and cultural identity (Majid Cooke and Vaz, 2011). In this regard the focus on “culture as an asset to conservation” has shifted to a deeper appreciation of “culture as an intrinsic element and expression of human relationships with nature”.

The Review findings suggest that not only do ICCAs exist in Sabah; there is ample evidence that they already play an under-appreciated role in conserving biodiversity, natural resources and ecological services. If ICCAs can substantially extend the cover and quality of Sabah’s PA system, and engage local communities in in-situ conservation this would be mutually beneficial to local people and the state. The findings of the ICCA Review offer a glimpse of what can be achieved for biodiversity conservation in Sabah if community roles are recognised and supported.

9.4.1 Conserving Cultures and Complementary Use Areas

Practically all communities have traditionally observed practices that deal with ensuring the sustainability of natural resources. This could be the protection of spawning areas for fish in inland rivers and streams, or setting aside areas of old growth forest to ensure a continued source of medicinal plants, rattan and game animals, and imposing social sanctions and penalties on those that do not abide by local regulations. *Pelihara*, in Bahasa Malaysia, for example, or the Kadazandusun

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Gompi guno are terms for looking after an area or resource to support its continued use. Based on this evaluation, ICCAs have the potential to substantially enlarge Sabah's PA network with adjoining community-managed landscapes.

The recent proposal to more effectively link Kinabalu National Park and the Crocker Range National Park through a patchwork of community-managed areas is one example of how such an approach can be beneficial to conservation. A key component of the proposed Kinabalu Eco-Linc is provided by the Bundu Tuhan Native Reserve at the foothills of Kinabalu Park. This is an area of 3,210 acres that is managed and guarded by an entire community. It is a source of pride that their leaders in 1961 had the vision to apply for this land to be made into a Native Reserve under the Land Ordinance, and a testimony to their determination that 22 years later the area was successfully gazetted. Furthermore, ensuring that this cultural landscape stays under community control helps conserve the unique character of the area, in contrast to other highland areas that have been taken over by commercial vegetable farms and resort developers.

9.4.2 Cultural Landscapes and Ecological Services

Village forest reserves also have a role in conserving vital ecological functions. Throughout Sabah, Gravity Feed Systems (GFS) are the main source of piped water supply to hundreds of rural households. Simple impoundments built on upstream form a mini-reservoir. Maintaining vegetation cover within the catchment is essential as this water is utilised by these communities in untreated form. Villagers collectively maintain the impoundment and pipes and ensure the forested catchment remains undisturbed to sustain their water supply, but the benefit of their action accrues to Sabah's urban population as well.

Resource management practices in coastal and marine areas are perhaps the least well documented and require further study. However there is some evidence of local collective action. For example, fishing communities off the coast Kudat in the north have taken to patrolling their shores in order to safeguard their fisheries resources - sometimes pitting their fishing boats against trawlers and fishing operations using poison or explosives. This suggests the potential impact local people could have if given greater legitimisation and support.

9.4.3 Impacts of Modernisation: Decline and Revival

It is a reality of present day Sabah that many CBNRM practices have fallen into decline as a result of modernisation and land use change. Religion, education, consumerism and nationalism are widely perceived to have contributed to the

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erosion of people's traditional connection with the environment (Padoch and Peluso, 1996, Borrini-Feyerabend, 2010). Moreover, the parental priority for the younger generation is often about setting them up for a future of paid employment beyond the village. There is no doubt that many indigenous communities continue to be faced with a challenging period of social and economic change. Nevertheless, it is a misconception that the only impact of modernity is the erosion of traditional values and loss of ecological knowledge. The actual situation is much more fluid, dynamic and open ended.

For one, the emergence of indigenous grassroots organisations and their increased ability to reach remote communities with information and capacity building resources has played a role in reviving the pride of the local community in their ethnic identity and has invigorated interest in culture, resource management and communal practices. Young people from such communities are already playing an important role in resource management planning. This is evident in Kg. Buayan in Ulu Papar where local people have been participating in documenting their Traditional Ecological Knowledge and collaborating with Sabah Parks in their use of the Community Use Zone within the Crocker Range Park (Wong *et al.*, 2009). Another example of revival is the 1997 initiative of Kg. Notorus in Penampang to resume its practice of Tagal, the indigenous system for the management of fish resources in response to the serious decline of fish in the Babagon River (Lasimbang, 2009). This in turn has spurred greater recognition for such practices and prompted its revival throughout Sabah.

Even new initiatives taken up by communities in the face of new threats or opportunities are equally valid examples of ICCAs. Concerns about biodiversity loss and environmental degradation have awakened a commitment to community-driven conservation among some indigenous communities, particularly the younger generation. Interaction with conservation NGOs and the emphasis on participatory planning has also helped build capacity among local communities located close to biodiversity rich areas. These experiences have empowered local people to play a more active role in the conservation and restoration of threatened habitats and defending community resource areas from encroachment (Vaz, 2006, Vogel, 2007).

For example, in Batu Puteh, along the Kinabatangan, new community organisations such as Model for Environmentally Sustainable Community Tourism (MESOCOT) have helped to reforest sections of FRs and riverine reserves damaged by the 1998 forest fires. They have also worked relentlessly to clear weeds that were choking Danau Tungog, restoring the ox-bow lake to a near pristine state. Benefits to conservation are evident in the diversity of birds and wildlife that frequent the lake. Working in collaboration with the SFD, they have successfully established a

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viable community and nature-based tourism business income opportunities for community.

In the headwaters of the Padas River, Lundayeh communities await the government's decision on the Native Reserve of 4,500 ha it applied for in 1999 to safeguard an area of mature secondary forest on State land from being logged over. This area comprises old secondary forest with former Lun Dayeh settlements and important historic and tourism sites – it mainly serves as a hunting and forest resource catchment, and riverine reserve for numerous Padas tributaries. These biodiversity rich ranges and valleys are comparable in importance to Kinabalu Park (Vaz, 1999). Presently, this cultural landscape which is dotted with stunning geological features is the focus of a vibrant village and forest-based tourism business which offers visitors a rare opportunity to view endemic flora, experience traditional lifestyles and capture a glimpse of 'wild' Borneo. Communities in Batu Puteh and Long Pasia, who may have initially benefitted from capacity building conservation projects, have since gone on to drive conservation initiatives and efforts through their own organisations and enterprises.

9.5 ICCA CASE STUDIES

The case studies highlighted here showcase the diversity of experiences across Sabah and demonstrate the relevance of ICCAs and community governance of conservation areas and vital resources. They are not exhaustive, but have been selected to show that community-based conservation can arise equally from the continuation of traditional observances and practices; the revival or restoration of traditional resource management that have fallen into decline; as well as the invigoration of community interest in conservation and resource management through interaction with other parties such as individuals, government, NGOs, and an enlightened private sector.

9.5.1 Enduring Belief Systems: Sacred Sites on Banggi Island

Perhaps one of the most compelling examples of ICCAs which fall into this category is Banggi Island located off the northwest coast of Sabah. Here the indigenous Bonggi are an ethnic minority that continues its longstanding practice of revering sacred sites, graves and prayer sites in forest areas. Although, some Bonggi have converted to Islam or Christianity, Bonggi belief systems continue to exert a powerful influence. The grave sites where their ancestors are buried are considered off-limits to all people, including themselves. These sacred grave sites vary in size from between 2 to 10 acres. Other sacred sites are those specifically managed for community congregational prayers. Bonggi prayer sites are usually large enough to

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accommodate all Bonggi villagers on the island. Rituals may last for weeks, so these areas have to be sufficiently large (8 to 10 acres). However, such large meetings are held very infrequently, perhaps once every 1- 3 years. At all other times, entry into these sites is forbidden to outsiders and Bonggi alike. By virtue of these taboos, these sites remain relatively undisturbed, enhancing their value for conservation.

The island has one fairly sizeable PA in the form of the Banggi FR, an area of 11,206 ha which was successfully reclassified as Class I (Protection) in 2010. The Bonggi people revere this forested hill for its sacred sites. It is meaningful for the Bonggi to have the important relationship between their community and the mountain recognised and they would welcome a role in helping to assure its continued protection. The Bonggi are an economically marginal group and being given the opportunity to partner the SFD in managing the FR could provide a means to improve their socio-economic situation. Sacred sites that occur on State land do not have adequate protection and are vulnerable to loss arising from government sponsored development schemes.

9.5.2 Endogenous Conservation and Development Vision: Bundu Tuhan Native Reserve

Bundu Tuhan is a Kadazandusun village in the district of Ranau. It comprises several hamlets spread over hills and valleys at the southern foothills of Mount Kinabalu. It has a population of approximately 3,600 people. Bundu Tuhan is exceptional among Sabah's villages in that it possesses a sizeable Native Reserve of 3,210 acres. Roughly 60% of this area has been voluntarily set aside by the community as a village forest reserve. The proposal to establish a Native Reserve using provisions in the Sabah Land Ordinance 1930 was first mooted by the community in 1961 as a means of securing the long term needs of the community for village forest and to retain a sufficient area under communal management to prevent internal conflict arising from competition for Native Titles. This is remarkable as this move took place at a time when even the term ICCA has not yet entered our vernacular. It was not prompted by helpful NGOs or interest groups although more educated and well-connected community members certainly played a key role.

Village leaders with the support of the District Officer submitted their application for a Native Reserve in 1966 and followed the process unstintingly until the Reserve was finally gazetted in 1983. Since that time, the district has experienced dramatic changes and forested areas have given way to commercial vegetable farming and tourism development. Nevertheless, as a result of this visionary action, Bundu Tuhan retains a pleasant forested setting which attracts visitors to its homestays; it also enjoys an abundant supply of clean water for its households and farms. The

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Native Reserve is completely community managed according to collectively recognised rules and regulations. Entry into the Reserve is prohibited unless you have the explicit permission of the community leaders.

The Bundu Tuhan Native Reserves provides a compelling example of the desire for communities to conserve forest, as well as their determination to sustain its wise use in perpetuity despite pressures and obstacles faced. Together with the adjacent Tenompok FR, Bundu Tuhan Native Reserve remains the most significant block of upland montane forest remaining as a link between the Kinabalu Park and Crocker Range Park.

9.5.3 Community Participation in Restoration: Batu Puteh, Lower Kinabatangan

What began in 1996 as the Model Ecologically Sustainable Community-based Conservation & Tourism Project (MESCOT) in the Orang Sungai village of Batu Puteh, in the Lower Kinabatangan is today a full-fledged ecotourism operation which demonstrates that communities can be strategic partners in biodiversity conservation. The Batu Puteh Community Ecotourism Co-operative (KOPEL), a community cooperative with over 200 members and six full-time staff, coordinates and administers the ecotourism initiatives and related village associations focussing on habitat rehabilitation, homestays, boat services, nature guides, cultural performances, and handicrafts. There are 35 homestay homes and 32 active forest guides. Almost all households derive some income from tourism either directly or indirectly.

Although the Lower Kinabatangan is renowned for its biodiversity-rich wetland habitats, it is also heavily disturbed. Areas around Batu Puteh have previously been logged and large areas have been converted to oil palm plantations. The MESCOT initiative first began when segments of the community wanted to develop a tourism product based on the natural areas surrounding the village. Unfortunately, in 1998, forest fires razed these forest remnants. The group decided to focus on rehabilitating the degraded wetland forests and wildlife habitats. Through a process of learning and experimentation, floodplain rehabilitation methods were pioneered and by 2008 more than 60 ha of degraded habitat had been restored.

Forest restoration has since become a core activity of MESCOT, in close collaboration with the SFD. In the Pin-Supu FR the community has also spearheaded the rehabilitation of Danau Tungog, an oxbow lake severely infested with water hyacinth (*Salvinia molesta*). The lake is natural sanctuary for more than 150 native freshwater fish species and a host of other rare aquatic birds and wildlife. Although, the process of removing the weeds was arduous and there were

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many setbacks, after two years of concerted effort the lake was cleared and fish populations are coming back. Regular maintenance keeps the weeds at bay and wildlife and birds are now regularly seen once more. In 2010, KOPEL and SFD launched the Tungog Rainforest Eco-camp, a complex of A-frame accommodation built on a network of wooden platforms within a section of the Pin-Supu FR managed by the community. The eco-conscious construction which includes rainwater collection, solar power and composting toilets was built with funds and labour from a number of national and international organisations. It is booked all year round.

KOPEL members have a strong sense of ownership of all these ventures and accomplishments. Thanks to fruitful interactions with government and local and international organisations, the ecotourism initiative, together with the habitat restoration programmes, has improved household incomes and invigorated community life. Fewer young people are leaving the community to look for work elsewhere. Although direct involvement in conservation emerged relatively recently in Batu Puteh, with access to education, exposure, support and partnerships, even in this area, in which logging and hunting were once pervasive, change has taken root within the community and tangible and sustained benefits to biodiversity can be seen.

9.5.4 Traditional Systems for Sustaining Inland Fisheries: The Practice of Tagal

Tagal is an indigenous system of sustaining riverine fisheries and conserving the river environment which has been practiced by communities in Sabah for generations. Tagal systems are broadly similar but their strength is in their diversity and adaptability. They are informed by location specific knowledge of fish ecology, and the participation of resident communities that collectively enforce norms and regulations. Longstanding traditions provide both the strength and adaptability behind the systems. Whenever the tagal system is in force, no fishing is allowed within particular zones for a specific length of time. Fish are harvested communally at the appointed time and the catch is shared equally among its members. Anyone found guilty of breaching tagal regulations will be fined heavily, for example a 50kg pig and RM200 (USD65). If a case cannot be solved by the Village Chief, it will be brought to the Native Court.

In various parts of Sabah fisheries resources had begun to decline from the 1960s as logging and the opening up of land for agricultural impacted riverine environments. Uncontrolled fishing, often with the use of explosives, poison or electricity, also became more widespread. In 1997, villagers in Kg. Notorus, in the Penampang District decided to revive its tagal system in the Babagon River with

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remarkable success. Based on anecdotal evidence, word of the restoration of fisheries in Babagon River prompted many other communities to reinstate their own tagal systems. By 2008, 179 villages had reportedly revitalised their tagal systems (Lasimbang, 2009).

The Department of Fisheries has been very supportive of tagal as a form of stakeholder participation. Section 35 of the Inland Fisheries and Aquaculture Enactment 2003 specifically allows for the declaration and recognition of the indigenous system of resource management (tagal). This recognition of indigenous management of fisheries resources has been an important milestone for the incorporation of traditional knowledge into conservation in Sabah. It is source of pride to all Sabahans and has noticeably increased the productivity of riverine fisheries and improved the quality of streams and rivers, although more research is needed to verify this. The Department of Fisheries website reports that there are now 212 tagal managed areas involving 107 rivers in eleven districts, and this figure is frequently revised upward to reflect the latest information.

The Department's receptivity to tagal is an example of what can be achieved for conservation when communities are actively engaged in natural resource management. The Fisheries Department supports, facilitates and promotes the system by serving as a technical advisor to the various Tagal Committees, carrying out research to further improve the system, conducting training and public education, and providing material assistances to the Tagal Committees such as signboards and fish fry. More needs to be done, however, to document the highly localised nature of customary laws and different tagal systems so that the traditional values inherent in the practice are not lost in the enthusiasm to 'scale up' the approach through standardisation and commercialisation.

9.5.5 Community Use Zones in Crocker Range Park

Crocker Range Park comprises 139,919 ha of mostly pristine highland forest. It is a biodiversity centre of global significance. The range extends over eight districts and provides water to both rural and urban populations in the West Coast and interior. Several Kadazan, Dusun and Murut communities have lived in this remote area and have done so for generations. They are highly dependent on their farms and natural resources in the Crocker Range Park for their livelihoods.

In 1969, large portions of Ulu Papar were gazetted within the Crocker Range FR. Later, in 1984, the FR was converted to the Crocker Range Park, a fully PA under the jurisdiction of Sabah Parks. In effect, the Ulu Papar villages were drawn into the state park. This sequence of events and the pursuant prohibitions against accessing

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resources came to be a long-standing source of contention for the Ulu Papar Dusun (also Long *et al.*, 2003).

The Parks Enactment 1984 prohibits any human modification of natural landscapes and extraction of natural resources – agriculture, hunting, fishing, gathering of forest products are technically illegal within the Park. Sympathetic to the plight of the Ulu Papar communities, Sabah Parks has tended to maintain a ‘soft’ approach by permitting the villages to remain close to the Park boundary and access resources close to their settlements. The quandary is that as long as these villages are seen to be ‘illegal settlements’ the government cannot provide them with infrastructure and facilities such as roads, schools and health care facilities. Essentially, communities can continue to assert their customary claims to land by staying inside the Park, but without legally recognised tenure and the power to manage their ancestral lands.

Community Use Zones (CUZs) were first proposed in the Zoning Plan for the Crocker Range Park Management Plan (2006) and seemed to offer a promising solution to the impasse. The CUZ proposal emerged from a five-year consultative process supported by BBEC Phase I to explore possible solutions to manage the Crocker Range Park from both biological and socio-cultural aspects. Subsequently, the legal framework for the establishment of CUZs was approved by the State Legislative Assembly in an amendment to the Parks Enactment 1984. According to the Crocker Range Park Management Plan, the future approach to managing Crocker Range Park is to focus on a wide range of stakeholders, involve local communities and to be adaptive and participative. On paper, the CUZ would legalise community access to resource areas within the Park, provide avenues for the local participation, and enable the settlements to be furnished with facilities and infrastructure.

This decision to ‘integrate’ local communities in Park management is a milestone in PA management policy in Sabah. The next step is for a CUZ Management Agreement to be developed by Sabah Parks with the respective communities involved. The groundwork has already been laid by the Darwin Initiative participatory documentation project which has been active in the proposed Buayan-Kionop CUZ in the Upper Papar region for almost ten years. This is a comprehensive landscape-level study of subsistence activities within the Resource Catchment Area which includes swidden cultivation, hunting, freshwater fishing and harvesting forest products. In addition to capturing the intricacies of traditional resource management, the project also improved knowledge of the historic and archaeological sites which makes this a truly distinctive cultural landscape and part of the area’s bio-cultural diversity heritage. With so much effort vested in these

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studies, local people have high hopes that they will have customary claims recognised and be given a role in managing the Buayan-Kionop CUZ in collaboration with Sabah Parks.

It is important that the process of establishing co-management in conjunction with the CUZ is not delayed further so that the positive impetus from previous activities is not lost. Moreover, as the Crocker Range Biosphere Reserve has recently been nominated as a UNESCO Man and the Biosphere (MAB) site by the Sabah government, local participation in the management of the area, tenure security and access to natural resources are important criteria for selection.

9.6 IMPLICATIONS OF THE ICCA REVIEW

9.6.1 What ICCAs Mean for Local Communities in Sabah

In consultations with indigenous and local communities in Sabah, there are strong common themes in their understanding of, and engagement with, the idea of ICCAs. In general, the ICCA concept is welcomed by indigenous peoples and local communities in Sabah who have long sought recognition of customary land, water, and natural resource rights, recognition and respect for their organisations governing community-conserved areas, and protection against encroachment from outside and imposed 'development' initiatives. Community participants feel that being designated as an ICCA would confer upon them the legitimacy they desire to perform their roles and land owners and resource managers. This would give them greater incentive to invest time, energy and resources into safeguarding natural resources and even defending these resources from outsiders. With a view to the future, communities also believe that officially recognised ICCAs should be eligible for some form of government support and development assistance which would help them improve their socio-economic status in conjunction with the ICCAs in their care.

9.6.2 Building upon State Policies, Plans and Blueprints

The future of ICCAs depends as much on the indigenous peoples and local communities who govern and manage them as on the local, national, and international forces that affect and shape their surrounding context. They need the support of civil society, national governments and international agencies to meet their challenges – old and new (Borrini-Feyerabend, 2010). Most communities perceive that the government's recognition of their right to manage their community-conserved areas is essential so that they may continue in their efforts. While the impulse, design and drive for managing conservation areas may come

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voluntarily from communities themselves, governments have the capacity to support them through a variety of legal and policy instruments.

A comprehensive review of legislation and policy guidelines on environmental conservation and resource management was conducted to find synergy between the ICCA concept and conventional PA management. One of the main findings was that it is not necessary to develop fresh legislation to working with communities towards conservation and sustainable resource use. There is already provision for this in many of the enactments and ordinances that relate to the management of land and other natural resources in Sabah.

All agencies have much scope to support ICCAs within their specific contexts and several have taken tentative steps towards this, while others have already made decisive moves to engage communities as active partners and stakeholders in conservation. Sabah does not lack the legal instruments or institutions needed to facilitate local community participation in biodiversity conservation and resource management. Mechanisms are required to encourage government agencies to be more participatory in addressing biodiversity conservation within their respective sectors. Specifically, the different agencies can themselves identify:

1. A series of biodiversity targets listed according to priority;
2. A timeline and strategy to achieve these targets;
3. A framework for engaging relevant communities, CBOs and NGOs in keeping with international protocols;
4. A programme for training and skills building to enhance use of participatory planning tools, the proper use of Free Prior and Informed Consent principles, and also boosting familiarity with the new Regulations for Access and Benefit Sharing;
5. A framework for effective monitoring and reporting with verifiable indicators of success.

For representatives of local communities and CBOs, highest on their agenda is the need to obtain communal tenure and collective rights to manage traditional resource areas, and acknowledge in District Plans that ICCAs cannot be subject to destructive land use change by outsiders or major infrastructure projects. In addition to this, state government agencies can also support ICCAs through its own policies on conservation and resource management. This includes enforcing environmental protection to regulate the primary sector - mining, agriculture, forestry, fisheries – and controlling land alienation in “ecologically important” or “sensitive” areas, such as watersheds, rivers, lakes, wetlands, and coastal zones.



SECTION 10
COMMUNICATION, EDUCATION AND
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10.1 INTRODUCTION

Communication, Education and Public Awareness (CEPA) programmes play an essential role in promoting an appreciation of biodiversity and awareness of current threats. Effective programmes can make a difference by nurturing concern for the environment and influencing behavioural change at the level of the individual, corporation, or larger society. The importance people attach to biodiversity and the environment has an impact on the way people interact with nature, manage waste or invest their time and resources. It can also influence government policies on economic development and environmental protection.

Article 13 of the Convention on Biological Diversity directs Contracting Parties to promote awareness and understanding of biodiversity using CEPA tools and initiatives. In the Strategic Plan 2011-2020 the importance of CEPA is reiterated in order to address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society. Target 1 states: “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”.

10.2 POLICIES ON ENVIRONMENTAL EDUCATION AND AWARENESS

The importance of Environmental Education (EE) in Sabah is emphasised in the Environment Protection Enactment 2002 in provisions to “promote environmental awareness on the importance of environmental protection, conservation and quality”¹⁹. Malaysia’s National Policy on Environment, 2002 also contains similar emphasis. Sabah has already been fairly pro-active in developing its Sabah Environmental Education Policy which aims to guide all stakeholders, namely government, non-governmental organisations, private, educational institutions, the media and general public in participating and implementing environmental education programmes in the state.

Strategies outlined in the Sabah Environmental Education Policy strategies:

1. Government agencies should actively implement environmental education;
2. Non-government organisations, the media, private sectors, professional bodies and the public should be actively involved in environmental education;
3. Educational institutions should actively participate in and implement environmental education;

¹⁹ Environment Protection Enactment 2002, Section 24 (1) (h)

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4. Efficiency and effectiveness of environmental education programmes and activities should be enhanced;
5. The functions of Sabah Environmental Education Network (SEEN) and other similar network and other similar networks should be strengthen; and
6. The capacity and capability of environmental education personnel needs to be raised.

10.3 SITE-BASED NATURE EDUCATION

Sabah is already considered to have some of the best site-based nature education centres in the country, some of which were established many years ago and have long been playing an education function for both domestic and international visitors of all ages. Many provide access to excellent and engaging information and interpretation materials on biodiversity and natural ecosystems in Sabah.

Among those that are exemplary for their facilities and programmes are:

- Kinabalu Park, which has an excellent interpretation centre and interpretative nature trails;
- The Rainforest Discovery Centre at Sepilok, which is the only site of its kind available in the country;
- The Klias Peatswamp Nature Education Centre, which is the only centre in the country focusing on this important ecosystem;
- The Kota Kinabalu Wetland Centre, which is strategically-located in the state's capital and serves as a centre for nature education on mangrove ecosystems and wetlands in general.

Other important nature education centres in Sabah include:

- Bukit Gemok Recreation Forest
- Madai Batulong Nature Centre
- Rafflesia Information Centre
- Danum Valley Field Centre
- Nature Education Centres of SWD: Danau Girang (wetlands), Gomantong (cave), Tabin Wildlife Reserve (tropical rainforest)
- Lok Kawi zoological and botanical garden
- Pusat Informasi Jatu, Kota Marudu
- Visitor Centres at Crocker Range Park: Inobong, Mahua, Keningau
- Poring Hotsprings

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10.4 THE BORNEAN BIODIVERSITY AND ECOSYSTEMS CONSERVATION PROGRAMME

CEPA activities in Sabah received a boost through the BBEC Phase I programme. BBEC's Public Awareness Component in particular actively promoted CEPA with a focus on biodiversity and ecosystems. This Component was developed with a high-level of local participation in order to support approaches tailored to the Sabah context. This included the contributions of several task forces each focusing on a specific target audience:

- Teacher Task Force (Led by the State Education Department)
- Policy Maker Task Force (Led by the Science and Technology Unit)
- Journalist Task Force (led by the Sabah Journalists Associations)
- Developers Task Force (Led by the Environment Protection Department)
- NGO Task Force (Led by the Environmental Action Committee)

The task forces successfully organised various CEPA activities such as workshops, exhibitions, and study tours as well as produced numerous materials including posters, brochures and newsletters. The BBEC programme managed to enhance the CEPA framework CEPA for biodiversity in Sabah by providing funds as well as creating a framework for evaluation, monitoring and reporting of CEPA activities.

10.5 THE SABAH ENVIRONMENTAL EDUCATION NETWORK

CEPA activities featuring biodiversity conservation fall under the larger umbrella of environmental education and awareness. SEEN, a network of people (35 stakeholders) has been working together to enhance environmental education programs and activities since 2005. SEEN's main goal was enhancing environmental communications, education and awareness efforts in Sabah through networking, cooperation and coordination among all key government agencies and NGOs that implement Environmental Education (EE) in Sabah. The Environment Protection Department (EPD) serves as the permanent Secretariat. The SEEN Chairman is the Director of EPD, while the Deputy Chairman is elected every two years.

The objectives of SEEN are:

- To provide a platform for more cohesive EE programmes and activities in Sabah;
- To provide a platform for training EE practitioners in Sabah;

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- To establish an effective network among the public and private sector, and NGOs engaged in EE programmes and activities in Sabah;
- To share expertise, information and other resources in the implementation of EE programmes and activities in Sabah;
- To evaluate the effectiveness of EE programmes and activities;
- To establish networking with local, national and international EE-related organisations.

SEEN members implement collaborative EE activities according to their organisational role, responsibilities and focal areas. When members agree to organise a collaborative event, a working group is formed in which expertise, funds and logistics are discussed and shared. Funding for SEEN comes from its members and also partners (non-members). Examples of previous and on-going activities by various SEEN members are listed in Table 10-1.

10.6 MEDIA COVERAGE AND PUBLICATIONS

Biodiversity in Sabah receives fairly good coverage in the mainstream media, especially in the local and national newspapers. Media coverage is generally supportive and balanced – coverage has included reports on biodiversity by government agencies and NGOs, as well as news reports and editorials on issues such as illegal logging and wildlife trade.

Sabah is fortunate to have a private publishing company specialising in natural history by Natural History Publications, which is a home grown enterprise that is responsible for publishing the majority of the books on nature and culture in Sabah. There is a wide selection of books available on various facets of Sabah's biodiversity, ranging from those for general interest as well as those targeted at a more specialised and informed readership. The presence of authoritative naturalists, researchers and conservationists with abundant knowledge on Sabah's biodiversity has been particularly important to the production of attractive high quality publications.

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Table 10-1: EE Activities Undertaken by Members of the SEEN Network

Organisation	CEPA activities	Target Audience
<i>Government Agencies</i>		
Environmental Protection Department	<ul style="list-style-type: none"> Organises talks, exhibitions, seminars, workshops and cleanliness activities. Co-organiser of the SERASI programme 	Students, teachers, government agencies, private sector.
Department of Environment	<ul style="list-style-type: none"> Organises talks, exhibitions, nature related games and art, radio talks, seminars, workshops and dialogues. Co-ordinates national-level programme (Sekolah Lestari) for Sabah, which promotes environmental awareness and actions among students. 	Students, teachers, developers, villagers, government agencies, private sector.
Science and technology Unit	<ul style="list-style-type: none"> Has organised exhibitions, seminar/workshops, EE courses and published newsletters, brochures, reports and environmental education workbooks. 	Policy makers, developers, teachers, journalists, NGOs.
Sabah Forestry Department	<ul style="list-style-type: none"> Conducts numerous programmes at its nature centres with emphasis on sustainable forest management - including seminars, camps, composting classes, colouring contests, bicycle rallies and jungle trekking. The Rainforest Discovery Centre at Sepilok offers environmental courses and workshops. 	School students, teachers and the general public.
Sabah Parks	<ul style="list-style-type: none"> Promotes nature education in their respective parks. 	Students, teachers and park visitors.
Sabah Wildlife Department	<ul style="list-style-type: none"> Organised the Orang-Utan Awareness Week. Honorary Wildlife Warden Programme. Visitor participation activities in the wildlife centres (e.g. Danau Girang, Sukau, Gumantong, Tabin) 	
Sabah Education Department	<ul style="list-style-type: none"> Promotes EE in schools. EE is not taught as a single subject but instilled within all subjects. Other EE programmes co-organised include Sekolah Rakan Alam Sekitar (SERASI) for all schools in Sabah, Sekolah Lestari, environmental workshops and courses. Organised the EE Race in 2008 to instill environmental awareness among teachers. 	The main target audiences are students and teachers from both primary and secondary schools as well as higher institutions.

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Organisation	CEPA activities	Target Audience
Sabah Biodiversity Centre	<ul style="list-style-type: none"> • Biodiversity Enactment 2000 requires SaBC to implement CEPA programmes. • Current CEPA focus is on the Lower Kinabatangan-Segama Ramsar site - has conducted talks, radio interviews and completed an educational video. • Currently developing a river environmental education programme for selected schools located at the proposed Crocker Range MAB site. 	
Department of Fisheries Sabah	<ul style="list-style-type: none"> • Uses class training and media to educate fishermen on sustainable fisheries practices. • The Marine Education Kit, produced with WWF Malaysia and the Ministry of Education is a successful CEPA program that is still ongoing. The kit, which is used by primary and lower secondary school teachers aims to provide awareness and understanding on the importance of marine ecosystem. 	Fishermen, students and teachers.
Department of Irrigation & Drainage Sabah	<ul style="list-style-type: none"> • Programmes are focused on water resources management. • An example is of an activity undertaken is the community based restoration and rehabilitation of the water bodies in the Salut-Mengkabong river basin 	
Universiti Malaysia Sabah	<ul style="list-style-type: none"> • Activities that have been conducted include mangrove replanting, cleanliness campaign and exhibitions. 	Students, general public.
Environmental Action Committee	<ul style="list-style-type: none"> • EAC is a partnership between the State Government and the people of Sabah to work together towards environmental awareness. • Various environmental seminars, forums, dialogues, camps and volunteer activities have been organised throughout Sabah. • A major event organised is the Sabah Environmental Awards to honor those who excel in their services and contributions to the environment in Sabah. 	All Sabahans
<i>NGOs</i>		
Sabah Wetland Conservation Society	<ul style="list-style-type: none"> • Kota Kinabalu Wetland Centre (KKWC) functions as an Environmental Education Centre on mangrove ecosystems. • Activities organised by the KKWC include talks, video shows, interpretative walks and mangrove replanting. 	School students, teachers and general public.

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Organisation	CEPA activities	Target Audience
Sabah Society	<ul style="list-style-type: none"> • Sabah Society's main focus is on promoting conservation. It organises regular field-trips throughout Sabah and talks for member as part of its continuous educational programme. 	General Public
HUTAN	<ul style="list-style-type: none"> • Initiated the HUTAN Environmental Education Programme (HEAP) targeting rural communities within Kinabatangan region. • HEAP emphasises on biodiversity conservation for rural communities' through projects such as "Fishermen for Conservation" and various forest restoration activities. 	Kindergarten, primary and secondary students as well as rural communities.
Sabah Nature Club	<ul style="list-style-type: none"> • Set up by Yayasan Sabah with the cooperation of Sabah Education Department. • Adopts an informal approach emphasising on field activities - activities undertaken include talks at schools, community workshops, exhibitions and nature orientation camps at Danum Valley Field Centre and Maliau Basin Studies Centre (conducted twice a year). • Students and teachers can become members of the SNC. At 2006, SNC had 39 000 registered members. 	Students and teachers in primary and secondary schools, universities and colleges.
WWF-Malaysia (Borneo Programme)	<ul style="list-style-type: none"> • Various campaigns and publication (books and magazine). 	General public, students
Malaysian Nature Society, SABAH	<ul style="list-style-type: none"> • Outdoor activities are on-going and children books and magazines are available for public. 	School children, general public.

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10.6 CHALLENGES IN CEPA

Sabah's policies on Environmental Protection and Education, the establishment of SEEN and the participation of media and publishing houses, the availability of accessible and well- equipped field centres have all contributed to a very strong CEPA baseline in Sabah. While SEEN provides the broad framework required for collaboration, challenges remain in enhancing and streamlining delivery mechanisms and main messages. A lack of sustained funding is a problem for enabling long-term and sustained programmes. In addition, collaborative efforts and mechanisms need to be fine-tuned in order to optimise resources and prevent duplication of efforts.

Moreover there is a continuous need to update materials and tailor approaches to a wide range of target audiences. School children and young people require stimulating materials and activities to capture their interest and enthusiasm, while rural populations would need content in indigenous languages and which relates more closely to their lives. There is also scope for developing special materials to encourage visitors and tourists in volunteer work and environmental programmes. Innovative approaches need to be taken to developing public awareness campaigns with greater and more lasting impact.

10.7 EXPANDING AND DIVERSIFYING CEPA

Learning occurs in formal contexts of learning, such as in schools and universities, as well as in informal contexts, such as through the guidance of elders regarding the natural environment, as well as in museums and parks, and through films, television and literature. Learning also occurs through participation in events, communication materials, and other opportunities for information exchange between stakeholders. Where possible, awareness and learning about biodiversity should be linked to and mainstreamed into the principles and messages of education for sustainable development.

CBD Strategic Plan 2011-2020

A strong focus on developing a strong sense of ownership among all people in Sabah for biodiversity and natural values in the state is now required which has the potential to influence changes in behaviour as well promote new initiatives and greater engagement by both the public and private sectors. However, in order to achieve this, sufficient investment is needed to develop a sustained campaign featuring education and promotional materials, activities and media coverage, as well as to take advantage of underdeveloped potential to engage wider networks through online social media, radio and television.

Making information about biodiversity in Sabah easily available on the internet will help promote appreciation for Sabah's heritage and provide an avenue for clearly stating conservation targets and goals, which should be updated with news of

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achievements and milestones met. This should have the impact of generating steady interest, stimulating willingness to participate and also creating media to acknowledge sponsors and supporters.

As indicated by the excerpt from the CBD Strategic Plan, there is also considerable scope to move beyond the classroom and expanding informal learning experiences through visits to nature centres, on-going rehabilitation projects, as well as opportunities to learn from local communities about traditional ecological knowledge and resource management.

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