THE REPUBLIC OF THE UNION OF MYANMAR

National Biodiversity Strategy and Action Plan

2011

National Biodiversity Strategy and Action Plan
Myanmar

Photo
Wild Asian Elephant (*Elephas maximus*) in Rakine Yoma Elephant Range

Foreword

Sustainable development of a country significantly depends on biodiversity conservation, management and utilization in a sustainable manner. Biodiversity is largely viewed as a solution to problems, particularly to improve the welfare of the current and future generations. In this regard, we need to have a sound strategy and action plan to provide a comprehensive framework for the sustainability of biodiversity while meeting the development goals for the human society. This document, National Biodiversity Strategy and Action Plan – NBSAP, is the framework that takes us in the direction of achieving the sustainable development without being detrimental to biodiversity.

Myanmar has been widely regarded as one of the biodiversity richest countries in the Asia and Pacific Region. However, biodiversity in our country has been dwindling for many years due to the lack of integrated efforts for the sound protection and management of biodiversity. Indeed, biodiversity is very special for our welfare since it is the major component of life supporting system. The protection and wise utilization of biodiversity is imperative to our nation as biodiversity provides the basic needs such as food, shelter, clothing, cosmetic, medicines, recreation and so on. Besides, the value of biodiversity became much higher than ever as regulating the stability of the climate entirely depends upon biodiversity.

This document is a product of a long collaborative process by governmental organizations, academic institutions and non-governmental organizations. The development of this NBSAP has opened a new chapter in our country for practising effective protection, sustainable management and wise use of biodiversity.

The sustainable development means more than just an economic progress of a country. It also consists of social and environmental aspects. It is crucial to attain the balance among these three aspects in order to ensure the sustainable development. In this regard, the NBSAP offers us opportunities to harmonize economic, social, and environmental aspects. With the great expectation on the sustainability of our biodiversity richness, I sincerely and earnestly urge all the segments of society to commit the effective implementation of the action plans prescribed in this NBSAP.

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Ministry of Environmental Conservation and Forestry
Chairman, National Environmental Conservation Committee
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The Steering Committee of the NBSAP Myanmar project thankfully acknowledges the GEF for proving the necessary start-up funding for the preparation of the NBSAP. We are also gratefull for receiving full support and contributions from all participants from the government departments, NGOs and academic institutions. Without their invaluable contributions including comments, suggestions, consultations, updated data and discussions, it would be difficult to accomplish the NBSAP. U Win Myo Thu, chairman of Economically Progressive Ecosystem Development Group (ECODEV) and national consultant to the NBSAP project, and his staff deserve our gratitude for their enormous effort from the beginning to the end of the NBSAP formulation process. UNEP is gratefully acknowledged not only for providing the GEF funding for preparing the NBSAP in Myanmar but also for contributing valuable suggestions and guidelines for formulating as well as editing the NBSAP. The NBSAP would not have been possible without the generous support and tireless guidance of Dr. Nyi Nyi Kyaw, Deputy Director General of Forest Department (FD). Last but not least, the committee is indebted to the FD for its technical and funding support in conducting a series of workshops and working group meetings, which finally and collectively achieved the formation of the NBSAP Myanmar. We thank Mr. Robert J. Tizard, Technical Advisor of Wildlife Conservation Society, Myanmar Program, for editing NBSAP Myanmar, and for his invaluable comments and suggestions to improve NBSAP Myanmar.

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EXECUTIVE SUMMARY

The United Nations Convention on Biological Diversity (CBD) is a framework for national action for the conservation of biodiversity, the sustainable use of its components, and the equitable sharing of benefits arising from the utilization of genetic resources. According to Article 6 of the Convention, each member country needs to develop its own National Biodiversity Strategy and Action Plan (NBSAP) to integrate conservation and the sustainable use of biodiversity. In order to fulfill this commitment to the Convention, Myanmar conducted a project entitled National Biodiversity Strategy and Action Plan in Myanmar (NBSAP Myanmar). The Government Meeting No. 17/2006 of the Republic of the Union of Myanmar, held on 25th May 2006, approved to formulate NBSAP of Myanmar. The United Nations Environment Program (UNEP) and Global Environment Facility (GEF) agreed to support the technique and funding in formulating NBSAP. With approval of the Government Meeting No. 11/2009 of of the Republic of the Union of Myanmar held on 19th March 2009, Forest Department of the Ministry of Environmental Conservation and Forestry, the Republic of the Union of Myanmar has signed the Project Cooperation Agreement (PCA) with UNEP, a GEF Implementing Agency, which is also accountable to the GEF Council for GEF financed activities, on 10th April 2009.

The NBSAP is the outcome of extensive data and information collating and analysis, as well as a series of workshops and working group meetings with participation from government departments, NGOs, and academic institutions. Based on the consultations, discussions, comments, suggestions and updated information of biodiversity and natural resources in the country, the NBSAP has been prepared and approved by national stakeholders. The NBSAP will act as the major guiding document for planning biodiversity conservation in the country, following its goal to provide a strategic planning framework for the effective and efficient conservation and management of biodiversity and natural resources based on greater transparency, accountability and equity. On 3rd May of 2012, the Government of the Republic of the Union of Myanmar adopted the Myanmar NBSAP by its Government Meeting No. 16/2012. The NBSAP is composed of six major chapters, which start with a general description of Myanmar's biodiversity and then extends to a strategy for the sustainability of biodiversity conservation.

Chapter 1 provides a general introduction to Myanmar, as well as objectives and methodology of the NBSAP. In **Chapter 2,** a detailed description about the diversity in ecosystems, habitats and species in Myanmar is presented, including the indication on species' status as being endemic, threatened or invasive. **Chapter 3** discusses the background of national policies, institutions and legal frameworks applicable to biodiversity conservation in Myanmar. **Chapter 4** analyses and highlights conservation priorities, major threats to the conservation of biodiversity as well as the important matter of sustainable and equitable use of biological resources in Myanmar. **Chapter 5** presents the comprehensive national strategy and action plans for implementing biodiversity conservation in Myanmar within a 5-year framework that includes strengthening and expanding on priority sites for conservation, mainstreaming of biodiversity conservation in other sectors and policies, implementing of priority species conservation, supporting for more active participation of NGOs and other institutions in society towards biodiversity conservation, implementing actions towards biosafety and invasive species issues, strengthening legislative process for environmental conservation and enhancing awareness on biodiversity conservation. In this chapter, sustainable management of natural resources and development of ecotourism are also mentioned. **Chapter 6** presents the required institutional mechanism for improving biodiversity conservation, the monitoring and evaluation of the implementation, as well as sustainability, of the NBSAP.

It is trusted that the NBSAP provides a comprehensive framework for planning biodiversity conservation, management and utilization in a sustainable manner, as well as to ensure the long term survival of Myanmar's rich biodiversity.

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ABBREVIATIONS

AAC	Annual Allowable Cut
AD	Ayeyawady Delta
AHP	ASEAN Heritage Park
ARDC	Agricultural Research and Development Corporation
ASL	Above sea level
BANCA	Biodiversity and Nature Conservation Association
CARI	Central Agricultural Research Institute
CAS	California Academy of Sciences
CBD	Convention on Biological Diversity
CBNRM	Community Based Natural Resource Management
CFI	Community Forestry Instructions
CHM	Clearing House Mechanism
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DAD-IS	Domestic Animal Diversity Information System
DAR	Department of Agricultural Research
DDA	Department of Development Affairs
DOF	Department of Fisheries
DISI	Directorate of Industrial Supervision and Inspection
DSWF	David Shepherd Wildlife Foundation
DWIRS	Department of Water Resources and Improvement of River Systems
EBAs	Endemic Bird Areas
ECODEV	Economically Progressive Ecosystem Development Group
EIA	Environmental Impact Assessment
EP	Eastern Plateau
EPA	Environmental Performance Assessment
FAO	Food and Agriculture Organization
FD	Forest Department
FREDA	Forest Resources, Environment, Development and Conservation Association
FSWG	Food Security Working Group
FUG	Forest User Group
GAD	General Administration Department
GCDT	Global Crop Diversity Trust
GDP	Gross Domestic Product
GEF	Global Environment Facility
IAS	Invasive Alien Species

IBAs	Important Bird Areas
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
ITTA	International Tropical Timber Agreement
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
KBAs	Key Biodiversity Areas
LBVD	Livestock Breeding and Veterinary Department
MAB	Man and the Biosphere
MAS	Myanma Agriculture Service
MCDC	Mandalay City Development Committee
MERN	Mangrove and Environmental Rehabilitation Network
MOAI	Ministry of Agriculture and Irrigation
MOBA	Ministry of Border Affairs
MOCU	Ministry of Culture
MOE	Ministry of Education
MOECAF	Ministry of Environmental Conservation and Forestry
MOEN	Ministry of Energy
MOFA	Ministry of Foreign Affairs
MOH	Ministry of Health
MOHT	Ministry of Hotels and Tourism
MOI	Ministry of Industry
MOINFO	Ministry of Information
MOLF	Ministry of Livestock and Fisheries
MOM	Ministry of Mines
MONPED	Ministry of National Planning and Economic Development
MORT	Ministry of Rail Transportation
MOT	Ministry of Transportation
MSS	Myanmar Selection System
NBSAP	National Biodiversity Strategy and Action Plan
NCEA	National Commission for Environmental Affairs
NCNPP	Nature Conservation and National Parks Project
NECC	National Environmental Conservation Committee
NGO	Non-Governmental Organization
NISM-GPA	National Information Sharing Mechanism on Global Plan of Action
NM	Northern Mountainous
NSDS	National Sustainable Development Strategy

NTFP	Non-Timber Forest Product
NWCD	Nature and Wildlife Conservation Division
OAG	Office of Attorney General
PAs	Protected Areas
PAS	Protected Area System
PFE	Permanent Forest Estate
PGR	Plant Genetic Resource
POPs	Persistent Organic Pollutants
SALT	Sloping Agricultural Land Technology
SAr	Semi-arid
SAs	Secondary Areas
SC	Southern Coastal
SLORC	State Law and Order Restoration Council
SLRD	Settlement and Land Records Department
SMTA	Standard Material Transfer Agreement
SP	Southern Plain
SPDC	State Peace and Development Council
SSC	Species Survival Commission
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WC	Western Coastal
WCS	Wildlife Conservation Society
WFP	World Food Program
WH	Western Hilly
WHC	World Heritage Convention
WRUD	Water Resource Utilization Department
WWF	World Wildlife Fund
YCDC	Yangon City Development Committee

CHAPTER 1: INTRODUCTION

1.1. Myanmar and its Natural Resources

Myanmar is the largest country in mainland Southeast Asia with a total land area of 676,577 square kilometers (261,228 sq miles). It is located between Latitude 9°28′ and 28°29′ North and Longitude 92° 10′ and 101° 10′ East. Myanmar shares international borders with the People's Republic of China in the North and North East, Lao PDR in the East, Thailand in the South East, and Bangladesh and India in the West (Figure 1). Its estimated length is approximately 2,100 km from North to South while its width is 925 km from East to West. The physical geography of Myanmar is structurally complex and diverse having the topography of steeper mountain ranges, upland plateaus and hill valleys in the eastern, northern and northwestern regions while the undulated central dry zone is surrounded by the western coastal range and lowland deltaic region in the lower part of the country and a narrow coastal strip is formed further south adjoining with peninsular Thailand. From the North to South, four major rivers; namely, Ayeyawady, Chin-dwin, Sit-taung and Thanlwin, are associated with the complex terrain formed by the large drainage systems and their wider tributary networks. As part of the eastern Himalayan mountain range, Hkakaborazi snow-capped mountain is located in the far north of the country with an altitude of 5,881 m above sea level (asl) and appears to be the highest mountain in Myanmar as well as in Southeast Asia. From the mouth of the Naff River in the far west to the most southern point of Victoria Island a long coastal line facing the Bay of Bengal and Andaman Sea forms 2,832 km of coastline.

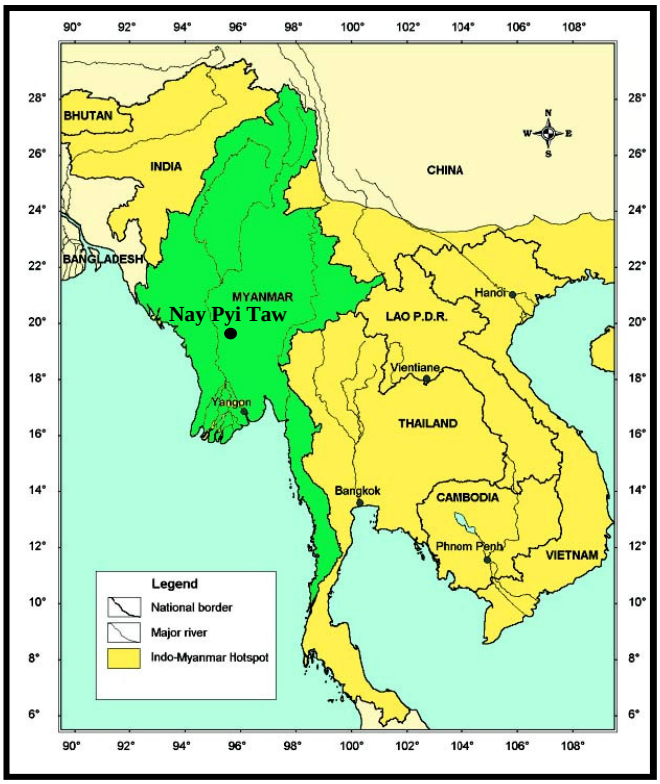

Figure 1. Location of Myanmar on the Indochina Peninsula.

Apart from the highest uplands in the far north of the country, the climate of Myanmar may practically be classified as tropical monsoonal, although important regional variations occur within that overall category. Throughout the year, three seasons are defined: the dry (summer) season (from March to May), the rainy season (from June to October) and the cold season (from November to February). Seasonally, the temperature ranges in most parts of the country between 32° C and 38° C during the dry season, 25° C and 35° C during the rainy season and 10° C and 25° C during the cold season. Average annual rainfall is as high as 2,500 mm in some parts of the country, particularly in coastal regions but as low as 500 mm in the dry zone located in the center of the country.

Alongside its geographical complexity and diversity, Myanmar is also rich in natural resources. The greatest wealth of the humid mountain slopes lies in timber, particularly teak, and while the young folded mountains of the west are not noted for mineral wealth, the older plateaus in the east have long been noted for a variety of metallic minerals, including silver, lead and zinc in Bawdin and tungsten in Mawchi. Furthermore, southern Taninthayi forms a minor part of the Southeast Asia tin zone. The sub-bituminous coal deposits are occur at Kalewa, near

the Chindwin Myittha confluence, and petroleum and natural gas deposits are occur in the the middle Ayeyawady lowlands. Prospects for the petroleum industry, which remain small scale by world standards, have much improved since the early 1990s, owing to foreign participation in onshore exploration and offshore exploration.

Myanmar is endowed with numerous agricultural resources and the Ayeyawady delta acts as a rice bowl for the country because of the stimulus of higher prices, higher-yielding varieties and improved water control. The Dry Zone is also well known for the production of oil seeds and cotton, especially under developed irrigation systems. Taninthayi region is appropriate for the cultivation of rubber and fruit crops. Besides substantial arable land, Myanmar is endowed with large freshwater and marine resources with a coastline of more than 2,800 km, 8.2 million ha of inland water bodies, and 0.5 million ha of swamp areas. Based on official estimates, the maximum sustainable yield for marine fisheries is approximately 1.05 million tons per year. During 2005 and 2006, Myanmar produced 2,585,538 metric tons of fish and prawns from both marine and fresh water resources (CSO 2007). In addition to fishing, Myanmar's inland waters have massive hydropower potential, of which only about 1% is now exploited. With extraordinary topographical variation, there is an unusual ecological diversity and these ecosystems are home to numerous species of fauna and flora. The country, once called the last frontier of biodiversity in Asia, has 251 known species of mammals, and 272 known reptile species, more than 1,000 bird species, and more than 11,000 plant species.

Three quarters of the total population of more than 50 million live in rural areas. There are more than 100 ethnic groups in the country, the largest of which are the Myanmar, who comprise about 70% of the total. About 90% of the population is Buddhist, but it is also home to Christians, Muslims, and Hindus. The accounts above give a clear picture of the social, cultural, economic, ecological and biophysical diversity of Myanmar. This diversity makes the need for sustainable conservation and management of biodiversity, for the maximum benefit of the citizens obviously apparent.

1.2. Objective of NBSAP Myanmar and its Guiding Principles

NBSAP Myanmar is a commitment of the Government and its people to the sustainable use of biological resources and to the fulfillment of Myanmar's obligations, as a member country, to the Convention on Biological Diversity (CBD). Conserving biodiversity not only secures the livelihoods of a major proportion of the population but also enhances the range of opportunities for economic prosperity and sustainable development of the nation. Therefore, the goal of the NBSAP is to provide a strategic planning framework for the effective and efficient conservation and management of biodiversity and natural resources with greater transparency, accountability and equity. Two specific objectives are set out –

1) to set the priorities for conservation investment in biodiversity management, and
2) to develop the range of options for addressing the issue of biodiversity conservation.

Assurance is also made that the formulation of the NBSAP is in line with the following environmental and conservation policies and programmatic frameworks that have been already developed and adopted to achieve the goal of sustainable development in Myanmar:

A. Myanmar National Environmental Policy
B. Myanmar Agenda 21
C. National Sustainable Development Strategy for Myanmar

In fact, Myanmar has a long and rich tradition of biodiversity conservation. The wildlife sanctuary in the vicinity of Mandalay city, decreed by King Mindon in 1859 was the earliest wildlife refuge area in Myanmar. With conservation culturally embedded in mind and in

practice, there are five grounded guiding principles stipulated for the formulation of the Myanmar NBSAP. These are -

1) Greater ecological enrichment and diversity in Myanmar is not only important for the sustainable development of the nation but also crucial for a healthier global environment. Wise use of biological resources is required and this needs to be balanced with the interests of stakeholders at the present and in the future.

2) Myanmar society enjoys its lifestyle in harmony and peace with nature and does no harm to the environment. This traditional norm and practice is an important element of social capital that needs to be fostered and taken into account for effective biodiversity conservation. In particular, securing the rights of indigenous and ethnic people is crucial for their coexistence with the ecosystem.

3) Effective and efficient biodiversity conservation could be achieved only by greater participation of all stakeholders including those at the grass roots level. The role of communities and women should be recognized to promote their active participation in the management of biological resources, and the role of government is to strengthen the active participatory process and private public partnerships.

4) Equity is the most important thing in using biological resources sustainably in the long run. Consideration of the poor and economically disadvantaged groups should be attentive to secure their access to common resources.

5) Strengthening capacity is the key to success of any endeavor in natural resource management and biodiversity conservation. This should be done at all levels within society.

1.3. Methodology of NBSAP

The NBSAP was developed by multi-stakeholder consultation and participation at various levels during workshops and working group meetings. Data was collated, analyzed and summarized by the Nature and Wildlife Conservation Division (NWCD), Forest Department (FD), Ministry of Environmental Conservation and Forestry (MOECAF). At the national level, the national steering committee was formed with the heads and relevant persons from governmental departments to direct the process of formulation (Annex 1).

Working groups and meetings were guided by the national steering committee and working groups made necessary studies and analysis. Three thematic working groups were formed: 1) Natural Resource Use: Sustainable Forestry, Agriculture, Fisheries, Plant Use, Biotechnology and Hunting; 2) Conservation and Ecology; and 3) Social and Economic: Sustainable Development and Economics, Law, Institutions, Public Awareness and Environmental Education. Working groups were composed of individuals from government departments, NGOs and academic institutions (Annex 2). Stakeholder consultation and participatory assessment that was previously initiated at community, regional and national levels by an environmental conservation and development NGO consortium in Myanmar (led by Birdlife International with the support of Conservation International, Critical Ecosystem Partnership Fund) were instrumental to the findings and suggestions described in the NBSAP. Draft analyses were also sent to various government departments for comments and additional inputs. Through national level workshops, the NBSAP was scrutinized for comprehensiveness.

CHAPTER 2: MYANMAR BIODIVERSITY AND ITS SIGNIFICANCE

2.1. Habitat and Ecosystem Diversity

As a result of the great variation in rainfall, temperature, complex river systems, and topography, there are several ecosystems in Myanmar. The following ecosystems are recognized:

(1) Forest Ecosystem

(2) Mountain Ecosystem

(3) Dry and Sub-humid Land Ecosystem

(4) Estuarine Mangrove Ecosystem

(5) Inland Fresh Water Ecosystem

(6) Grassland Ecosystem

(7) Marine and Coastal Ecosystem

(8) Small Island Ecosystem

Among the ecosystems, forests are considered to be integral for the stability of the environment in Myanmar. In spite of decreasing forest areas all over the world, Myanmar is able to maintain coverage of nearly half of its total land area with forests (FAO 2010). The FD has systematically managed the natural forests since the advent of scientific forestry in 1856. Among forest types, deciduous forests constitute 37% of total forested areas (Figure 2). These forests are crucial for the socio-economic benefit of the people of Myanmar as they not only provide local villagers with numerous forest products to fulfill their basic needs but also contribute substantial foreign exchange earnings to the State economy. This forest type is mainly composed of numerous commercially important timber species including teak (*Tectona grandis*), which is central to forest management in Myanmar. Many other *c*ommercially important hardwood timber species are associated with teak including *Xylia xylocarpa* (Myanmar Iron Wood), *Pterocarpus macrocarpus*, *Gmelina arborea*, *Melitia pendula* and *Dalbergia oliveri*. A high diversity of vegetation including bamboos is observed in the different types of deciduous forests in Myanmar. The Myanmar Selection System (MSS), in which trees having exploitable size are harvested, entails not only sustaining timber yield but also ensuring several ecological functions including support of habitat for wildlife. This can be proven by the recent rediscovery of Gurney's Pitta**,** a globally endangered bird species, which was last recorded in 1939 in Myanmar**.** This species was recorded again and as many as 120 pairs reported in the lowland sundaic forests of Taninthayi Region (BirdLife International 2005). These lowland sundaic forests**,** however**,** have almost all been converted to other land uses in the Indo-Malayan Region and the forests found in Myanmar are regarded as the only remnants to support the habitat of Gurney's Pitta, one of the world's most beautiful birds.

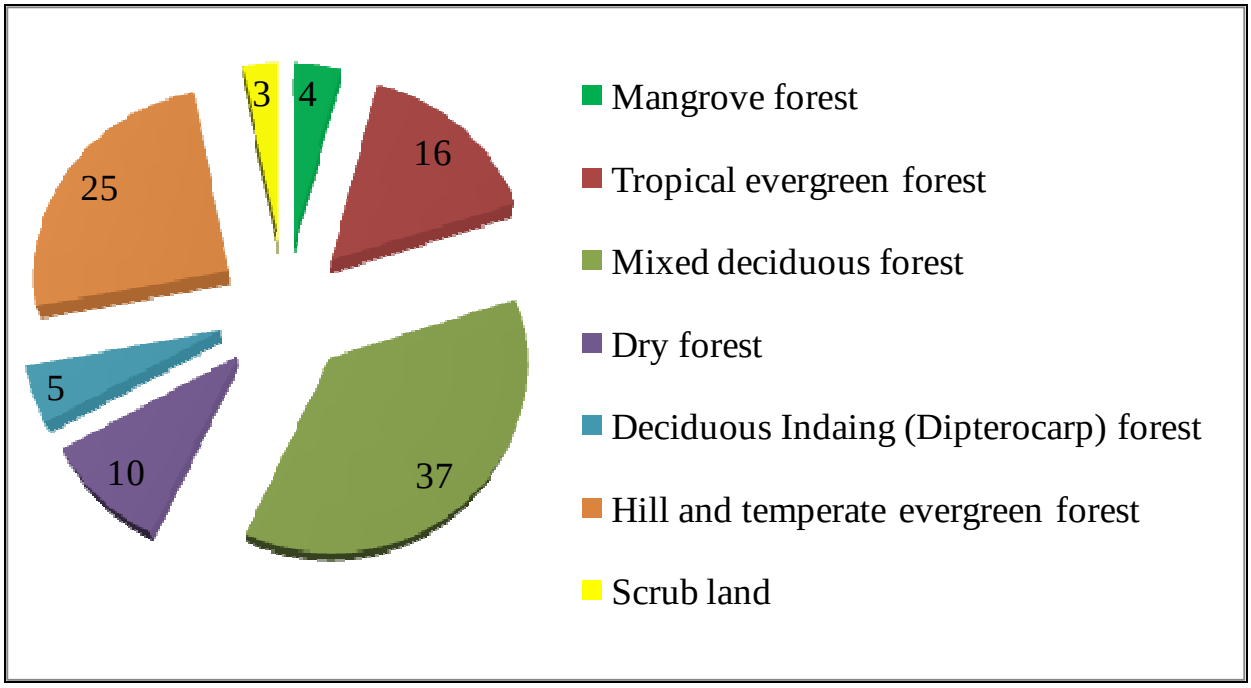

Figure 2. Forest Area by Forest Types of Myanmar (Percentage of total forest area).

Source: Remote Sensing and GIS Section, Planning and Statistic Division, FD 2011.

One of the most species-rich forest types in the country is tropical evergreen forest, which is distributed in areas of high mean annual rainfall and low seasonality, predominantly close to the coast. A species-rich tree flora, dominated by members of the *Dipterocarpaceae*, characterizes this forest type. Good accessibility and the availability of high-value timber species have made tropical evergreen forests a major focus of commercial logging throughout mainland South-East Asia, and large areas have been degraded or cleared. Some of the most extensive intact areas remaining in the region are observed in Taninthayi Region, in the south of the country, although these areas are under severe and immediate threat of conversion to oil palm. Another lowland forest type is mangrove forest. This forest type develops in permanently or seasonally inundated lowlands, and, in Myanmar, it is distributed in the Ayeyawady Delta, Rakhine State and Taninthayi Region. Because of its coincidence with areas of high human population and suitability for conversion to agricultural land, mangrove has been extensively cleared throughout mainland South-East Asia. Myanmar supports some of largest remaining examples of this highly threatened habitat in the region. The lowlands of the Central Dry Zone support dry forest and deciduous *dipterocarp* forest. Dry forests are characterized by *Terminalia oliveri, Tectona hamiltoniana* and *Acacia catechu*. Invasive species, such as *Prosopis juliflora* and *Euphorbia* spp. are widespread, particularly in more open areas. Deciduous dipterocarp forest, known locally as *indaing* forest, is dominated by *Dipterocarpus tuberculatus* and characterized by a low, open canopy, a grassy understorey and low tree species richness. In the surrounding hill region and around the periphery of the Central Dry Zone, the dominant lowland forest type is mixed deciduous forest. As this forest type is characterized by the presence of Teak (*Tectona grandis*), it is of high economic importance, and has been the focus of commercial logging operations. At higher elevations around the Central Dry Zone, moist semi-evergreen forest is distributed. An analysis of forest cover change in Myanmar between 1990 and 2000 has revealed the northern edge of the Central Dry Zone and adjacent hill forests to be a deforestation hotspot, with at least 7% of the forest cover being lost over this period (Leimgruber *et al.* 2005). It is presumed that fuel wood extraction and agricultural expansion were the main causes of this habitat loss.

At elevations above 900 m asl, evergreen forest types are the most widespread natural habitats, with hill evergreen forest up to around 1,800 m asl and temperate evergreen forest is located above this elevation. Montane evergreen forest is characterized by the presence of members of the Fagaceae, Lauraceae and Magnoliaceae, together with members of the Ericaceae, such as ***Rhododendron*** spp. At high elevations in the north of the country, montane oak forest and coniferous forest are found, while the highest elevations support sub-alpine forest and alpine meadows, with some peaks having a permanent covering of snow and ice. In Myanmar, hill and montane evergreen forest types are generally less threatened than lowland forest types.

Myanmar supports a diversity of freshwater ecosystems, from fast-flowing mountain streams to wide, slow-flowing lowland rivers, as well as lakes and other non-flowing wetlands. Forested streams and rivers in the upper catchment of the country's rivers may support high levels of endemism. The most abundant order of the fresh water fish species are *Osteoglossiformes spp., Clupeiformes spp., Cypriniformes spp., Siluriformes Perciformes* and *Tetraodontiformes spp.*; however, the freshwater biodiversity of these ecosystems, as with most other freshwater ecosystems in the country, remains largely unknown. Large, slow-flowing, lowland rivers support a number of important wildlife habitats, including deep pools, sandbanks, sandbars, and braided, fast flowing sections with emergent vegetation. Other important habitats are associated with lowland rivers, including ox-bow lakes and alluvial grasslands. Such habitats have been extensively lost throughout the rest of mainland South-East Asia. Other freshwater ecosystems include large, freshwater lakes, such as Indawgyi and Inlay. As elsewhere in the region, freshwater ecosystems in Myanmar support the livelihoods of significant proportion of the human population. As a result, they are frequently subjected to high levels of human use, often with negative implications for biodiversity. According to wetland inventory carried out in 2004, a total of 99 wetland sites including swamp land were identified. Most of these wetland sites are located alongside the Ayeyawady/Chindwin River and 85 sites are recognized in this river basin. A few wetlands are reportedly found in the Thanlwin river basin (6 sites) and in the Sittaung river basin (5 sites). The Rakhine coastal region also hosts another 3 wetland sites. These wetlands are not only important for fresh water biodiversity but also the home of globally threatened bird species.

Myanmar supports some of the most extensive and least disturbed coastal and marine ecosystems in mainland Southeast Asia. An extensive coastline accommodates half a million hectares of brackish and freshwater swampland that supports essential ecological functions and habitats as spawning, nursery and feeding grounds for aquatic organism like fish, prawns and other aquatic fauna and flora of economic importance. These ecosystems have not escaped the threats that have resulted in their extensive degradation and loss in other parts of the region, including conversion to agriculture and aquaculture and fuel wood collection. Mangrove is one of the most widespread habitats in coastal regions, particularly near estuaries. Some of the most extensive areas of mangrove are in the coastal zones of Rakhine State and Taninthayi Region. The Ayeyawady Delta also supports significant areas of mangrove, although rates of net forest loss there are the highest in the country, with over 20% of forest cover being lost over the period 1990-2000 (Leimgruber *et al.*2005). Other coastal habitats include intertidal mud and sand flats, which are very important for migratory water birds, as well as sand dunes and beach forest.

The biological values of Myanmar's natural habitats and ecosystems have been recognized by a number of global conservation priority setting exercises. For instance, the country includes all or part of seven Global 200 Ecoregions defined by World Wildlife Fund (WWF) (Olson and Dinerstein 1998, Dinerstein *et al*. 1999): the Eastern Himalayan Alpine Meadows; the Eastern Himalayan Broadleaf and Conifer Forests; the Kayah-Kayin/Taninthayi Moist Forests; the Northern Indochina Subtropical Moist Forests; the North-eastern India and Myanmar Hill Forests; the Mekong and Thanlwin Rivers; and Inlay Lake.

2.2. Species Diversity and Endemism

Because of the very wide variations in latitude, altitude and climate within the country, Myanmar supports a high diversity of habitats, and is extremely rich in plant species. The country is located at the convergence of four major floristic regions: the Indian, Malesian (Sundaic), Sino-Himalayan and Indochinese. Northern Myanmar, in particular, is one of the floristically richest and most diverse areas in mainland Southeast Asia. As long ago as the 1940s, this area was recognized to support at least 6,000 vascular plant species, of which perhaps 25% are endemic (Kingdon-Ward 1944-5). The plant diversity of the country as a whole is even higher: a recent revision of the checklist of gymnosperms and angiosperms in Myanmar contains 11,800 species in 2,371 genera and 273 families (Kress *et al.* 2003). When ferns and non-vascular plants are added, the total plant diversity of the country is higher.

The available information on species diversity and endemism indicates that Myanmar supports extraordinary plant and vertebrate diversity, plus levels of endemism comparable to other countries in the Indo-Myanmar (Indo-Burma) Hotspot. However, detailed baseline data are still lacking for many taxonomic groups, and new species for science are still being regularly discovered in the country. These include Leaf Deer (*Muntiacus putaoensis),* a species of muntjac discovered in the Northern Forest Complex in 1997 (Amato *et al*. 1999), which is believed to be the smallest species of deer in the world. In addition, a new species of bat, Kachin Woolly Bat (*Kerivoula kachinensis*), was recently described from collections made by the Harrison Institute and Yangon University (Bates *et al.* 2004). Regarding reptiles and amphibians, 14 new species have been reported from collections made by the Myanmar Herpetological Survey, comprising: two species of frog, *Bufo crocus* (Wogan *et al.* 2003) and *Chirixalus punctatus* (Wilkinson *et al.* 2003); two species of snake, *Naja mandalayensis* (Slowinski and Wuster 2000) and *Lycodon zawi* (Slowinski *et al.* 2001); and 10 species of lizard, *Cyrtodactylus* spp. (Bauer 2002, 2003) and *Calotes chincollium* (Vindum *et al.* 2003). Furthermore, recent studies have discovered many new species of freshwater fish, including *Danio kyathit* (Fang 1998), *Botia kubotai* (Kottelat 2004) and *Batasio elongatus* (Ng 2004). The continued discovery of new species and new records for the country, are likely to further increase levels of known species diversity and endemism in Myanmar.

Forest ecosystems support the highest levels of plant species richness, among which montane forests and lowland evergreen forests are the most species-rich. Plant families particularly notable for their high species diversity in the country include the Orchidaceae, Zingiberaceae and Dipterocarpaceae. An analysis by the International Union for Conservation of Nature (IUCN) identified four Centers of Plant Diversity in Myanmar (Davis *et al.* 1995). These comprise Northern Myanmar (with an estimated 6,000 species), Taninthayi (with an estimated 3,000), Natmataung National Park and the Chin Hills (with an estimated 2,500), and the Bago Yoma Range (with an estimated 2,000).

Myanmar supports at least 251 mammal species (Groombridge and Jenkins 1994), although a number of these species have not been confirmed to occur in recent years. Seven mammal species are thought to be endemic to Myanmar (Bates *et al.* 2004, Groombridge and Jenkins 1994), including Anthony's Pipistrelle (*Hypsugo anthonyi*) and Joffre's Pipistrelle (*Hypsugo joffrei*). Several other mammal species have very restricted global ranges that include parts of neighboring countries. These include Kitti's Hog-nosed Bat (*Craseonycteris thonglongyai*), one of the smallest mammal species in the world, which is known only from southern Myanmar and a small area of western Thailand, and the recently reported Leaf Deer, which is only known from northern Myanmar and Northeastern India.

Myanmar supports at least 1,056 bird species, a greater diversity than any other country in mainland Southeast Asia (Duckworth *et al.* 1999, Wells 1999, Robson 2000, Round 2000). Despite its high species richness, Myanmar's avifauna contains only four national endemic

species: Hooded Treepie (*Crypsirina cucullata*), White-browed Nuthatch (*Sitta victoriae*), White-throated Babbler (*Turdoides gularis*) and Burmese Bushlark (*Mirafra microptera*) (Alström 1998, Stattersfield *et al.* 1998). White-browed Nuthatch is restricted to the southern Chin Hills, while the other three endemic species are concentrated on the Central Dry Zone.

In addition, Myanmar supports numerous endemic sub-species, several of which may warrant full species status, for example White-bellied Minivet (*Pericrocotus erythropygius albifrons*). In addition to the four nationally endemic bird species, Myanmar supports at least 19 other restricted range bird species (species with a global breeding range of less than 50,000 km^2), most of which are found in parts of other countries. These restricted-range species facilitate defining four Endemic Bird Areas (EBAs) and three Secondary Areas (SAs). EBAs are areas to which the global ranges of at least two restricted-range species are entirely restricted, while SAs are areas that support one or more restricted range species but do not qualify as EBAs (Stattersfield *et al.* 1998).

The Northern Forest Complex and Chin Hills of Myanmar comprise part of the Eastern Himalayas EBA. At least 14 of the restricted-range species found in this EBA occur within Myanmar: Blyth's Tragopan (*Tragopan blythii*); Sclater's Monal (*Lophophorus sclateri*); Ward's Trogon (*Harpactes wardii)*; Rusty-bellied Shortwing (*Brachypteryx hyperythra)*; Striped Laughingthrush (*Garrulax virgatus*); Brown-capped Laughingthrush (*G. austeni*); Wedge-billed Wren Babbler (*Sphenocichla humei*); Snowy-throated Babbler (*Stachyris oglei*); Streak-throated Barwing (*Actinodura waldeni*); Grey Sibia (*Heterophasia gracilis*); Beautiful Sibia (*H. pulchella*); White-naped Yuhina (*Yuhina bakeri*); Broad-billed Warbler (*Tickellia hodgsoni*); and White-browed Nuthatch. In addition, Yellow-vented Warbler (*Phylloscopus cantator*) may breed in the country, and Dark-rumped Swift (*Apus acuticauda)* may occur as a migrant, although there is no confirmation of breeding. Many of the restricted-range species in the Eastern Himalayas EBA are altitudinal migrants, breeding at higher elevations and spending the non-breeding season at lower elevations.

The Central Dry Zone of Myanmar comprises the Ayeyawady (Irrawaddy) Plains EBA. Three restricted range species occur in this EBA, all of which are national endemic: Hooded Treepie, White-throated Babbler, and Burmese Bushlark. Parts of extreme northeastern Myanmar are included within the Yunnan Mountains EBA, which is centered on northern Yunnan and central Sichuan provinces of China. Only one of the restricted range species that define this EBA is currently known to occur in Myanmar: Brown-winged Parrotbill (*Paradoxornis brunneus*). The Cocos Islands of Myanmar, which lie in the Andaman Sea, are included within the Andaman Islands EBA. Two of the restricted-range bird species endemic to the Andaman archipelago occur on these islands: Brown Coucal (*Centropus andamanensis)* and Andaman Drongo (*Dicrurus andamanensis*).

Myanmar includes all or part of three SAs. The Northern Myanmar Lowland SA, which contains the upper Chindwin and Mali Hka catchments of northern Myanmar, supports a single restricted-range species, Chestnut-backed Laughingthrush (*Garrulax nuchalis*), which also occurs in India. The Myanmar-Thailand Mountain SA, which includes parts of east-central Myanmar, plus parts of northwestern Thailand, also supports a single restricted-range species: Burmese Yuhina (*Yuhina humilis*). Finally, the Peninsular Thailand Lowland Forests SA, which includes parts of Taninthayi Division, Myanmar, plus part of peninsular Thailand, also supports a single restricted-range species: Gurney's Pitta (*Pitta gurneyi*).

Based on the results of the Myanmar Herpetological Survey, conducted by the FD, California Academy of Sciences (CAS) and the Smithsonian Institution (SI), Myanmar supports at least 361 reptile and amphibian species, comprising 279 species of reptile and 82 species of amphibian. These figures do not include 12 new species recorded for the country that are awaiting publication, and an other 52 potential new species have also been recorded from the

survey. Therefore, the total number of reptile and amphibian species known from Myanmar may be as high as 425. A number of these species are thought to be national endemic, including seven species of turtle: Burmese Frog Faced Soft Shell Turtle (*Chitra vandijki*); Myanmar Star Tortoise (*Geochelone platynota*); Rakhine Forest Turtle (*Heosemys depressa)*; Burmese Roofed Turtle (*Batagur trivitta)*; Myanmar Flapshell Turtle (*Lissemys scutata*); Burmese Eyed Turtle (*Morenia ocellata*); and Burmese Peacock Softshell (*Nilssonia formosa*).

The freshwater fish fauna of Myanmar is one of the least known in Southeast Asia (Kullander *et al.* 2004). Myanmar is estimated to support at least 350 freshwater fish species, a significant fraction of which may be national endemic (S. Kullander, C. Ferraris, Jr and Fang Fang *in litt.* 2004). Since 1997, twenty-seven new species of freshwater fish have been described from Myanmar, and all of them are endemic (Kullander and Britz 2002), and at least 10 more new species are waiting publication (Kullander *et al*. 2004). National endemic fish species include the miniature fish (*Danionella translucida*) and (*D. mirifica*), the world's smallest freshwater vertebrates (Britz 2003). Considerable local endemism is thought to have gone without notice, as a result, fish species in Myanmar being misidentified as better-known species from the Indian Sub-continent (Kullander *et al.* 2004). Moreover, because of patchy collecting effort, it is difficult to assess local endemism apart form the fish in Inlay Lake, which supports several national endemic species (Kullander *et al*. 2004).

Species diversity of coastal and marine ecosystems is yet to be explored. According to species assessment done by the research vessel of "Dr. Fridtjof Nenson" in 1978-80, over 800 marine fish species were identified in Myanmar coastal areas and seascapes. Among them, the common family of marine fish species are *Ariidae* (Sea Catfishes), *Carangidae* (Caranx, Travelly & Scad), *Clupeidae* (Hilsa shad, Sardine), *Lutjanidae* (Snapper), *Mullidae* (Goat fishes), *Muraensociadae* (Pike Conger), *Nemipteridae* (Threadfin Breams), *Polynemidae* (Indian Threadfin), *Pomadasyidae* (Sea Grant), *Sciaenidae* (Croaker), *Scomberiade* (Mackerels), *Serranidae* (Groupers), *Stromatidae* (Pomfrets), *Synodontidae* (Lizard fish), and *Trichiuridae* (Hairtails). Recent observations of the Department of Fisheries (DOF) also report about 16 marine mammals including Dugong, which is a globally threatened species (Table 1). Dugong populations seem to be abundant in Myanmar, especially in the Rakhine State. From the southern part of Gwa, northward to Kyaukpyu, Manaung and its vicinity, there are dense sea grass beds with recent Dugong observations. However, these reports concern incidental catch by fishers' nets. Actually Dugong is not a preferred source of food for locals but is mainly caught accidentally or for peculiar recipes. According to reports, there were seven deaths of dugong caught in Rakhine State between 1994 and 2004. There are unconfirmed but frequent reports from locals on several additional Dugong areas in southern coastal areas of Myanmar.

Table 1. List of Marine Mammal Species Observed in Myanmar's Coastal Areas and Seascapes.

No	Scientific Name	Local Name
1	*Sausa chinensis*	Indo-pacific Hump-back Dolphin
2	*Tursiops aduncus*	Bottlenose Dolphin
3	*Tursiops truncatus*	Bottlenose Dolphin
4	*Stenella longirostris*	Long-snout Spinner Dolphin
5	*Stenella attenuata*	Pan-tropical Spotted Dolphin
6	*Neophocaena phocaenoides*	Finless Porpoise
7	*Orcaella brevirostris*	Irrawaddy Dolphin
8	*Physeter macrocephalus*	Sperm Whale
9	*Balaenoptera musculus*	Blue Whale
10	*Balaenoptera physalus*	Fin Whale

Table 1. List of Marine Mammal Species Observed in Myanmar's Coastal Areas and Seascapes (Cont'd).

No	Scientific Name	Local Name
11	*Stenella coeruleoalba*	Striped Dolphin
12	*Delphinus capensis*	Long-beaked Common Dolphin
13	*Kogia breviceps*	Pygmy Sperm Whale
14	*Feresa attenuata*	Pigmy Killer Whale
15	*Balaenoptera adeni*	Bryde's Whale
16	*Dugong dugon*	Sea Cow

Another group of species that are of concern for marine biodiversity are sharks. Due to the high market prices and demand on shark products such as meat, skins, fins, cartilage, jaws and livers, shark hunting is growing worldwide and the shark population has been declining globally. Many shark fisheries in Myanmar are small scale, which utilize wooden boats with an engine not more than 25 horsepower. Most of the shark landings are coming from incidental catches. Elasmobranch fishing has also been banned in Myanmar since 2004 but illegal shark hunting is still a threat for shark species. According to an assessment done by the DOF in 2004, a total of 24 shark species belonging to 5 major families are found in Myanmar seascapes. Details are given in Table 2.

Table 2. List of Shark Species in Myanmar.

Family	Scientific Name	English Name	Myanmar Name
1. HEMISCYLLIDAE	*1. Chioscyillium griseum*	Ray bamboo shark	Nga-Mann-Ain-Myaung
	2. Chioscyillium punctatum	Brown banded bamboo shark	Nga-Mann -Ga-Phyone / Nga-Mann-Tauk-Tet/ Nga-Mann-Apho-Gyi
2.STEGOSTOMIDAE	*1. Stegostoma fasciatum*	Zebra shark	Nga-Mann-Tauk-Tet
3. HEMIGALEIDAE	*1. Chaenogaleus macrostoma*	Hook tooth shark	Nga-Mann-Htoe-War
4.CARCHARHINDAE	*1. Carcharhinus albimarginatus*	Silvertip shark	Nga-Mann-Gaung-Waing
	2. C. amblyrhynchoides	Graceful shark	
	3. C. borneensis	Borneo shark	Nga-Mann-Pu
	4. C. brivipinna	Spinner shark	Nga-Mann-Taung-Mae
	5. C. dussumieri	White cheek shark	Nga-Mann-Zaung-Phyu
	6. C. falciformis	Silky shark	
	7. C. leucas	Bull shark	Kyar-Nga-Mann
	8. C. limbatus	Blacktip shark	
	9. C. melanopterus	Blacktip reef shark	
	10. C. plumbeus	Sandbar shark	
	11. C. sorrah	Spot tail shark	Thae-Nga-Mann
	12. Galeocerdo cuvier	Tiger shark	
	13. Glyphis gangetis	Ganges shark	Loon-Nga-Mann
	14. Loxodon macrorhinus	Slit eye shark	
	15. Rhizoprionodon acutus	Milk shark	
	16. R. oligolinx	Gray sharpnose shark	

Table 2. List of Shark Species in Myanmar (Cont'd).

Family	Scientific Name	English Name	Myanmar Name
	17. Scoliodon laticaudus	Spadenose shark	
	18. Eusphyra blochii	Winghead shark	
5. SPHYRIDAE	*1. Sphyrna lewini*	Scalloped hammerhead	Nga-Mann-Kywe-Gyo-Toe
	2. S. mokarran	Great hammerhead	Nga-Mann-Kywe-Gyo-Shae

Source: Department of Fishery (DOF), 2004.

Recently, DOF conducted a study on sea cucumbers since there has been a concern over the decline of its population because of commercial scale harvesting. So far, 10 species of sea cucumber have been identified in Myanmar, and they are (1) Black Fish *ris* (*Actinopyga milia*), (2) Stone Fish (*Actinopyga lecanora*), (3) Prickly Red Fish (*Thelenota anana*), (4) Amber Fish *ax* (*Thelenota an*), (5) Curry Fish (*Stichopus variegates*), (6) Green Fish (*Stichopus chloronotus*), (7) Black Tea Fish (*Holothuria nobilis*), (8) Lolly Fish (*Holothuria atra*), (9) White Teat Fish (*Holothuria fuscogilva*), and (10) Leopard / Tiger Fish (*Bohadschia argus*).

There are also some important species other than marine fish for conserving marine diversity. These are sea grass, coral reefs and marine turtles. Little is known about sea grass although it has an important ecological role. The sea grass, which often grows in relatively shallow waters, forms a key feeding, breeding, and nursery ground for many species of fish, turtles, lobsters, and dugong. Moreover, sea grasses improve water quality and their root-like stems stabilize the sea bottom. There is not much information on the status of sea grass in Myanmar. Most of these sea grass species are found in Rakhine and Taninthayi coastal areas but they are not observed in the Ayeyawady Delta and Gulf of Mottama coastal regions where water turbidity is very high because of enormous sediment discharges from upstream watersheds. The project report released by Istituto Oikos and BANCA mentioned that 11 species of sea grass were found around the Lampi Marine National Park (Istituto Oikos and BANCA 2011). Similar to sea grass, coral reefs also play a vital role in marine ecosystems in terms of providing nutrients and habitat for many marine species. A total of 51 coral species have been identified in Myanmar by the DOF but systematic assessment is still needed to map out the status of coral reef diversity and their trend in the seascape. Available information on coral reef species is described in Table 3. Myanmar's coastal shoreline also provides nesting sites for marine turtles and five of the world's seven marine turtle species are found in Myanmar. They are (1) Hawksbill Turtle (*Eretmochelys imbricata*), (2) Green Turtle (*Chelonia mydas*), (3) Loggerhead Turtle (*Caretta caretta*), (4) Olive Ridley Turtle (*Lepidochelys olivacea*), and (5) Leatherback Turtle (*Dermochelys coriacea*). These five species are known to feed and/or nest along the coastal regions of Rakhine, Ayeyawady and Taninthayi. They are threatened by over exploitation and accidental capture by fishing boats, as well as the pollution and destruction of nesting sites. As a result, the population of marine turtles has reportedly declined.

Table 3. List of Coral Reef Species in Myanmar.

No.	Scientific Name	Common Name
1	*Lobophyllia spp.*	Coral
2	*Turbinaria bifrons*	Bowl Coral
3	*Turbinaria mesenterina*	Pagoda Coral
4	*Galaxea fascicutalis*	Galaxy Coral
5	*Galaxea astreta*	Galaxy Coral

Table 3. List of Coral Reef Species in Myanmar Myanmar (Cont'd).

No.	Scientific Name	Common Name
6	*Heliopora coerulea*	Blue Coral
7	*Pavona spp.*	Leaf Coral
8	*Pavona decusata*	Catcus Coral
9	*Pavona minuta*	Catcus Coral
10	*Acropora acuminate*	Coral
11	*Acropora cytherea*	Coral
12	*Acropora austere*	Coral
13	*Acropora digitifera*	Coral
14	*Acropora gemmifera*	Coral
15	*Acropora tenuis*	Coral
16	*Acropora glauca*	Coral
17	*Podabacia crustacean*	Cauliflower Coral, Antler Coral
18	*Goniastera favulus*	Coral
19	*Favia maritime*	Golfball Coral, Small Star Coral
20	*Favia stelliger*	Golfball Coral, Small Star Coral
21	*Favia veroni*	Golfball Coral, Small Star Coral
22	*Portie lutea*	Boulder / Pore Coral
23	*Fungia scutaria*	Mushroom Coral
24	*Fungia fungites*	Mushroom Coral
25	*Pavona descussata*	Catcus Coral
26	*Acropora aspera*	Coral
27	*Acropora secale*	Coral
28	*Acropora hyacinthus*	Coral
29	*Acropora yongei*	Coral
30	*Goniastra retiforms*	Coral
31	*Fungia scutaris*	Mushroom Coral
32	*Porties solida*	Boulder / Pore Coral
33	*Millepora platyphtlla*	Fire / Finger Coral
34	*Heliopora coerulea*	Blue Coral
35	*Montipora efforescens*	Velvet Coral
36	*Montipora informis*	Velvet Coral
37	*Montipora solanderi*	Velvet Coral
38	*Portie lutea*	Boulder / Pore Coral
39	*Portie nigrescens*	Boulder / Pore Coral
40	*Pavona frondifera*	Leaf Coral
41	*Lophyllia hemprichii*	Coral
42	*Polyphyllia talpina*	Feather Coral
43	*Goniopora columna*	Sunflower Coral
44	*Goniopora fructicosa*	Sunflower Coral
45	*Goniopora lobata*	Daisy Coral
46	*Goniopora stuchburyi*	Coral
47	*Goniopora pectinat*	Coral
48	*Fungia fungites*	Mushroom Coral
49	*Favia speciosa*	Coral
50	*Galaxea fascicularis*	Tooth Coral
51	*Turbinaria crater*	Coral

An attempt was made during the NBSAP process to compile all available information on species diversity in Myanmar but species inventories are still partial and never completed for any given ecosystem. These data are important to biodiversity conservation in the country. Most data are outdated and deficient for understanding the full picture of species diversity and its trends. Therefore, investment in species inventories is largely needed to fill the gaps in scientific information for the effective implementation of biodiversity conservation nationwide.

2.3. Globally Threatened Species

A significant number of the plant and animal species that occur in Myanmar have been assessed as globally threatened, following the global threat criteria of IUCN/SSC (1994). However, in the Indo-Myanmar (Indo-Burma) Hotspot, comprehensive global threat assessments are only available for mammals, birds, amphibians and some groups of reptiles. Baseline data on species diversity in Myanmar is incomplete for most, if not all, major taxonomic groups, and the available data of the current status of the country's diversity is mainly the globally threatened species that are currently listed in the *IUCN Red List of Threatened Species version 2011* (IUCN 2011; Annex 3).

Mammals

In 2010, forty-five globally threatened non-marine mammal species have been recorded in Myanmar (IUCN 2011; Annex 3). Globally threatened non-marine mammal species of Myanmar included two endemic species: Anthony's Pipistrelle and Joffre's Pipistrelle. Myanmar also supports an endemic sub-species of Eld's Deer (*Cervus eldii thamin)* (endangered). This subspecies, which is known as Thamin, occurs in the Central Dry Zone (McShea *et al.* 1998, Wemmer 1998). Myanmar also supports a large number of globally threatened species with wide distributions in the Indo-Myanmar (Indo-Burma) Hotspot and elsewhere, including endangered species of Asian Elephant (*Elephas maximus*) and Tiger (*Panthera tigris*), and vulnerable species of Gaur (*Bos gaurus*), Clouded Leopard (*Neofelis nebulosa*), Fishing Cat (*Prionailurus viverrinus*), Dhole (*Cuon alpinus*) and Himalayan Black Bear (*Ursus thibetanus*). Most of these species are mainly threatened by subsistence hunting in Myanmar, as elsewhere.

High mountains in northern Myanmar support a number of mammal species, which are characteristic of the Eastern Himalayas, including vulnerable species of Red Panda (*Ailurus fulgens*), Takin (*Budorcas taxicolor*) and Red Goral (*Naemorhedus baileyi*). For most of these species, the current population status in Myanmar is poorly known and comprehensive population surveys should be given a high priority.

A few globally threatened mammal species recorded in Myanmar have not been confirmed to occur in the country in recent years, including Lesser One-horned Rhinoceros (*Rhinoceros sondaicus)* and Hairy Rhinoceros (*Dicerorhinus sumatrensis*), both are critically endangered species, and field surveys are required to conclude whether these species are still existing in their habitats of Myanmar. While Tiger has been the major focus of the national status survey, it is also required to conduct national level surveys for other mammal species, as it is possible that populations of some or all of these species may persist in Myanmar.

10 primate species of Myanmar are included in IUCN Red List of threatened species of 2011: Four species belong to endangered status and the remaining six are under the vulnerable status (Annex 3).

In addition to wild populations, Myanmar owns one of the largest captive Asian Elephant herds in the world, with almost 3,000 animals managed by the government and by private owners. These animals represent a major workforce, especially for timber extraction in forestry sector. It has been estimated that there are approximately 3,000 wild elephants in Myanmar's

forests. In recent years, there has been concern that live-capture, although prohibited by law, may have had a significant impact on the remaining wild Asian Elephant populations.

Birds

Thirty-six globally threatened bird species have been detected in Myanmar in 2010 (IUCN 2011; Annex 3). A large proportion of these species are characteristic of forest ecosystems; most major forest types support a suite of globally threatened species. Hill and temperate forests are important for a number of globally threatened passerines, including endangered species of White-browed Nuthatch (*Sitta victoriae*), vulnerable species of Beautiful Nuthatch (*Sitta formosa*) and Giant Nuthatch (*S. magna*) and vulnerable species of Blyth's Tragopan (*Tragopan blythii*). These forests also support important population of vulnerable species of Rufous-necked Hornbill (*Aceros nipalensis*). Lowland semi-evergreen mixed deciduous and deciduous dipterocarp forests support important population of critically endangered species of White-bellied Heron (*Ardea insignis*) and endangered species of Green Peafowl (*Pavo muticus*); a species that has undergone dramatic declines across much of mainland Southeast Asia (BirdLife International 2001). Lowland wet evergreen forests in southern Myanmar support a number of globally threatened bird species, including endangered species of Gurney's Pitta (*Pitta gurneyi*) and vulnerable species of Plain-pouched Hornbill (*Aceros subruficollis*). For most globally threatened bird species, which are characteristic of forest habitats, habitat loss due to unwise resource utilization is the main threat. Furthermore, over-exploitation is also a major threat to a number of larger-bodied species, including hornbills, galliforms and pigeons.

Many of Myanmar's globally threatened bird species are characteristic of wetland ecosystems, including some of the most threatened bird species in the country. A number of these species are characteristic of coastal habitats, such as Spotted Greenshank (*Tringa guttifer*) (Endangered). However, the majority are characteristic of freshwater habitats, including endangered species of White-winged Duck (*Cairina scutulata*), and Masked Finfoot (*Heliopais personata*) and vulnerable species of Indian Skimmer (*Rynchops albicollis*). Across the Indo-Myanmar (Indo-Burma) Hotspot, wetland ecosystems generally receive less conservation investment, and are under higher levels of threat than forest ecosystems. Myanmar supports some of the best examples of these ecosystems remaining in the hotspot, most notably: networks of flowing and non-flowing wetlands within lowland forest; wide, slow-flowing, lowland rivers; and mangrove. Myanmar's globally threatened bird species also include critically endangered species of Spoon-billed Sandpiper (*Eurynorhynchus pygmeus*), a migratory shore bird mainly occur in Gulf of Mottama. In addition to forest and wetland ecosystems, open country ecosystems are also important for globally threatened bird species, including critically endangered vulture species such as Red-headed Vulture (*Sarcogyps calvus*). The populations of these species in Myanmar are of high global conservation significance. It is because these species do not appear to be affected by the factors, mainly toxicity from the veterinary pharmaceutical diclofenac (Oaks *et al.* 2004), which are responsible for the precipitous decline of vulture populations in the Indian Sub-continent over the last decade (BirdLife International 2001, Pain *et al.* 2003,). Globally threatened species, characteristic of open country habitats, are facing a number of threats, including disturbance on habitats, and use of agrochemicals. A number of globally threatened bird species recorded in Myanmar in the past have not been confirmed to occur in the country in recent years. These include vulnerable species of Jerdon's Babbler (*Chrysomma albirostre*), a species that is the characteristic of tall riverine grasslands in Pakistan, Nepal, northern Indian and, at least previously in Myanmar, where this species has not been recorded since 1941; and critically endangered species of Pink-headed Duck (*Rhodonessa caryophyllacea*), one of the most enigmatic bird species in the world, which previously inhabited secluded wetlands and marshes in the forests and grasslands of northern Myanmar and northern India, and there have been no confirmed records from Myanmar since 1910 or from

anywhere in its range since 1949 (BirdLife International 2001, 2003). Though no recent record has been reported for the existence of Pink-headed Duck, the upper section of the Chindwin River plus several of its major tributaries, such as the Tanai, Tawang and Palaunglanbum Rivers are supposed to be the last frontier for the Pink-headed Duck as its occurance has been reported by local people (U Htin Hla verbally 2004 cited in BirdLife International 2005).

Reptiles

Twenty-four globally threatened reptile species have been recorded in Myanmar in 2010, most of them are turtles (IUCN 2011; Annex 1). As elsewhere in Asia, the distribution and habitat requirements of most turtle species in Myanmar are still little known. Most recent records of these species are obtained from wildlife markets. The main threat to wild populations is over-exploitation, driven in most cases by the high value of turtles in the wildlife trade. Most turtle species have naturally slow reproductive rates, and consequently, the turtle species may not be able to sustain its population under the high levels of exploitation. There is an urgent need to identify and secure wild populations of all globally threatened turtle species in the country. Comprehensive global threat assessments have not been conducted for other reptile taxa occurring in Myanmar. A global reptile assessment conducted by IUCN-Species Survival Committee (SSC) is not yet available for Myanmar. Nevertheless, Myanmar is likely to support a greater number of globally threatened reptile species than that are currently recognized by IUCN Red List of Threatened Species ver. 2011.

Amphibians

None of the amphibian species in Myanmar have been assessed as globally threatened species by IUCN Red List of Threatened Species ver. 2011. However four amphibian species, all frogs, have been identified as near threatened status and their populations are decreasing (IUCN 2011). These species are ***Limnonectes blythii*** (Giant Asian River Frog), ***Bufo pageoti***, ***Glyphoglossus molossus*** and ***Nanorana arnoldi***. The apparent lack of globally threatened amphibian species from Myanmar may reflect low levels of survey effort rather than the true conservation status of Myanmar's amphibians. A number of globally threatened species may occur but remain unrecorded to date. Further research and surveys may reveal that the country supports a number of endemic species that qualify as globally threatened. Collections made by the Myanmar Herpetological Survey are thought to contain a number of undescribed amphibian species and await further analysis.

Fish

Similar to other species groups in Myanmar, there is also a need for a comprehensive global threat assessment of fish species in order to identify global conservation priorities in Myanmar. The fish diversity of Myanmar's non-marine habitats is seriously threatened by destructive fishing practices, dam construction, pollution and invasive species. A number of fish species may be threatened with global extinction, particularly among the fauna of Inlay Lake, which is extremely sensitive and supports national endemic. To date, however, no fish species confirmed to occur in non-marine habitats in Myanmar have been assessed as globally threatened.

Invertebrates

In the absence of comprehensive global threat assessments of invertebrate taxa in Myanmar, it is difficult to identify taxonomic priorities for global invertebrate conservation in the country. Only a single invertebrate species found in Myanmar has been assessed as globally threatened: Andaman Crow ***Euploea andamanensis***. This butterfly species is endemic to the Andaman archipelago, and occurs on Myanmar's Table and Cocos islands.

Plants

Global threat assessments have only been conducted for a small proportion of Myanmar's plant species, principally gymnosperms and certain angiosperm families. 43 plant species recorded in Myanmar have been assessed as globally threatened (IUCN 2011). All the globally threatened angiosperms are trees, and over two thirds are members of the Dipterocarpaceae. The globally threatened gymnosperms comprise the vulnerable species of *Cycas siamensis*, *Calocedrus macrolepis*, *Cephalotaxus mannii* and *Taiwania cryptomerioides*, and endangered species of *Picea farreri*. The major threats to globally threatened plant species in Myanmar are degradation and loss of forest due to unsustainable resource extraction. Species with a high economic value are also threatened by over-exploitation, such species consists of *Aquilaria malaccensis* (vulnerable), and a source of an aromatic non-timber forest product (NTFP) called agarwood.

2.4. Agricultural Biodiversity

Plants play a vital role for the survival of human society. Plant genetic resources provide enormous potential for food security, biofuel and biopharmaceutical production. Based on the richness of biodiversity under increasing threat, Conservation International has defined biodiversity hotspot areas of the world as priority areas for conservation. Myanmar is located at the junction of the Himalayan, Mountains of Southwest China and Indo-Burma biodiversity hotspot areas.

Diverse climatic conditions and parent rock types of Myanmar have given the country a wide range of soil classes with varying topology, but only Fluvisols, Luvisols, and Aerisols are agriculturally important. There exist diverse opinions on the agroecological zones of Myanmar by different researchers. Combining five major soil zones (Figure 3) with three rainfall regimes (Figure 4), Virmani *et al*. (1991) classified fifteen agro-climatic zones in Myanmar.

In contrast, Tun *et al*. (2005) identified eight agroecological zones in Myanmar by using monthly meteorological data accumulated at 34 observatory sites throughout Myanmar for more than 30 years of rainfall; maximum, minimum, and mean temperatures; differences between day and night temperatures; evapotranspiration and sunshine, compiled by FAO (1987): Northern Mountainous (NM), Eastern Plateau (EP), Semi-arid (SAr), Western Hilly (WH), Western Coastal (WC), Southern Coastal (SC), Southern Plain (SP) and Ayeyawady Delta (AD). The NM, EP and WH zones have the most complex topography, with high mountains and deep valleys.

Based on a current report by Myanmar Agriculture Service to FAO (2009), major agro-climatic zones are summarized in (Table 4). Rich diversity of tropical and subtropical species and diverse ecosystems are found in those diverse agroecosystems of Myanmar. Approximately, over 60 different crops are grown in the country and they could be grouped into seven categories as follows (Myint 1989):

1. Cereals – Rice, wheat, maize and millet.
2. Oil seeds – Groundnut, sesame, sunflower and mustard.
3. Pulses– Black gram, green gram, butter bean, red bean, pigeon pea, chickpea, cowpea and soybean, etc…
4. Industrial crops – Cotton, sugar cane, tobacco, rubber and jute.
5. Culinary crops – Potato, onion, chili, vegetables and spices.
6. Plantation crops – Tea, coffee, coconut, banana, oil palm, toddy palm and other fruits.
7. Other crops – other crops that are not listed in the above groups.

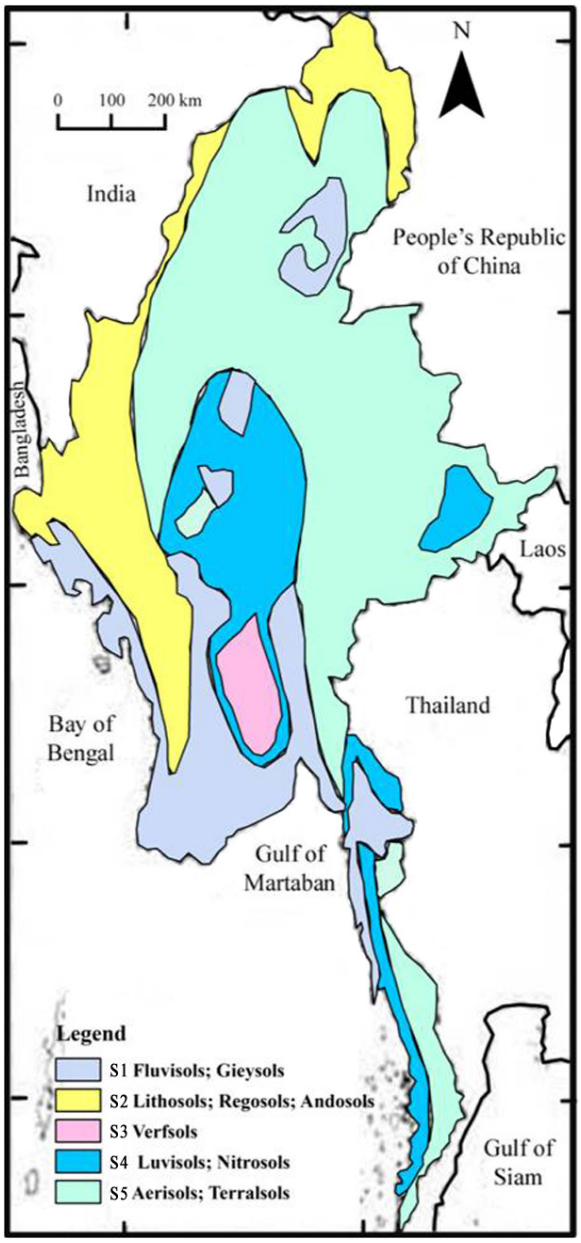

Figure 3. Major Soil Zones.

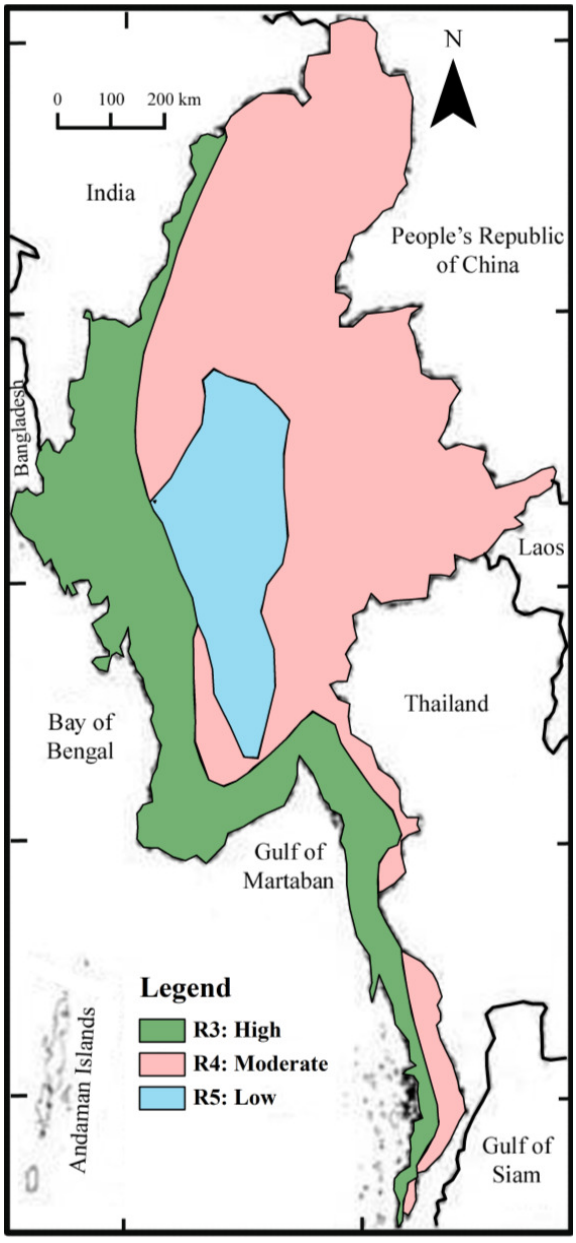

Figure 4. Major Rainfall Zones.

Table 4. Major Agro-climatic Zones in Myanmar (MAS quoted in FAO/WFP, 2009).

Name	Geographical description	Administrative units	Main agricultural practices
A. Bago, Kachin River-side Land	Upper Delta, Kachin plain, flat plain along the side of river Ayeyawady and Sittaung, moderate rainfall (1000 - 2500 mm).	Ayeyawady Region, Kachin State, Sagaing Region, Mandalay Region and Bago Region.	Rice, pulses, oilseeds, sugarcane, tobacco and Kaing/Kyun cultivation
B. Central Dry Zone	Central dry zone, rainfall less than 1000 mm, highest temperature in summer, flat plain, some areas with uneven topography.	Magway Region, Mandalay Region, and Sagaing Region.	Upland crops, oilseeds, pulses, rice, cotton, irrigated agriculture and Kaing/ Kyun cultivation

Table 4. Major Agro-climatic Zones in Myanmar (MAS quoted in FAO/WFP, 2009) (Cont'd).

Name	Geographical description	Administrative units	Main agricultural practices
C. Delta and Coastal Lowland	Delta, lowland and mouth of rivers in coastal area, heavy rainfall (more than 2500 mm).	Ayeyawady Region, Yangon Region, Bago Region, Mon State, Kahyin State, Taninthayi Region and Rakhine State.	Rice, pulses, oilseeds and nipa palm
D. Kachin and Coastal Upland	Mountainous, slope land, heavy rainfall (more than 2500 mm).	Kachin State, Rakhine State, Taninthayi Region, Mon State, Kayin State, Kayah State, Yangon Region and Bago Region.	Orchard, plantation crops, fruit trees and upland agriculture
E. North, East and West Hills	Hilly areas, uneven topography, moderate to heavy rainfall, slope land	Kachin State, Chin State, and Shan State.	Upland crops, shifting cultivation and fruit trees
F. Upper, Lower Myanmar and Shan Plain	Plain, upper and lower parts outside of central dry zone, plateau.	Sagaing Region, Kachin State, Shan State, Bago Region, Magway Region, Mandalay Region and Yangon Region.	Upland crops, oilseeds, pulses, vegetable and wheat

Inter- and intraspecific genetic variations are also observed among the crops sown nationwide, especially for rice, maize, sorghum, millet, sesame, groundnut, niger, ginger, turmeric, custard apple, okra, chili, pepper, tomato, citrus, water melon, mango, jack-fruit, banana and medicinal plants (Tun and Than 1995).

Myanmar is assumed to be home of important crop species such as rice, mango, banana and sugarcane. Wild relatives and local landraces of those cultivated crops are distributed in Myanmar. According to genetic, geographical and molecular studies, Myanmar is supposed to be in the center of diversity of cultivated rice, *O. sativa indica* (Londo *et al*. 2006 quoted in DAR 2011). Several wild legume species related to cultivated mung bean, black gram and azuki bean are distributed in different ecosystems of Myanmar, including coastal sandy soils, lime stone hills and high lands of Shan state (Ye and Yamaguchi 2007). These wild legume species could provide useful genes for legume crop improvement of Myanmar. Moreover, several lesser used plant species are grown and used by diverse ethnic groups in Myanmar.

Similar to global phenomena, habitat destruction, replacement of traditional varieties with modern varieties, climate change (e.g. raising temperature, drought and salinity), population pressure and natural disasters (e.g. Nargis, 2008) are threatening the agricultural biodiversity of Myanmar. Surveys and inventories of plants, animals and microorganisms related to agricultural production, their conservation and utilization in Myanmar are needed to sustain the food security and development of Myanmar. As an agro-based country, agriculture sector is the backbone of Myanmar's economy contributing 36% of gross domestic product (GDP) (CSO 2007). The population of Myanmar is expected to be 60 million by the year 2015(CSO 2007). Increasing population pressure, changes in life style and food habits of the country demand more food supply and more diverse diets. It is critically important to make a balance and take a proactive approach to the conservation and utilization of natural and biological resources of the country.

Recognizing the great value of plant genetic resources (PGR) and the increasing threat of loss of plant genetic diversity from their natural habitats and farm lands, Seed Bank of MOAI has made efforts to collect and conserve the agrobiodiversity of Myanmar (Table 5). Currently, more than 10,929 accessions of important crops have been systematically conserved in *ex-situ*

(Cold storage facility and field gene bank for vegetative propagated crops). Moreover, several attempts are being made to exploit the useful genes from this conserved germplasm using biotechnology. Research focused on a better understanding of plant genetic diversity present at the gene, species and ecosystem levels could contribute to sustainable conservation and effective utilization of PGR.

International collaboration for sustainable conservation and utilization of PGR are being made with the Myanmar Seed Bank such as:

- Characterization and regeneration of some Annex-1 crops in collaboration with Global Crop Diversity Trust (GCDT), Italy,
- Cooperation on biotechnology and PGR between Rural Development Administration (RDA) Korea,
- Conservation and use of underutilized species with Tsukuba University, Japan and
- Establishment of National Information Sharing Mechanism on Global Plan of Action (NISM-GPA) with FAO.

However, Myanmar needs to strengthen its capacity for PGR management by upgrading the current *ex situ* conservation facility into a genebank, implementing on farm conservation of wild crop relatives and by establishing biodiversity education, sound policies and legislation for natural resources, environment and international collaborations.

Table 5. Current Status of Collected, *ex situ* Conservation and Distribution of PGR in Myanmar Seed Bank (March, 2011).

Crop group	Collected samples	Ex situ (-5° C), 30-40% RH	Distribution
Rice	7,908	6,845	12,375
Wild Rice	187	184	600
Cereal Crops	2,504	1,273	-
Food Legumes	228,2	1,945	2,268
Oil Seed Crops	239,2	640	104
Others	1174	42	240
Total	**16,447**	**10,929**	**16,237**

Source: DAR Quarterly report (2011).

2.5. Livestock Biodiversity

To meet the growing market demand on meat, eggs and milk, livestock production has been gradually increased over the years ever since the Government made an effort to promote the livestock sector in 1949. Commercial interest drives the trend of importing exotic breeds from other countries into Myanmar for maximizing the return on investment in livestock production. This causes concern for the loss of livestock biodiversity in Myanmar.

The breeding of major livestock and their associated regions are described in Table 6, however a systematic national assessment of livestock diversity is yet to be done. During the formulation of the NBSAP, experts did a quick assessment from the concerned government departments. The following accounts give the status of two species that are considered at risk because of a population decrease nationwide (LBVD 2011). These are Myanmar Myin Horse and Inbinwa chicken.

Horse – Myanmar Myin

Horses are used to pull carts in Myanmar, especially in the central part of the country. Horses are also used in traditional ceremonies and as special occasions as ornaments. The possession of horses in rural areas reflects the wealth of the household. In the past, with the favourable climate and available abundant agricultural byproducts, breeding of horses was quite

common among rural communities. However, recent urbanization and improvement in transportation infrastructure and facilities has changed the trend of breeding horses. It is now seldom that people raise horses in villages and consequently, the population of horses has decreased in recent years.

Inbinwa chicken

Local farming of Inbinwa chicken or Myogyi chicken is considered endangered in Myanmar. This local race has been popular among urban consumers due to its unique flavor and good mass of flesh. But the population of Inbinwa chicken has steadily declined over the years since poultry farming of broiler chickens has become dominant during last decade due to its short production life cycle and market incentives given by commercial broiler companies. Since farmers practise the scavenging system for raising chickens, it is difficult for disease control, and poultry yield is much lower than that of exotic broiler chickens. Therefore, farmers have lost their interest in Inbinwa chicken farming.

Table 6. Breeds of Domestic Animal in Myanmar.

No.	Species	Scientific Name	Local Name	Region/Location
1	Cattle	*Bos indicus*	Pya Sein, Shwe Ni, Shan Nwa, Katonwa, Kyauk Phyu	Mandalay, Magway, Sagaing,Shan, Kayin, Rakhine
2	Mythun	*Bos frontalis*	Nwa Nauk	Chin
3	Buffalo	*Bubals bubals*	Myanmar Kywe, Shan Kywe	Ayeyawady, Sagaing, Shan
4	Horse	*Equus caballus*	Myanmar Myin, Shan Myin	Magway, Mandalay, Sagaing, Shan
5	Ass	*Equus asinus*	Myanmar Mye	Shan
6	Pig	*Sus domesticus*	Bo cake, Chin wet	Badoung, Akhar, Wet taung Magway, Mandalay, Sagaing, Shan
7	Sheep	*Ovis aries*	Myanmar Thoe, Karla Thoe	Magway, Mandalay, Sagaing
8	Goat	*Capra hircus*	Seik Ni / Jade Ni,/ Nyaung Oo/Htain San / Hkway Seik	Magway, Mandalay, Sagaing , Rakhine
9	Chicken	*Gallus gallus*	Taik Kyet, Tainyin Kyet, Kyet Lada, Inbinwa Kyet	Wide spread
10	Turkey	*Meleagris gallopavo*	Kyet Sin	Wide spread
11	Duck	*Anas platyrbynchos*	Khayan Be, Taw Be	Wide spread
12	Duck, Muscovy	*Cairina Maschata*	Mandarli	Wide spread
13	Goose	*Anser cygnoides*	Ngan	Wide spread
14	Quail	*Coturnix spp*	Ngown	Wide spread

2.6. Status of Invasive Species

Invasive Alien Species (IAS) are non-native species in a specific ecosystem whose introduction and subsequent establishment impact negatively on the economy, agriculture, biodiversity and/or animal and human health. They include animals, plants, fungi and microorganisms introduced from their original habitat and have the ability to outcompete native species for food and habitat. Little is known about the status of IAS in Myanmar but a few IAS have been observed throughout the country introduced by water, air and/or land transport. Trans-boundary movement of IAS is potentially high along the national border of Myanmar with neighbouring countries such as India, Bangladesh, China, Laos and Thailand. IAS can also be introduced unintentionally by tourists or through the transport of cargo or movement of pets,

plant parts, seeds and residues. For purposes of research, medicine, ornament and industrial uses, IAS might be intentionally imported into Myanmar.

According to the Forest Research Institute of Myanmar, IAS such as *Prosopis* spp., *Acacia auriculiformis*, *Ageratum conyzoides*, *Leucaena leucocephala*, *Eucalyptus* spp., *Casurina equisetifolia*, *Chromolaena odorata*, *Hyptis suaveolens*, *Lantana camara*, *Mimosa diplotricha*, *Mikania micrantha*, *Sorghum halepense*, *Paspalum conjugatum*, *Imperata cylindrica*, *Echinochloa crus-galli*, *Eleusine indica*, *Pennisetum polystachion* and many others are commonly found in forest plantations, agriculture land, urban areas, wetlands and natural lands. Their presence in these places is associated with the risk of native species losses and as such IAS threaten biological diversity, agricultural and forest ecosystems. Water Hyacinth *(Eichhornia crassipes)* was put into lakes and ponds for aesthetic purposes but it has been widely spread into natural water bodies. Ponds, lakes and streams are clogged with these plants and consequently, it is threatening the biodiversity of native aquatic species. Another example of an IAS is *Achatina fulica* or the Giant African Snail, which was introduced into Myanmar through trade. It has moved into croplands and is a vector for parasites, which attack native snail species but its population is now decreasing gradually in Myanmar. Importation of the honey bee (*Apis mellifera ligustica*) from Israel in 1979 by the Bee Keeping Department of Myanmar resulted in the introduction of the parasitic mite (*Varroa jacobsoni*). This parasite attacks the imported and indigenous bee species including the Giant Honey Bee, Hollow Hived Honey Bee and Bush Honey Bee. More information of IAS in Myanmar is presented in Table 7 in order to better understand its impact on the environment.

Table 7. Featuring A Few IAS in Myanmar.

	*Acacia auriculiformis* A.Cunn Introduced from Australia for fuel, pulp and paper production. The flowers cause irritation to eyes and cause asthma.
	*Achatina fulica* This snail is widely distributed in many parts of the country impacting agricultural crops and forest nursery plants. They are also a nuisance and carry parasites that threaten native snails, and affect native ecosystems by altering the food chain.
	*Clarias gariepinus* This African catfish was introduced from Thailand in 1991 for food. As a carnivorous fish, they eat other aquatic species and threaten the biodiversity of aquatic ecosystems after escape from fish farm due to negligence of fish farmers.
	*Chromolaena odorata* (L.) R.M.King & H Robinson This shrub is widely distributed in natural forests, plantations and fallow lands, and is allelopathic and toxic to animals.

Table 7. Featuring A Few IAS in Myanmar (Cont'd).

	*Cyprinus carpio* A fresh water fish introduced from Indonesia in 1964 as a source of protein and in some cases also for ornamental purposes. This fish reduces water quality and destroys aquatic vegetation.
	*Lantana camara* L Lantana was brought into Myanmar during British colonial rule before World War II as an ornamental. However, it has become invasive, displacing indigenous plants and the organisms associated with them.
	*Leucaena leucocephala* (Lam.) De Wit Introduced from Hawaii in 1978 for fuel wood It is a fast growing species with high seed production. As a result, areas surrounding mature leucaena trees have an abundance of younger saplings and the land is no longer usable for other purposes such as farming.
	*Mimosa diplotricha* Mimosa diplotricha is a scrambling plant that can rapidly invade large areas posing a threat to indigenous plants. Due to the presence of thorns, it is difficult for plantation workers to remove this weed.
	*Pennisetum polystachion* *Pennisetum polystachion* was introduced from Australia in 1976 to improve pasture production. It is highly flammable and contributes to increased fire intensities and frequencies.
	*Pomacea canaliculata* It is a serious pest in paddy (rice) fields with bright pink egg masses. It is abundant in Inlay Lake.
	*Prosopis juliflora* DC Introduced around the 1950s by the Agricultural Research and Development Corporation (ARDC) for greening of the dry zone in the central part of Myanmar. High drought resistance, greater tolerance to saline soils, and aggressive regeneration, has meant that this species survives well in semi arid areas and as a result rapidly colonizes large areas. It has sharp and poisonous thorns, which can injure livestock and people.
	*Teredo sp.* Ship worm, Marine borer This is a seaborne IAS that decays wood and causes destruction of the wooden parts of ships, canoes, bridges and wharves.

With the available information, an attempt is made in compiling a list of the major IAS in Myanmar together with their scientific names, invasive pathways, distribution in Myanmar, and observed damage or negative impact by these species (Table 8). Further research and study are required to know the impact of IAS on biodiversity and environment. All of these accounts call for attention to potential damage caused by these species to the environment and biodiversity so that urgent measures can be taken to minimize their negative impact.

Table 8. List of Major IAS in Myanmar.

No.	Species Name	Common Name	Type	Introduction / Accidental	Habitat	Impact
1.	*Acacia auriculiformis* A.Cunn.	Acacia, Aurisha	Tree	Intentional for agro-forestry	Road side, plantations,	Cause irritation and asthma from pollen
2.	*Leucaena leucocephala* (Lam.) De Wit	Leucaena	Tree	Intentional for fuel wood	Plantations, gardens, open spaces	Displacing native species.
3.	*Prosopis juliflora* DC.	Mesquite,	Shrub/ Tree	Intentional for shade, fodder and dry zone greening	Dry land, pasture	Very aggressive in displacing native vegetation. Its poisonous thorns can injure livestock and people.
4.	*Chromolaena odorata* (L) R.M King & H Robinson	Bitter bush	Shrub	Ornamental	Fallow lands, road sides, pasture	Skin irritation, asthma, and toxic to animals. Displaces native vegetation and species.
5.	*Hyptis suaveolens* (L.) Poit	Bush tea	Shrub	-	Plantation, road sides, pastures, dry lands	Causes asthma, and damage to arable lands.
6.	*Lantana camara*	Lantana	Shrub	Intentional for ornament	Plantation, pasture, urban	Poisonous to cattle, understory competitor, and displaces native species.
7.	*Echinochloa crus- galli* (L.) P.Beauv.	Barnyard grass	Grass	Unintentional	Rice fields	Yield reduction, and toxic to animals.
8.	*Imperata cylindrical* (L.) P. Beauv.	Blady grass, Congo grass	Grass	Cosmopolitan distribution	Plantation, pasture, dry lands	Inhibits natural regeneration of forests and highly flammable.
9.	*Pennisetum* spp.	Mission grass	Grass	Intentional for pasture	Forest and plantations	Aggressive and competitive, and inhibits growth of plantation trees.
10.	*Mikania micrantha H.B.K*	Mile-a-minute weed, Chinese creeper, American rope	Climber	Ornamental	Forest and plantations	Smothers other plants, and competes for water and nutrients.

Table 8. List of Major IAS in Myanmar (Cont'd).

No.	Species Name	Common Name	Type	Introduction / Accidental	Habitat	Impact
11.	*Mimosa diplotricha*	Sensitive plant	Small shrub	Ornamental		Thorny, spreads rapidly, smothers vegetation
12.	*Eichhornia crassipes (Mart.) Solms*	Water hyacinth	Aquatic weed	Aesthetic/ Ornamental	Lakes, ponds, creek - water bodies	Clogs and dries up waterways.
13.	*Achatina fulica*	Giant African snail	Snail	Ornamental	Gardens, nurseries, croplands	Nuisance, impacts crops, transmits parasites.
14.	*Pomacea canaliculata*	Golden apple snail	Snail	Unintentional	Paddy field	Poses major threat to rice production.
15.	*Clarias gariepinus*	African cat fish	Fish	Intentional for food production		Reduces water clarity and destroys other aquatic organisms.
16.	*Cyprinus carpio*	Carp	Fish	Intentional for food production	Water reservoirs, lakes, mangroves	Reduces water clarity and, destroys and uproots aquatic vegetation.
17.	*Ctenopharyngodon idella*	Grass carp	Fish	Intentional for food production	Water reservoirs, lakes	Eliminating vegetation from water systems, and carry parasites such as Asian tapeworm and induce other harmful effects to introduced waters.
18.	*Oreochromis spp.*	Tilapia	Fish	Intentional for food production	Water reservoirs, lakes	Declining culturally valued native fish species, and the alteration of natural benthic communities.
19.	*Teredo spp.*	Ship worm, Marine borer	Marine worm	Moving	Sea, Mangrove area	Decays wood, timber and destroys bridges.

Focus on priority species and sites of IAS

Considering the negative impacts of IAS, comprehensive research needs to be undertaken by a multi-disciplinary team composed of scholars and researchers from various concerned government departments and universities in order to fill the knowledge gap about the presence of IAS and its associated impacts on environment and local livelihoods. If a national research project is not possible, the following sites should be given priority at least for conducting a systematic study in order to respond to the problems caused by IAS in these areas.

(1) Inlay Lake, situated in Southern Shan State of Myanmar, is a unique place from a historical and geographical perspectives with distinctive features attracting both local and foreign visitors. The lake is also a major source of water for hydro-electricity generation. There is

also a wildlife sanctuary in the lake in order to protect endangered bird species. Local people, known as *Inthars*, live near the lake and their livelihoods are dependent on tourism, agriculture, fishing, handicraft making and silversmithing. However, Inlay Lake is facing rapid environmental degradation and its biodiversity are threatened by increasing competition among stakeholders for the use of natural resources and land. One of the environmental threats is the increased population of Golden Apple Snail (*Pomacea canaliculata*) in recent years. It is believed that a business company introduced this snail in order to control the growth of water hyacinth (*Eichhornia crassipes)*. However, the population of snail rapidly increased in the water bodies and it is now becoming an extremely serious pest that is affecting vegetables grown in floating garden by the *Inthars*. It is also a health concern when people touch the snail.

(2) Dry Zone, located in the central part of Myanmar, also needs urgent action to strengthen the management of IAS that is widespread in the region. With the aggressive regeneration capacity and rapid growth, IAS such as *Prosopis juliflora* easily colonizes the remaining dry forests, grazing land and farmland. This imposes not only a serious threat to biodiversity and land use in the dry zone but the thorns can injure people and livestock. Without proper control and management, this semi-arid ecosystem is likely to be strongly affected by invasive species.

CHAPER 3: CONTEXT OF BIODIVERSITY CONSERVATION IN MYANMAR

3.1. National Environmental Policy and Agenda 21

Myanmar's National Environmental Policy developed in 1994 for integration of environmental consideration into social and economic development clearly describes that ….

> …….. The wealth of the nation is its people, its cultural heritage, its environment and its natural resources. The objective of Myanmar's environmental policy is aimed at achieving harmony and balance between these through the integration of environmental considerations into the development process to enhance the quality of the life of all its citizens. Every nation has the sovereign right to utilize its natural resources in accordance with its environmental polices; but great care must be taken not to exceed its jurisdiction or infringe upon the interests of other nations. It is the responsibility of the State and every citizen to preserve its natural resources in the interests of present and future generations. Environmental protection should always be the primary objective in seeking development."

In compliance with Myanmar's National Environmental Policy, Myanmar Agenda 21 was developed in 1997 and it was a collaborative effort made by various government agencies in order to strive for the sustainable development of the country. Myanmar Agenda 21 is a blue print for all natural resource management and environmental conservation work and the pursuit of the activities contribute to biodiversity conservation throughout the country; for example, efforts made in sustainable forest management, sustainable tourism and sustainable transport and infrastructure development with a reduced impact on biodiversity. Within the framework of Myanmar Agenda 21, important measures for biodiversity conservation are summarized as follows:

- Strengthening protected area management
- Promoting international cooperation
- Developing a national database of biodiversity
- Strengthening laws and legislation for biodiversity conservation management
- Protecting threatened and endangered species of plants and animals
- Strengthening sustainable use of natural resources
- Enhancing institutional capacity for biodiversity conservation and management
- Promoting education awareness and involvement of local communities in biodiversity conservation and management
- Studying the economic issues related to biodiversity

The level of implementing these activities is widely varied. Apart from the efforts made in expansion of protected areas nationwide; most of the activities are not fully operational yet. The MOECAF is the most responsible agency for implementing the national policy on nature conservation in Myanmar but other Ministries such as the MOAI, MOLF, etc., share the common responsibility and accountability for biodiversity conservation. The institutions that are key to environmental management and biodiversity conservation are discussed in the following section.

3.2. Existing Institutional and Legal Framework for Environmental Protection and Biodiversity Conservation

Myanmar was governed by the State Peace and Development Council (SPDC) for the period from September, 1988 to March, 2011 (which was formerly known as the State Law and Order Restoration Council - SLORC). Recently SPDC handed over power of the state to the

newly elected government on 30 March, 2011. Under the new government, legislative function is mainly the responsibility of the Pyithu Hluttaw and Pyidaungsu Hluttaw. Administrative function is performed by the Cabinet lead by the Union President. Under this new political era, Myanmar is practicing decentralization, and this means that each of the 14 Regions and States in Myanmar has its own governing body. Even though, institutional reform is still ongoing under the new government, it has been clearly mentioned in the inaugural speech of the President that serious attention would be paid to the conservation of forests and woodlands, measures would be taken in various sectors to reduce air and water pollution, dumping of industrial waste would be controlled and wildlife would be conserved. The President also stressed a new policy to work for economic development in parallel with environmental conservation. This clearly indicates that the government has vowed to consider the sustainability of biological diversity in the country's sustainable development.

Prior to 1989, no governmental agency existed to oversee environmental matters in Myanmar. In 1989, the Ministry of Foreign Affairs (MOFA) began to assume authority over domestic environmental protection issues, while the Cabinet retained responsibility for international environmental matters. In 1990, a new body known as the National Commission for Environmental Affairs (NCEA) was initiated by the MOFA to act as a central management agency for environmental matters. Creation of NCEA was a significant step in the integration of environmental considerations into Myanmar's development plans. The NCEA's main mission is to ensure sustainable use of environmental resources and to promote environmentally sound practices in industry and in other economic activities. NCEA is supposed to formulate broad policies on natural resource management, to prepare environmental legislation (standards and regulations) for pollution control, monitoring and enforcement, to promote environmental awareness through public education and to liaise as necessary with international organizations in environmental matters.

The NCEA has a Chairman, a Secretary and a Joint Secretary. Until 2004, the former two were simultaneously senior officials in the MOFA, with the NCEA Chairman being the Minister of MOFA. Thus, there appeared to be great potential for coordination of MOFA and NCEA work, especially in relation to international environmental obligations and cooperation with international agencies. However, the management structure was changed in 2005 and the Minister from MOECAF became chairperson of NCEA. Accordingly, Director General of Forestry Planning and Statistics Department was given the responsibility of NCEA's secretary.

The NCEA was composed with nineteen members, all of whom were heads of departments from various sectoral ministries. This ensured multi-agency representation from the other sectors of the economy. There are four sub-committees operating within the NCEA: the Committee on Conservation of Natural Resources; the Committee on Control of Pollution; the Committee on Research, Information and Education; and the Committee on International Cooperation. A Director General or the Head of a relevant government department chaired each of these sub-committees. The operational functions of the NCEA were conducted and coordinated by a secretariat called the NCEA Office, which was established in 1992. This was headed by a Director, who liaises directly with the NCEA Chairman and Secretary while serving as a Joint Secretary of the commission. During the preparation of the NBSAP, NCEA is being reformed once again.

Government agencies

The other important sectoral agencies in the area of environmental protection are the MOECAF and the Ministry of Health (MOH). MOECAF is broadly implementing the mainstream conservation activities related to land degradation (through Watershed Management and Greening Semi-arid Zone), biodiversity conservation (focusing on Protected Area System and Law enforcement) and sustainable use of forest resources (Sustainable Forest Management,

Forest Plantation, Community Forestry & Law enforcement). Some of these activities are also conducive to the conservation of coastal areas such as mangrove rehabilitation and Coastal Watershed Management. MOH is the active agency in public health care, particular reference to reduction of the environmental health risk as guided by National Health Policy. In recent years, MOH has been reinforcing their routine work in incorporating environmental health activities such as surveying for toxic and hazardous materials, monitoring occupational health linked to environmental pollution, and improving clean water supplies and sanitation.

The MOAI is also an important agency in influencing environmental matters relating to land use change and water resources, while Myanmar Agriculture Service (MAS) is delivering extension services for sustainable land use technology. The Department of Agriculture Mechanization is responsible for land reclamation and consolidation works under MOAI. The Water Resource Utilization Department and Irrigation Department under MOAI are concerned with improving water supply for agriculture. Besides, the Myanmar Seed Bank (National Centre of Agrobiological Resources) under MOAI is focal agency for conserving crops and their wild related species in an ***ex-situ*** facility. Key agencies other than MOECAF and MOAI in combating land degradation are the Ministry of Border Affairs (MOBA), National Races and Rural Development and the MOLF. Department of Fisheries under MOLF is responsible for not only fishery resource management but also fish diversity conservation in both fresh water and marine environments.

In terms of providing services for solid waste collection, Yangon and Mandalay (Major Cities of Myanmar) City Development Committees (known as YCDC and MCDC) are major agencies for improving solid waste management systems. YCDC and MCDC are fully responsible for municipal affairs and the development of those two major cities. For the rest of the 328 urban areas and townships throughout the country, solid waste management and drinking water supply are the responsibility of the Department of Development Affairs (DDA) under the MOBA, National Races and Rural Development.

In respond to inland water pollution and air pollution from mobile sources and stationary sources, the following agencies are relevant in terms of partially bounded duties and responsibilities despite having no clear-cut institutional focus on pollution control and monitoring.

Directorate of Industrial Supervision and Inspection (DISI)	❖ Responsible for renewal of annual registration and license upon the satisfactory inspection of factories under Ministry of Industry (MOI) and private sector in line with Departmental Environmental Quality Standards.
Ministry of Science and Technology (Pollution Control Committee)	❖ Technical surveys, research, surveillance and monitoring of pollution.
Department of Cottage Industry	❖ Responsible for supervision and monitoring of small scale cottage industries which are mostly located in residential areas and emitting a great deal of foul smells (such as food preparation industries).
Local Industrial Zone Supervision Committee (set up for each industrial zone as semi-governmental structure including private factory owners)	❖ Handling overall concerns and supervision of industrial zones covering pollution aspects and liaising with respected government agencies.

Localized Industrial Development and Management Committees (set up locally in each State and Region)	❖ Responsible for overall aspects of managing all industries in the given area.
YCDC/MCDC and Township-wise DDA	❖ In addition to solid waste management, these are the most relevant agencies in dealing with wastewater management.
Department of Water Resources and Improvement of River Systems	❖ Improving river systems (dredging & river training) may also link with solid waste management, toxic contamination and inland water pollution.
Ministry of Energy	❖ Solely responsible for policy formulation for Automobile fuel consumption and responsible for mobile source pollution to be controlled by quality of fuel.
Road Transport Administration Department	❖ Responsible for vehicle inspection and annually renewable license upon satisfactory vehicle roadworthiness including emissions of noise and pollution.

As for the sustainable use of water resources, several agencies are separately concerned for water supplies.

- ❖ Irrigation Department is responsible for agriculture water supply for irrigation development. To some extent, urban water supply is also covered by irrigation schemes. Preventing saline water intrusion is also related to the obligation of this department.
- ❖ Water Resource Utilization Department (WRUD under MOAI) is responsible for pumping up water from rivers for agriculture.
- ❖ Department of Water Resources and Improvement of River Systems (DWIRS) is responsible for improving water canals and river systems linked with sedimentation and water quality in rivers.
- ❖ Municipal bodies like YCDC, MCDC and Township DDA are taking the responsibility for urban water supplies.
- ❖ Department of Health is partially responsible for improving rural water supplies and Sanitation.

Local authorities like the State/Region Administration are partly responsible for coastal zone management while there is no specific agency dealing with area-based environmental conservation and management. For instance, the FD is implementing mangrove conservation and rehabilitation while the DOF is focusing on Fishery and Aquaculture development in coastal areas.

To give environmental matters a priority, the National Environmental Conservation Committee (NECC) was formed. Creation of the NECC is an attempt to consolidate the environmental conservation activities at local and national levels. It is chaired by the Union Minister of the MOECAF. In April 2011, NECC was reformed by including 21 members from 19 ministries. Sub-committees were formed eco-region wise under NECC, and their main functions are:

1. to address the environmental problems due to unsustainable land use,
2. to address the environmental problems in rivers and wetland areas,

3. to implement environmental conservation activities in industrial zones and civil areas,
4. to develop policies, principles, rules and regulations for environmental matters and
5. to strengthen the awareness of environmental matters.

Non-Governmental Organizations (NGOs)

In addition to government agencies, there are growing numbers of international and local NGOs addressing environmental issues over the past decade. The local NGO with the largest program of conservation activities in Myanmar is the Forest Resources, Environment, Development and Conservation Association (FREDA), which was established by retired senior officers from the MOECAF and Myanmar Timber Enterprise. FREDA is currently implementing a number of pilot projects on sustainable forest management, and mangrove protection and rehabilitation, in collaboration with several Japanese NGOs. In addition, FREDA conducted the ***Surviving Together Programme*** at Alaungdaw Kathapa National Park, in collaboration with the FD, WildAid and the David Shepherd Wildlife Foundation (DSWF). This program included implementing conservation outreach activities and promoting alternative income generating activities for local communities.

Another local NGO engaged in biodiversity conservation is the Biodiversity and Nature Conservation Association (BANCA). BANCA mainly focuses on bird conservation, and its activities include a number of collaborative projects with BirdLife International, including the inventory and conservation of Important Bird Area - IBAs (including two Darwin-Initiative-funded projects), and the publication of a local-language field guide on the birds of Myanmar. Other recent activities of BANCA have included vulture surveys in Shan State. BANCA has recently participated in a project namely “Conservation and Management of Lampi Marine National Park” collaborative with FD and Istituto Oikos, Italy.

A third local NGO engaged in biodiversity conservation is the Myanmar Bird and Nature Society (MBNS), which focuses on protection, research and public education related to birds and nature. MBNS has implemented a number of conservation projects, including a study on the ecology of White-browed Nuthatch at Natmataung National Park, an environmental awareness program for primary schools in Yangon, and a national bird festival.

There are a number of other local NGOs in Myanmar, many of which have a principal focus on rural development or health. Several of these organizations are focusing on the natural resources sector, for example: Friends of Rainforests in Myanmar, which is working on environmental protection, poverty reduction, education and health promotion, and promotion of renewable energy; and the Renewable Energy Association Myanmar, which is working on promoting renewable energy sources, including fuel wood substitution and biogas use. These organizations could make important contributions to biodiversity conservation, particularly by addressing threats arising from unsustainable use of natural resources.

In addition to local conservation NGOs, international NGOs such as Save the Children, CARE, World Vision, Wildlife Conservation Society (WCS) etc. are working in Myanmar. Mostly these INGOs are working for community development activities and emergency assistance but a few of them integrate environmental conservation activity as an integral part of sustainable livelihood program. Among INGOs, WCS is the only INGO that has a memorandum of understanding with the MOECAF for implementing a specific biodiversity conservation and environmental management program in Myanmar. In particular, WCS is strengthening the institutional capacity of the NWCD of the FD specifically the capacity of staff for protected area management and research activities. The major achievements of WCS include formulating a National Tiger Action Plan and contributing to the expansion of protected areas, especially for

establishing the world's largest Tiger reserve. Other academic institutions and INGOs like the Smithsonian Institution, California Academy of Sciences, BirdLife International, Flora and Fauna International and Conservation International are working in Myanmar through their counterpart agencies, either government or local NGOs.

In recent years, an innovative attempt was made by both international and local NGOs in forming NGO networks for shared learning and collective environmental advocacy. The Mangrove and Environmental Rehabilitation Network (MERN) is one of the networks of this kind for the joint implementation of activities related to environmental management and biodiversity conservation. MERN is lead by FREDA and BANCA, and another 15 local organizations also participate in the network. Similarly, the Food Security Working Group (FSWG) is another NGO network comprised of 45 local and international NGOs. The major focus is securing food for the poor and a collective effort is made for promoting community based natural resource management that is linked with biodiversity conservation.

Environmental Law and Legal Framework for Biodiversity Conservation

Myanmar's environmental law is drafted but it is still in the process of final approval and not yet enacted. At present, environmental protection and management are partly covered by some sectoral laws enacted for regulation of various socioeconomic development activities such as agriculture, livestock, fisheries, forestry and industry. Existing sectoral laws covering environmental regulation are given in Box 1. These laws are generally too broad and inadequate to deal with complex environmental management issues. There is no legislation to deal with specific issues such as waste management, land use and biodiversity (Forest Law and Protection of Wildlife and Protected Areas Law are effective for species and habitat protection; however, it is still inadequate in protecting against the threats of bio-pollution, loss of ecosystem niches and bio-piracy). In relation to pollution, Myanmar has no specific laws to govern air and water pollution. There is a general provision in Section 3 of the Public Health Law, which empowers the Government to carry out measures relating to environmental health, such as garbage disposal, use of water for drinking and other purposes, radioactivity, protection of air from pollution, sanitation work and food and drug safety. However, detailed provisions do not exist to ensure more effective and comprehensive regulation of these matters.

The issue of air pollution from vehicles is increasing in recent years but the existing legal instrument is only to check the vehicle emission level when these vehicles undergo inspection for the annual renewal of their vehicle registration. The control of water pollution in the country is implemented inline with the guidelines issued in June 1994 by the Myanmar Investment Commission. These guidelines should include wastewater treatment plants or systems. Some elements of the Pesticide Law include only a small section for controlling water pollution. There have been increased observations of water pollution in rivers and lakes from sewage, industrial waste and solid waste disposal. Currently enacted legislation does not fully cover such environmental pollution matters. The Standing Order No 3/95 of the MOI has set the water quality standard for industrial effluent but this is only applicable to regulate wastewater discharged from MOI factories. This standing order also describes the requirements for air pollution abatement measures in manufacturing but it does not specify the measures needed to be taken to achieve a standard quality. Myanmar Agenda 21 recognizes the need for Environmental Impact Assessment (EIA) law. While the National Environmental Law is still in draft, Myanmar currently has no formal guidelines for EIA. EIAs are conducted, however, on an *ad hoc* basis for projects funded by international organizations and some foreign corporations.

Box 1: Myanmar Laws Relating To Environment.

A. Administrative Sector

1. The Yangon Police Act, 1899
2. The Towns Act, 1907
3. The Village Act, 1907
4. The Explosive Substances Act, 1908
5. The Poisons Act, 1919
6. The Police Act, 1945
7. The Emergency Provisions Act, 1950
8. The Territorial Sea and Maritime Zones Law, 1977

B. Agriculture and Irrigation Sector

9. The Embankment Act, 1909
10. The Pesticide Law, 1990
11. The Fertilizer Law, 2002
12. The Plant Pest Quarantine Law, 1993and amended in 2011
13. The Seed Law, 2011

C. Culture Sector

14. The Protection and Preservation of Cultural Heritage Region Law, 1998

D. City Development Sector

15. The Yangon Water-works Act, 1885
16. The City of Yangon Municipal Act, 1990 and amended in 1995 and 1996)
17. The Underground Water Act, 1930
18. The City of Mandalay Development Law, 1992

E. Finance & Revenue Sector

19. The Myanmar Insurance Law, 1993

F. Forestry Sector

20. The Forest Law, 1992
21. The Protection of Wildlife and Protected Areas Law, 1994

G. Health Sector

22. The National Food Law, 1997
23. The Traditional Drug Law, 1996
24. The Prevention and Control of Communicable Diseases Law, 1995
25. The National Drug Law, 1992
26. The Union of Myanmar Public Health Law, 1972
27. The Control of Smoking and Consumption of Tobacco Product Law, 2006

H. Hotels and Tourism Sector

28. The Myanmar Hotels and Tourism Law, 1993

I. Industrial Sector

29. The Oilfields Act, 1918
30. The Petroleum Act, 1934
31. The Factories Act, 1951
32. The Oilfield (Workers and Welfare) Act, 1951
33. The Private Industrial Enterprise Law, 1990

Box 1: Myanmar Laws Relating To Environment (Cont'd).

J. Livestock and Fisheries Sector

34. The Law Relating to Aquaculture, 1989
35. Fishing Rights of Foreign Fishing Vessels, 1989 and amended in 1993
36. The Myanmar Marine Fisheries Law, 1990, and amended in1993
37. The Freshwater Fisheries Law, 1991
38. The Animal Health and Development Law, 1993
39. The Veterinary Council Law, 1995

K. Mining Sector

40. The Salt Enterprise Law, 1992
41. The Myanmar Mines Law, 1994
42. The Myanmar Gemstone Law, 1995
43. The Myanmar Pearl Law, 1995

L. Science and Technology Sector

44. The Science and Technology Development Law, 1994
45. The Atomic Energy Law, 1998

M. Transportation Sector

46. The Canal Act, 1905
47. The Yangon Port Act, 1905
48. The Defile Traffic Act, 1907
49. The Ports Act, 1908
50. The Inland Steam Vessels Act, 1917
51. The Myanmar Aircraft Act, 1934
52. The Motor Vehicles Law, 1964 and amended in 1989
53. The Highways Law, 2000
54. Conservation of Water Resources and River Law, 2006

Within the existing legal framework, the following rules and regulations were promulgated to protect and conserve biodiversity in Myanmar.

1879 Elephant Preservation Act

1883 Amendment to Elephant Preservation Act

1902 Forest Act

1912 The Wild Birds and Animals Protection Act

1936 The Protection of Wildlife Act

1956 Amendment to the Protection of Wildlife Act

1992 Forest Law

1994 The Protection of Wildlife and Protected Areas Law

1995 Forest Rules

1995 Forest Policy

2002 The Protection of Wildlife and Protected Areas Rules

International Laws, Treaties and Conventions

Myanmar is a signatory to a number of international agreements concerning biodiversity conservation and sustainable natural resource uses. For the most part, Myanmar's commitments to these agreements have yet to be fully translated into effective conservation action. In Table 9, international and regional laws, treaties and conventions that Myanmar has participated in are listed and the ones related to biodiversity are discussed below.

Table 9. Environmental Conventions / Protocols / Agreements Signed or Ratified by Myanmar.

No.	Environmental Conventions/ Protocols/ Agreements	Date of Signature	Date of Ratification	Date of Member	Cabinet Approval Date	Remark
Regional						
1.	Plant Protection Agreement for the Southeast Asia and the Pacific Region, Rome, 1956		4-11-1959 (Adherence)	4-11-59		
2.	Agreement on the Networks of Aquaculture Centers in Asia and the Pacific, Bangkok, 1988		22-5-1990 (Accession)			
3.	Southeast Asia Nuclear Weapon Free Zone Treaty, Bangkok, 1995	15-12-1995	16-7-1996 (Ratification)			
4.	ASEAN Agreement on the Conservation of Nature and Natural Resources, Kuala Lumpur, 1985	16-10-1997				
5.	ASEAN Agreement on Transboundary Haze Pollution	10-6-2002	13-3-2003 (Ratification)		7/2003 27-2-2003	
International						
1.	Treaty Banning Nuclear Weapons Test in the Atmosphere in Outer Space and Under Water, Moscow, 1963	14-8-1963	15-11-1963 (Ratification)			
2.	Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Sea-Bed and Ocean Floor and in the Subsoil there of, London, Moscow, Washington, 1971	11-2-1971				
3.	Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and on their Destruction, London, Moscow, Washington, 1972	10-4-1972				
4.	International Convention for the Prevention of Pollution from Ships, London, 1973		(Accession)			Undertakes to give effect to this Convention under para 1 & 2 of Article 1 of the Protocol of 1978

Table 9. Environmental Conventions / Protocols / Agreements Signed or Ratified by Myanmar (Cont'd).

No.	Environmental Conventions/ Protocols/ Agreements	Date of Signature	Date of Ratification	Date of Member	Cabinet Approval Date	Remark
International						
5.	Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, London, 1973		4-8-1988 (Accession)			Except for Annexes III, IV and V of the Convention
6.	Treaty on the Non-Proliferation of Nuclear Weapons, London, Moscow, Washington, 1968		2-12-1992 (Accession)			
7.	United Nations Framework Convention on Climate Change, New York, 1992 (UNFCCC)	11-6-1992	25-11-1994 (Ratification)		41/94 9-11-1994	
8.	Convention on Biological Diversity, Rio de Janeiro, 1992	11-6-1992	25-11-1994 (Ratification)		41/94 9-11-1994	
9.	United Nations Convention on the Law of the Sea, Montego Bay, 1982	10-12-1982	21-5-1996 (Ratification)			
10.	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and their Destruction, Paris, 1993	14-1-1993				
11.	International Tropical Timber Agreement (ITTA), Geneva, 1994	6-7-1995	31-1-1996 (Ratification)			
12.	Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985		24-11-1993 (Ratification)	22-2-1994	46/93	
13.	Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987		24-11-1993 (Ratification)	22-2-1994	46/93	
14.	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990		24-11-1993 (Ratification)	22-2-1994	46/93	
15.	The Convention for the Protection of the World Culture and Natural Heritage, Paris, 1972		29-4-1994 (Acceptance)		6/94 9-2-94	
16.	ICAO ANNEX 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. 1 Aircraft Noise		(Accession)			

Table 9. Environmental Conventions / Protocols / Agreements Signed or Ratified by Myanmar (Cont'd).

No.	Environmental Conventions/ Protocols/ Agreements	Date of Signature	Date of Ratification	Date of Member	Cabinet Approval Date	Remark
International						
17.	ICAO ANNEX 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. II Aircraft Engine Emission		(Accession)			
18.	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies (Outer Space Treaty), London, Moscow, Washington, 1967	22-5-1967	18-3-1970 (Ratification)			
19.	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and / or Desertification, Particularly in Africa, Paris, 1994 (UNCCD)		2-1-1997 (Accession)	2-4-1997	40/96 4-12-96	
20.	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany, 1979		13-6-1997 (Accession)	11-9-1997	17/97 30-4-1997	
21.	Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, New York, 1994		21-5-1996 (Accession)			
22.	Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, Rome, 1973		8-9-1994 (Acceptance)			
23.	Cartagena Protocol on Biosafety, Cartagena, 2000	11-5-2001			13/2001 22-3-2001	
24.	Kyoto Protocol to the Convention on Climate Change, Kyoto, 1997		13-8-2003 (Accession)		26/2003 16-7-2003	
25.	Stockholm Convention on Persistent Organic Pollutants (POPs)		18-4-2004 (Accession)	18-7-2004	1-4-2004	

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES has been in operation since 1975 and, 175 countries have signed the Convention as of 2010. It was established to ensure that trade in wildlife and wildlife products is managed sustainably. It aims to regulate international trade in wildlife products through international cooperation while recognizing national sovereignty over wildlife resources. CITES poses three appendices of species for regulating trade. Two main appendices are Appendix I, which lists species that cannot be traded commercially and Appendix II, which lists species that can only enter international trade under specific controlled circumstances. Myanmar's accession to CITES on 13th June 1997 was highly significant, in light of the significance of the wildlife trade as a driving force for over-exploitation of wildlife populations in the country.

Convention on Biological Diversity (CBD)

The CBD has been effective since 1993, and, as of December 2010, 193 nations have signed this convention. Its objectives are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. It seeks to promote conservation of biological diversity in the wild, through requesting contracting parties to identify regions of biodiversity importance, establish a system of protected areas, restore degraded ecosystems, maintain viable populations of species in their natural surroundings, and develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations. Myanmar ratified the CBD on 25th November, 1994 and this NBSAP is prepared as a commitment to Article 6 of the Convention. Myanmar is also preparing a clearinghouse mechanism (CHM) as a commitment to Article 18.3 of the Convention.

World Heritage Convention (WHC)

The WHC has been effective since 1975, and, as of December 2010, had 192 contracting parties. The WHC's aim is to identify and conserve cultural and natural monuments and sites of outstanding universal value. The convention is implemented through the nomination of World Heritage Sites by national governments. Myanmar acceded to the WHC on 29 April 1994. To date, no sites in Myanmar have been inscribed on the list of World Heritage Sites despite the fact that a number of sites clearly meet the criteria for nomination.

Ramsar Convention

Effective since 1975, the Ramsar Convention, officially known as the Convention on Wetlands of International Importance especially as Waterfowl Habitat, currently has 144 contracting parties. It provides a framework for international cooperation for the conservation and wise use of wetlands. As of December 2004, the contracting parties had nominated 1,401 Ramsar sites globally, covering a total area of 123 million ha. Myanmar acceded to the Ramsar Convention on 17 March 2005, nominating Moeyungyi Wetland Bird Sanctuary as the country's first Ramsar site. In addition to Moeyungyi, Myanmar supports a large number of other wetlands that could also be listed as Ramsar sites.

Man and the Biosphere (MAB) Programme

The MAB Programme operates through National Committees and Focal Points among the United Nations Educational, Scientific and Cultural Organization (UNESCO) member states. It aims to develop the basis, within the natural and the social sciences, for the conservation and sustainable use of biological diversity, and for the improvement of the relationship between people and their environment. An essential tool for the MAB programme is the network of Biosphere Reserves, which are areas of terrestrial and coastal ecosystems where solutions are promoted to reconcile biodiversity conservation with its sustainable use. Although Myanmar has established a National MAB Committee, it has yet to designate any Biosphere Reserve.

3.3. Performance Assessments and Gaps in Biodiversity Conservation

In Myanmar**,** the Kings initiated biodiversity conservation as early as 1775 when teak was proclaimed a Royal Tree. The vicinity of the King's palace was declared a refuge area for the wild animals in the city of Yadanapon (now Mandalay) in 1850. The Elephant Preservation Act was enacted in 1879, and amended in 1883. The FD was given responsibility for wildlife protection under the Burma Forest Act of 1902, which designated wild animals as "forest produce" and provided for the making of rules to control hunting and fishing in Reserved Forests. The first Game Sanctuaries were established in 1911, but ratified protected areas were not set up until 1920. The Burma Wildlife Protection Act was imposed in 1936. In 1927, a post of Game Warden was created within the FD with specific responsibilities for wildlife conservation and management, including control of keddah operations for capturing wild elephants. The post of Game Warden lapsed at the time of the Japanese occupation in 1942 and has never been revived. Since the War and subsequent independence, the FD has retained general responsibility for wildlife conservation. During this time there has neither been any departmental unit with specific responsibilities nor any staff with professional training in this particular field. However, the Nature and Wildlife Conservation Division (NWCD) was created within the FD when the "Nature Conservation and National Parks Project (NCNPP)" was implemented from 1981 to 1984. Protected Area System (PAS) management was introduced since then and the Protection of Wildlife and Protected Areas Law was enacted in 1994. A policy target was set by the Myanmar Forest Policy of 1995 that protected area coverage must be at least 5% of the total land area of the country. In 2000, the 30-year Forest Master Plan of the MOECAF adjusted this target to 10% of total land area.

As guided by the National Forest Policy and Master Plan, the FD has made strenuous effort to expand the protected area (PAs) coverage during the last decade. Currently, Myanmar has established 36 PAs, and six of these are recognized as ASEAN Heritage Parks (AHPs). The locations of established PAs and AHPs are displayed in Figure 5. The six AHPs are Hkakaborazi National Park, Indawgyi Lake Wildlife Sanctuary, Alaungdaw Kathapa National Park, Inlay Lake Wildlife Sanctuary, Meinmahla Kyun Wildlife Sanctuary and Lampi Marine National Park. The status of AHPs will be an important stepping-stone towards acquiring UNESCO World Heritage Site status, which does not yet exist in Myanmar.

To assess Myanmar's performance in biodiversity conservation, the percentage of land area covered by PAs was developed to measure achievement towards the 10% policy target. The percentage of land area covered by PAs was calculated in 2010 as 37,894.48 sq. km. This is the equivalent to 5.6% of the country. Since the 10% policy target was set to be achieved by 2030, performance was considered impressive in terms of progress towards the target by 2010. Prior to 1996, protected areas constituted less than 1 % of the total land area with individual PAs ranging in size from 0.47 km^2 to 2,150 km^2 (Figure 6). Since 1996 the establishment of protected areas shifted from protection of certain species or habitats to protection of entire landscapes or ecosystems. Twelve new protected areas ranging in size from 23 km^2 to 11,002 km^2 were added to the PAS between 1998 and 2010. This period coincides with WCS's conservation work to strengthen the capacity of FD staff especially their institutional capacity for establishing PAs. The Northern Forest Complex in particular is evidence of successful collaboration between government and a NGO for biodiversity conservation. Table 10 shows PAs in Myanmar and more detailed information on Myanmar's PAs are described in Annex 4.

Figure 5. Location of Protected Areas and ASEAN Heritage Sites of Myanmar.

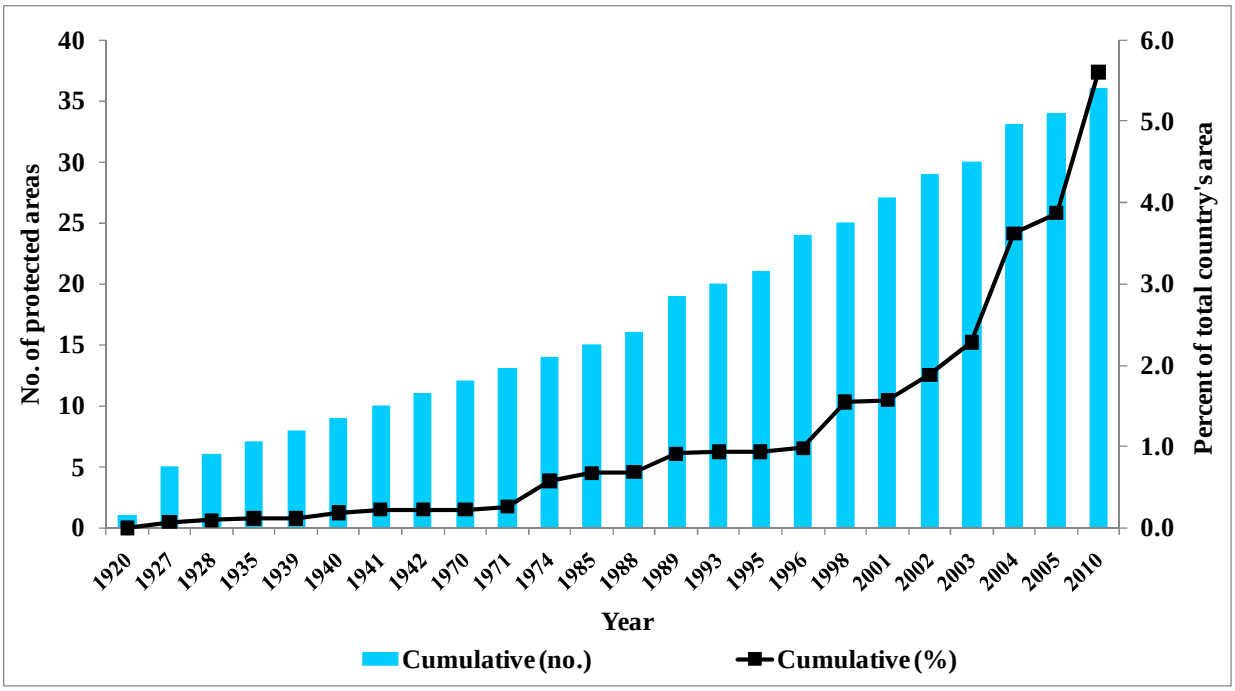

Figure 6. Cumulative Protected Areas Between 1920 and 2010.

As discussed above, Myanmar has committed to biodiversity conservation in terms of establishing PAs in the past decade but more needs to be done in improving the quality of the national PAs network, as well as, improving the management effectiveness of the PAs. Despite recent expansion of PAs, there is increasing evidence that existing PAs have been subject to extensive encroachment and overexploitation of biological resources. For instance, the mangrove ecosystem of Meinmahla Kyun Wildlife Sanctuary in the Ayeyawady Delta has been heavily affected by human activities and has lost important habitat for many species. Systematic analysis of the many challenges such as illegal logging, invasive species, conflicts in resource uses, need participatory management, lack of regional special plans adopting BD conservation, is immediately needed to develop effective PAs management. Cyclone Nargis compounded the situation when it hit the area in 2008 and more remaining habitat was severely damaged.

Table 10. Established and Proposed Protected Areas in Myanmar.

No.	Established Year	Name	Areas		General Location
			Sq. km^2	Sq. mile^2	
Established Protected Areas					
1	1920	Taunggyi Bird Sanctuary	16.06	6.20	Shan State
2	1927/2006*	Pidaung Wildlife Sanctuary	122.07	47.13	Kachin State
3	1927	Shwe-U-Daung Wildlife Sanctuary	58.04	22.41	Mandalay Region
	1927	Shwe-U-Daung Wildlife Sanctuary	117.97	45.55	Shan State
4	1927	Pyin-O-Lwin Bird Sanctuary	127.25	49.13	Mandalay Region
5	1927	Moscos Islands Wildlife Sanctuary	49.18	18.99	Taninthayi Region
6	1928	Kahilu Wildlife Sanctuary	160.55	61.99	Kayin State
7	1935	Mulayit Wildlife Sanctuary	138.54	53.49	Kayin State
8	1939	Wethtikan Bird Sanctuary	4.40	1.70	Magway Region
9	1940	Shwesettaw Wildlife Sanctuary	464.28	179.26	Magway Region
10	1941	Chatthin Wildlife Sanctuary	269.36	104.00	Sagaing Region
11	1942/2002*	Kelatha Wildlife Sanctuary	23.93	9.24	Mon State

Table 10. Established and Proposed Protected Areas in Myanmar (Cont'd).

No.	Established Year	Name	Areas		General Location
			Sq. km^2	Sq. mile^2	
Established Protected Areas					
12	1970	Thamihla Kyun Wildlife Sanctuary	0.88	0.34	Ayeyawady Region
13	1971	Minwuntaung Wildlife Sanctuary	205.88	79.49	Sagaing Region
14	1974	Htamanthi Wildlife Sanctuary	2150.73	830.40	Sagaing Region
15	1985/2001*	Inlay Wetland Bird Sanctuary	640.91	247.46	Shan State
16	1988	Moeyongyi Wetland Bird Sanctuary	103.6	40.00	Bago Region
17	1989	Hlawga Park	6.24	2.41	Yangon Region
18	1989	Alaungdaw Kathapa National Park	1402.79	541.62	Sagaing Region
19	1989	Popa Mountain Park	128.54	49.63	Mandalay Region
20	1993	Meinmahla Kyun Wildlife Sanctuary	136.70	52.78	Ayeyawady Region
21	1995	Lawkananda Wildlife Sanctuary	0.47	0.18	Mandalay Region
22	1996	Lampi Marine National Park	204.84	79.09	Taninthayi Region
23	1996	Loimwe Protected Area	42.84	16.54	Shan State
24	1996	Parsar Protected Area	77.03	29.74	Shan State
25	1998	Hkakaborazi National Park	3812.46	1472.00	Kachin State
26	2001	Kyaikhtiyoe Wildlife Sanctuary	156.23	60.32	Mon State
27	2001	Minsontaung Wildlife Sanctuary	22.61	8.73	Mandalay Region
28	2002	Rakhine Yoma Elephant Range	1755.70	677.88	Rakhine State
29	2002	Panlaung-pyadalin Cave Wildlife Sanctuary	333.80	128.88	Shan State
30	2003	Hponkanrazi Wildlife Sanctuary	2703.95	1044.00	Kachin State
31	2004	Indawgyi Wetland Wildlife Sanctuary	814.99	314.67	Kachin State
32	2004	Hukaung Valley Wildlife Sanctuary	6371.37	2460.00	Kachin State
33	2004	Bumhpabum Wildlife Sanctuary	1854.43	716.00	Kachin State
34	2005	Taninthayi Nature Reserve	1699.99	656.37	Taninthayi Region
35	2010	Natmataung National Park	713.54	275.50	Chin State
36	2010	Hukaung Valley Wildlife Sanctuary (extension)	4333.05	1673.00	Kachin State
	2010	Hukaung Valley Wildlife Sanctuary (extension)	6669.22	2575.00	Sagaing Region
Grand Total			**37894.42**	**14631.12**	
Proposed Protected Areas					
1	2001	Kyauk Pan Taung Wildlife Sanctuary	132.61	51.20	Chin State
2	2002	Maharmyaing Wildlife Sanctuary	1180.39	455.75	Sagaing Region
3	2002	Taninthary National Park	2589.99	1000.00	Taninthayi Region
4	2002	Lenya National Park	1766.37	682.00	Taninthayi Region
5	2004	Lenya National Park (extension)	1398.59	540.00	Taninthayi Region
6	2006	Shinpin Kyatthaut Wildlife Sanctuary	71.90	27.76	Bago Region
7	2008	Bawditahtaung Nature Reserve	72.52	28.00	Sagaing Region
Grand Total			**7212.37**	**2784.71**	

Source: Nature and Wildlife Conservation Division, FD 2011. *: Renotification

Another shortcoming of the established PAs network is its ecosystem and species representation. According to the figure given in Table 11, PAs for terrestrial ecosystems are dominant among the PAs so far established.

Table 11. Protected Areas by Type of Habitat.

Habitat	No. of PAs	Area Extent of Relevant PAs (ha)	% of Total PAs
Terrestrial PAs	28	3,593,892	94.84
Wetland PAs	4	156,396	4.13
Marine PAs	4	39,160	1.03
Grand Total	**36**	**3,789,448**	**100.00**

Source: Nature and Wildlife Conservation Division, FD 2011.

Approximately 95% of the total PAs are terrestrial PAs. Wetlands PAs and marine PAs are only 4.13% and 1.03%, respectively. In addition, it is reported that the percentage of nationally threatened species in relation to globally threatened species was highest for reptile species in comparison with mammal, bird and amphibian species (Table 12 and Figure 7). As wetlands and marine coastal ecosystems are considered important for conserving this faunal group, more emphasis should be paid to establishing PAs in these ecosystems.

Table 12. Percentage of Threatened Species Over Globally Threatened Species During 2004-2010.

Species Group	Assessment Year	Total Threatened Species in the World	Threatened Species in Myanmar	Proportion of Myanmar to the World (%)
Mammals	2004	1101	40	3.63
	2008	1141	45	3.94
	2009	1142	45	3.94
	2010	1130	45	3.98
Birds	2004	1212	49	4.04
	2008	1222	41	3.36
	2009	1223	39	3.19
	2010	1240	34	2.74
Reptiles	2004	304	26	8.55
	2008	423	26	6.15
	2009	469	26	5.54
	2010	594	24	4.04
Amphibians	2004	1770	0	0.00
	2008	1905	0	0.00
	2009	1893	0	0.00
	2010	1898	0	0.00
All	2004	4387	115	2.41
	2008	4691	112	2.10
	2009	4727	110	2.18
	2010	4863	103	

Source: IUCN Red List 2011.

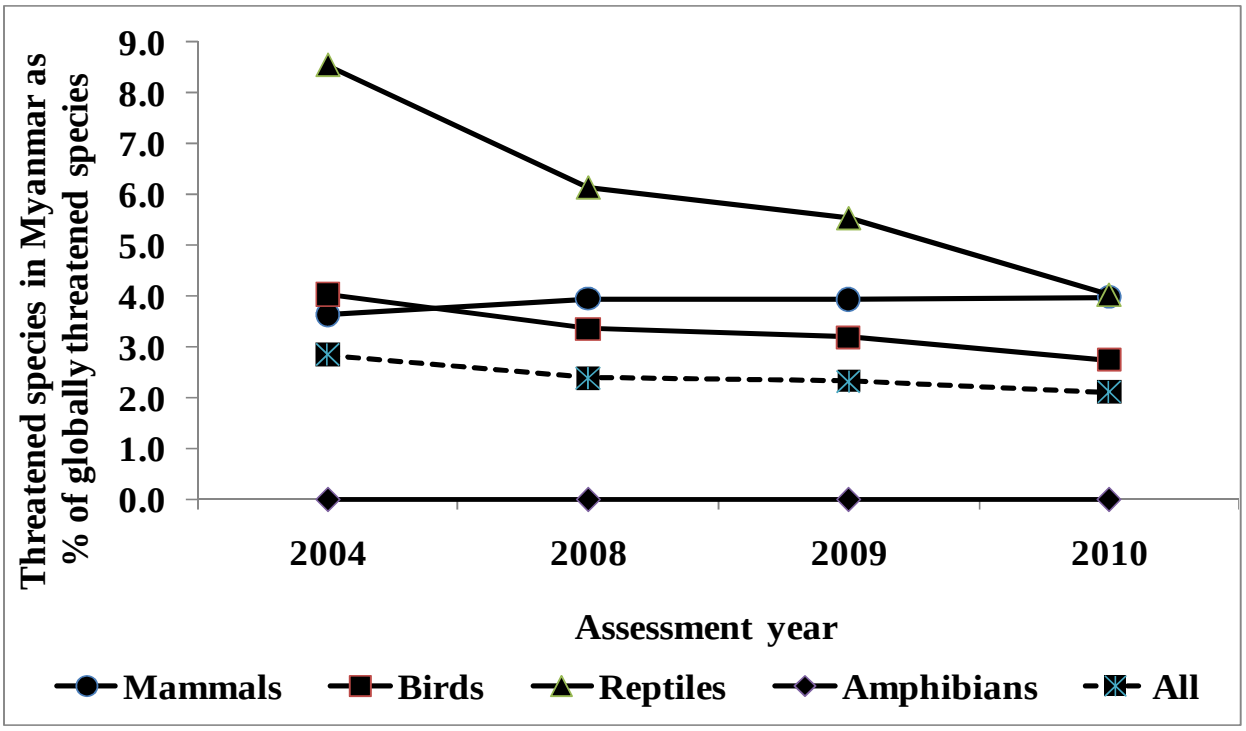

Figure 7. Nationally Threatened Species as Percent of Globally Threatened Species Dduring 2004 and 2010. *Source: IUCN 2004; IUCN 2008: IUCN 2009: IUCN 2010.*

In addition to the identified gap of established PAs, low investment for biodiversity conservation is one of the underlying causes that lead to ineffective biodiversity conservation. The NWCD within the FD is responsible for managing PAs including financial expenditure on wildlife conservation. According to an environmental performance assessment carried out by NCEA during the period 2004 –2006, total expenditure of FD allocated for NWCD (at constant price level of 1988 base year) declined over the period (Table 13). In the National Forest Policy of 1995, it was clearly stated that at least 25% of revenue generated by the Forestry Sector should be used for conservation investment. However, this is yet to happen and attention of policy makers is needed on this matter.

Table 13. Annual Expenditure of Forest Department at 1988 Constant Price Level (Million Kyats).

Year	Forest Reserve	Natural Re-generation	Plan-tation	Research	Train-ing	NWCD	Person-nel	Admini-stration	Total
1988	0.11	0.08	48.30	4.77	0.00	12.50	24.86	84.63	175.25
1994	0.04	0.05	22.30	2.42	0.00	6.37	32.84	35.30	99.31
1995	0.07	0.04	22.76	2.52	1.21	5.59	27.55	32.16	91.89
1996	0.15	0.12	22.89	2.64	1.12	8.54	23.67	32.55	91.68
1997	0.64	0.43	39.78	3.12	1.29	9.31	22.28	39.40	116.24
1998	0.44	0.27	35.94	2.53	1.96	10.15	17.12	36.67	105.08
1999	0.70	0.62	45.25	2.23	3.24	19.98	15.14	43.75	130.90
2000	0.98	1.30	56.46	4.82	4.15	12.31	68.51	75.92	224.45
2001	0.61	2.90	44.16	4.07	3.54	10.34	50.94	63.21	179.76
2002	0.42	2.03	42.25	3.14	3.27	7.47	46.34	45.73	150.65

Source: FD (2005) & CSO (2002).

International assistance given for biodiversity conservation is also minimal with a small amount of assistance being received through NGOs. Very limited overseas assistance is given to NWCD, which is a key institution for managing PAs and biodiversity conservation in Myanmar.

Investment in human resource development, particularly to advanced education and training, is very limited, and results in a shortage of qualified professionals in the field of nature and biodiversity conservation.

There is also a gap in legal instruments for protecting the environment and biodiversity. The Protection of Wildlife and Protected Areas Law (1994) gives limited protection to fish and marine species. Fisheries Laws (Freshwater and Marine) contain legal provision for protection of these species. However, overlapping and oversight of these two laws for species protection causes loopholes for law enforcement in practice. The status of species protection is also another issue that needs reconciliation between international conventions such as CITES and National Laws. There is confusion between species referred to in Appendix 1 and 2 of CITES and the terms fully protected species and seasonally protected species used in Myanmar law. As a member country, the law needs to be amended as necessary for compliance with CITES.

The Protection of Wildlife and Protected Areas Law (1994) also contains the legal provision for permitting a license to local communities or private citizens if they wish to operate a zoo or botanical garden. This raises the possibility that a conservation area that is traditionally managed by the local community could be given better legal protection by NWCD. However, such a case has not yet happened and clearer rules and regulations to promote community led nature conservation for sharing benefits in a transparent, accountable and equitable manner are needed.

3.4. Performance of Agriculture, Livestock and Fisheries Biodiversity

Traditionally, the FD of the MOECAF takes responsibility for nature and biodiversity conservation. However, there are also institutional efforts by other line Ministries for the pursuit of biodiversity conservation in agriculture, livestock and fisheries sectors. Concerning agriculture biodiversity, the Department of Agricultural Research (DAR) under the MOAI has operated a seed bank at the Central Agriculture Research Institute (CARI) at Yezin, Pyinmana since 1987 with the following three main objectives.

1. Systematic conservation of plant genetic resources for food and agriculture in Myanmar.
2. Sustainable utilization of PGR for food and agriculture in Myanmar.
3. Equitable exchange of PGR and related information.

DAR has collected different varieties of PGR and landraces throughout the country, and Germplasm has been conserved in the Myanmar Seed Bank as ex-situ conservation of PGR (Table 14). Recalcitrant seed crops such as mango, banana, root and tuber crops are conserved in field genebanks. However, implementation of in-situ conservation is not yet carried out for effective conservation and genetic improvement at the local level. Ideally, the national seed bank should be expanded but limited financial and human resources prevent CARI from doing this.

Table 14. Plants Included in Ex-situ Conservation at National Seed Bank.

No.	Plant Species	Accession
1	*Arachis hypogaea* L.	604
2	*Cajanus cajan* (L.) Millsp.	101
3	*Cicer arietinum* L.	482
4	*Corchorus capsularis* L.	42
5	*Glycine max* (L.) Merr	80
6	*Guizotia abyssinica* (L.f.) Cass.	2
7	*Helianthus annuus* L.	16

Table 14. Plants Included in Ex-situ Conservation at National Seed Bank. (Cont'd)

No.	Plant Species	Accession
8	*Hibiscus esculentus* L.	14
9	*Lagenaria vulgaris* Ser.	36
10	*Luffa acutangula* (L.) Roxb.	43
11	*Luffa acutangula* (L.) Riem.	41
12	*Momordica charantia* L.	15
13	*Oryza latifolia* Desv.	1
14	*Oryza nivara* S.D.Sharma & Shastry	41
15	*Oryza officinalis* Wall. Ex	38
16	*Oryza rufipogon* Griff.	71
17	*Oryza sativa* L.	6897
18	*Oryza spontanea*	33
19	*Pennisetum americanum* (L.) Leeke	142
20	*Phaseolus lunata* L.	68
21	*Sesamum indicum* L.	41
22	*Sorghum bicolor* (L.) Moench	312
23	*Triticum aestivum* L.	1551
24	*Vigna mungo* (L.) Hepper	126
25	*Vigna radiata* (L.) R. Wilczek	189
26	*Vigna unguiculata* (L.) Walp.	151
27	*Wild vigna*	86
28	*Zea mays* L.	74
	Total Accessions	**11297**

Concerning livestock biodiversity conservation, the Livestock Breeding and Veterinary Department (LBVD) under the MOLF, is responsible for both livestock development and the conservation of farm animal genetic resources. In collaboration with the United Nations Food and Agriculture Organization (FAO), LBVD has conducted livestock biodiversity conservation activities since 1993 as part of a regional project for "Conservation and Use of Animal Genetic Resources in Asia and Pacific". Through the project, information related to the status of farm animals in Myanmar were updated and uploaded on FAO's website – DAD-IS (Domestic Animal Diversity Information System). LBVD has also carried out biodiversity conservation activities, especially for in-situ conservation of local chicken breeds; namely, Inbinwa and Taik Kyet, in Yangon and the dry zone. Currently, a buffalo research and conservation program is being carried out in Laputta township of Ayeyawady delta to increase the buffalo population and improve the quality of buffalo bred in cyclone-affected areas in lower Myanmar. Special attention is also paid to the conservation of Mithun, a semi-domesticated bovine species found in Chin State. Since the Mithun population has decreased from 1993 to 2002, a program was launched for in-situ and ex-situ conservation of Mithun. For ex-situ conservation, semen from Mithun bulls were collected, conserved by cryo-preservation techniques and stored at the semen bank in the Livestock Up-grading section in Yangon. Female Mithun were not only bred naturally but also inseminated with frozen semen straws. Loans are also given to rural households in Chin State for Mithun farming. As a result, the Mithun population has gradually increased in Chin State. Although LVBD have made a great effort for livestock biodiversity conservation, more needs to be done to improve livestock genetic resource assessments, database management, monitoring mechanisms and regulatory enforcement.

Regarding biodiversity conservation in the fisheries sector, the major approaches adopted by DOF include conducting species assessments, protection from over-exploitation of fishery species that are at risk of extinction and species-specific conservation. Significant accomplishments in recent years include notifying the fish protection area for Ayeyawady Dolphin in the upper section of Ayeyawady River and for Sharks in Taninthayi Coastal Area starting from “Ross island” (12º 13' N and 98º 05.2' E) to “Lampi islands” (10º 41.5' & 10º 95.3' N and 98º 4.9' & 98º 18.3' E) (Figure 8).

Sharks and rays can be used sustainably by tourism activities, especially shark-watching dive tours in this area while shark fisheries are totally banned. DOF also collaborated with international agencies for an assessment of the Mergui Archipelago, which is a pristine seascape ecosystem and famous for its sharks, rays, coral reefs and other marine creatures. Limited financial resources and technical capacity prevent DOF to pursue its full potential to achieve conservation. Awareness of the importance of fishery biodiversity conservation needs to be increased. Increased participation in conservation programs is also crucially needed for success.

3.5. Performance of Biosafety Measures

Myanmar neither has a stand-alone national policy on biosafety nor biotechnology yet. Traditionally, sectoral policies and laws cover some aspects of biosafety measures and government departments sectorally pursue their respected duties and responsibilities for matters related to biosafety in the country. For instance, the MOAI is responsible for implementing four sectoral laws, namely, (1) The Pesticide Law (1990), (2) The Plant Pest Quarantine Law (1993, revised in 2011), (3) The Fertilizer Law (2002) and (4) The Seed Law (2011), in order to regulate the quality of agricultural chemicals for safer use in agriculture as well as to protect from the invasion of undesirable agricultural seeds, plant parts, pest and diseases into Myanmar. This will prevent bio-pollution and disease outbreak from such unwanted imports. Likewise, the MOLF is responsible for implementing (1) The Animal Health and Development Law (1993), (2) The Law Relating to Fishing Rights of Foreign Fishing Vessels, (3) the Myanmar Marine Fisheries Law (1990), (4) The Freshwater Fisheries Law (1992) and (5) The Territorial Sea and Maritime Zone Law (1997). Under these laws, efforts are made to control diseases, pollution and environmental destruction that could do harm to animal husbandry, aquaculture, and fisheries production. Within the context of these legal instruments, MOAI and MOLF are operating quarantine stations at major border checkpoints, international airports and seaports. However, huge challenges remain for regulating the trans-boundary crossing of living and non-living items across the entire length of the international borders of Myanmar. In addition, there are no legal provisions yet in the existing legal framework for the compulsory inspection and certification of the import of microorganism and forest flora and fauna. Although, cooperation has been made between the FD and the Customs Department for controlling the over exportation of wild species that are restricted by CITES for international trade.

Considering the shortcomings discussed above, Myanmar has made an attempt in the formulation of a National Biosafety Framework in compliance with the Cartagena Protocol on Biosafety. The Global Environment Facility (GEF) and the United Nations Environment Program (UNEP) provided technical and financial support to Myanmar for implementing a project on the "Development of National Biosafety Framework” during the period 2004 to 2006. As an outcome of the project, a National Biosafety Framework has been drafted and put up to higher authorities for final approval.

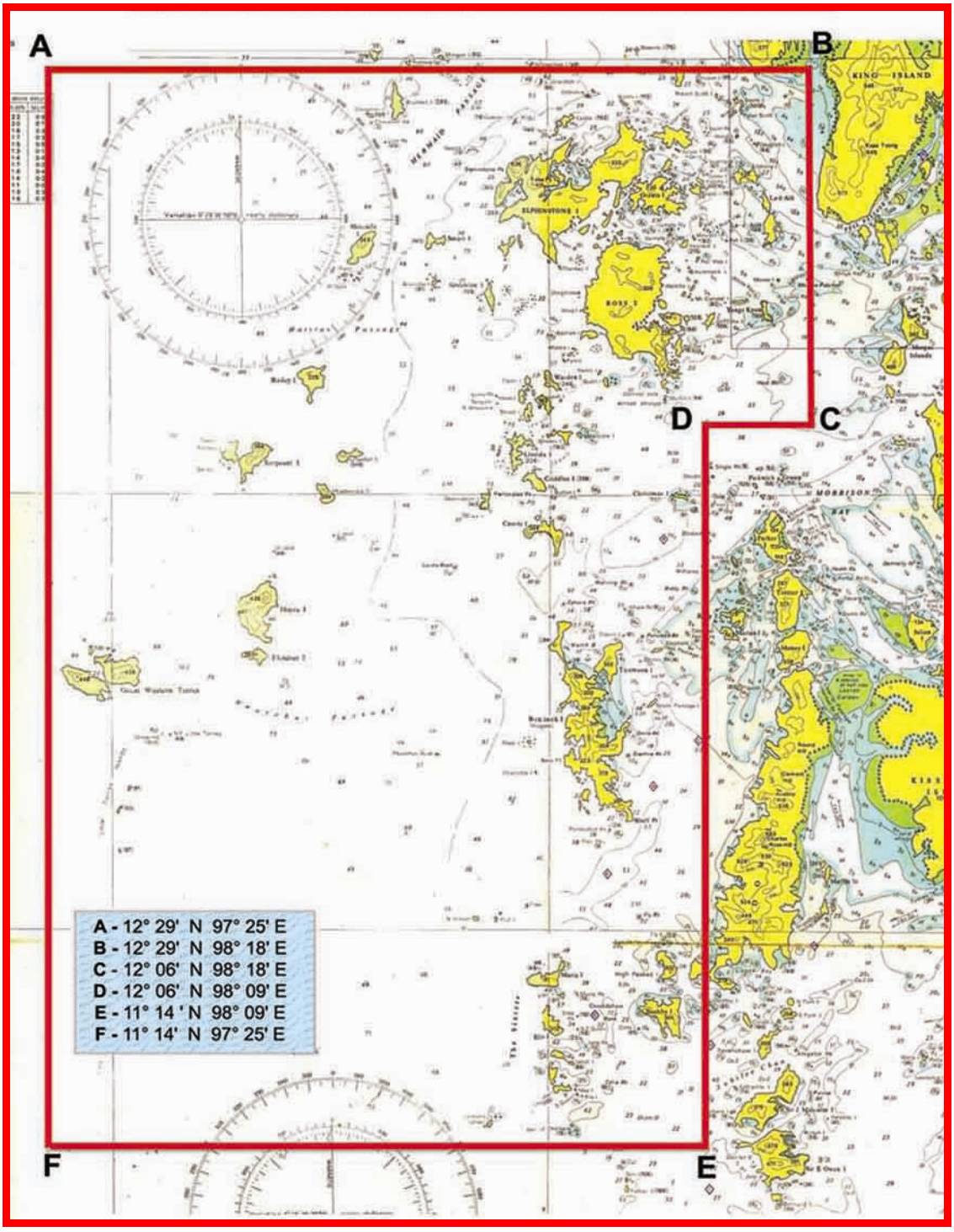

Figure 8. Shark Protected Area.

3.6. Major Threats to Biodiversity Conservation

The Indo-Myanmar (Indo-Burma) Hotspot is one of 25 biodiversity hotspots in the world (Myers *et al*. 2000), and the area has been losing plants and vertebrates as a result of forest loss. Throughout the hotspot, a combination of population growth, economic development, increasing consumption and integration into the global economy is placing increasing pressure on natural habitats and species populations. Biodiversity in Myanmar has been under severe pressure due to population growth accompanied by increased resource utilization as well as the ever-increasing demand for resources from neighboring countries (Aung *et al.* 2004). Because of these direct threats to biodiversity habitat degradation and the loss of biodiversity have resulted. Pollution

and invasive species are also significant threats, and their effects are most clearly seen in relation to freshwater ecosystems. The root causes of biodiversity loss in Myanmar are also correlated with poverty, capacity constraints, lack of environmental safeguards, lack of comprehensive land-use policies and plans, undervaluation of resources, lack of grassroots support for conservation, and global climate change. With regard to agrobiodiversity, modern technology, cultivation of monocultures, habitat loss, climate change and natural disasters (e.g. Nargis in 2008; Giri in 2010) are major threats to the continued existence of traditional crop landraces, wild crop relatives and components of their agroecosystems.

3.7. Over-exploitation of Natural Resources

Over-exploitation of Animals

Throughout the Indo-Myanmar (Indo-Burma) Hotspot, unregulated, unsustainable, unreported illegal exploitation has driven many animal species to the verge of extinction in the wild, and severely suppressed the populations of others (Nash 1997, Nooren and Claridge 2001, Oldfield 2003). This is very much the case in Myanmar, where hunting occurs in about 70% of PAs (Rao ***et al.*** 2002), and threatens a number of species with national extinction (Lynam 2003).

There are several inter-related causes for the over-exploitation of animals in Myanmar, including subsistence needs, recreation, and opportunistic exploitation. Trade demand, from both domestic and international markets, is often a key factor driving exploitation, and is particularly significant in the case of species used in the manufacture of traditional medicines, such as Tiger (Rabinowitz 1998, Lynam 2003) and turtles (Jenkins 1995, Platt ***et al.*** 2000). Reports of the seizures of illegal wildlife trade reveal that the high demand from China and Thailand is the major driving force for the illegal exploitation of wildlife.

The dynamics of the wildlife trade in Myanmar are not known in detail. However, extrapolating from other countries in Southeast Asia, trade pressure on Myanmar's wildlife populations can be expected to increase, as wildlife populations in other countries become depleted. Limited resources, manpower, capacity and motivation among enforcement agencies mean that there are few effective controls on the exploitation of animals, even within PAs. Incentives to hunt animal species are often high for rural people, particularly where there is an actual or perceived trade demand.

Over-exploitation of Plants

Although few detailed data are available on this issue, the threat posed by exploitation of plant species in Myanmar is potentially as massive as the exploitation of animal species. Plants have numerous human uses, including as a source of food, construction materials, ornaments and medicines. As a result, they are exploited for both local consumption and trade. Although human population densities in the mountainous areas of Myanmar are lower than those in most neighboring countries, the level of human impact on the landscape is increasing (Eberhardt 2003).

In many parts of the country, exploitation of plants is taking place on a commercial scale. Myanmar's forests support a great diversity of commercially valuable timber species, including teak and various members of the ***Dipterocarpaceae*** and ***Leguminosae***, and the impacts of commercial logging on these forests have been documented (Brunner ***et al.*** 1998). Other economically valuable plant species threatened by over-exploitation include ***Pterocarpus macrocarpus***, which is a hardwood highly favour by Chinese market for construction and furniture making, ***Aquilaria malaccensis***, which is a source of agarwood, rattans ***Calamus*** spp., which are used in furniture and handicraft manufacturing, and orchids, which are harvested for domestic sale and export to China, in response to demand for the traditional medicine trade.

Over-fishing

A significant proportion of Myanmar's human population is dependent on freshwater fish as a source of food and/or income. Small-scale, artisanal fishing is practised throughout the country, particularly along major rivers and at large lakes. Although there is little information available about the impacts of such practices on fish populations, they are potentially sustainable at current levels. Transition from subsistence to a market economy and use of improved fishing gear are likely to increase pressure on fish resources. Other countries in this situation have tended to introduce some form of aquaculture and resulting in profound changes in local cash flow, habitat modification and control of water resources, and this pattern could be repeated in Myanmar.

The use of poison for fishing has been identified as a threat to biodiversity at several sites in Myanmar. At Alaungdaw Kathapa National Park and Htamanthi Wildlife Sanctuary, for example, pouring liquid pesticides into pools in seasonal streams affect aquatic fauna, and such practices can result in the poisoning of wild animals that drink water from the pools, and have negative impacts on the health of livestock and humans (CARE Myanmar 2003). The use of poison and explosives for fishing is often associated with infrastructure development programs, particularly as road workers often have access to dynamite (Kullander ***et al.*** 2004).

3.8. Habitat Degradation and Loss

Logging

Forest ecosystems support some of the most threatened elements of biodiversity in Myanmar, including the majority of globally threatened plant and animal species. Thus, maintenance of extensive, undisturbed forest ecosystems must remain a cornerstone of conservation efforts in the country. However, there has been a long history of logging of Myanmar's forests, much of it on a commercial scale, which has had a massive impact on their extent and condition. Historically, mixed deciduous forests, which are rich in Teak, were the principal focus of commercial logging. However, harvestable Teak is becoming increasingly scarce.

According to the statistics of FD, forest cover has gradually declined over the period. As shown in Figure 9, forest cover in 1990 was 58% of total land area and it was reduced to 51.5% in 2000, 49.2% in 2005 and 47% in 2010. Annual loss of forested area was equivalent to 435,000 hectares for the period 1990-2000, 309,000 hectares between 2000 and 2005 and 310,000 hectares during 2005-2010 (FAO 2010). Before 1990, annual loss of forest cover was approximately 108,000 hectares per year, and annual forest loss during the period 1990 to 2000 was four fold higher than that measured before 1990. Since the private sector was allowed to export timber after Myanmar adopted an open market economy in 1988, timber extraction has sharply increased in the country, particularly for the period from 1990 to 2000. The country report of the global forest resource assessment in 2010 mentioned that only about 20% of the total land area is closed forest (Table 15 and Figure 10). According to an Environmental Performance Assessment conducted by NCEA in 2006, it was found that the ratio of wood removal from one thousand hectares of forest was only 624 cubic meter in 1975 but had doubled, reaching the level of 1,232 cubic meters in 2000. Comparing this figure to the level of annual forest loss for the same periods, there is evidence that extraction of wood from forest has doubled (including firewood and charcoal) and is associated with the trend of four times higher annual forest loss. Since the global average of wood removal over thousand hectares of forest was found to be 765 cubic meters in 1994, the level of forest extraction in Myanmar is very alarming. As such the over exploitation of forest products largely contributes to deforestation and forest degradation, the loss of forest habitats threatens the biodiversity of terrestrial forest ecosystems.

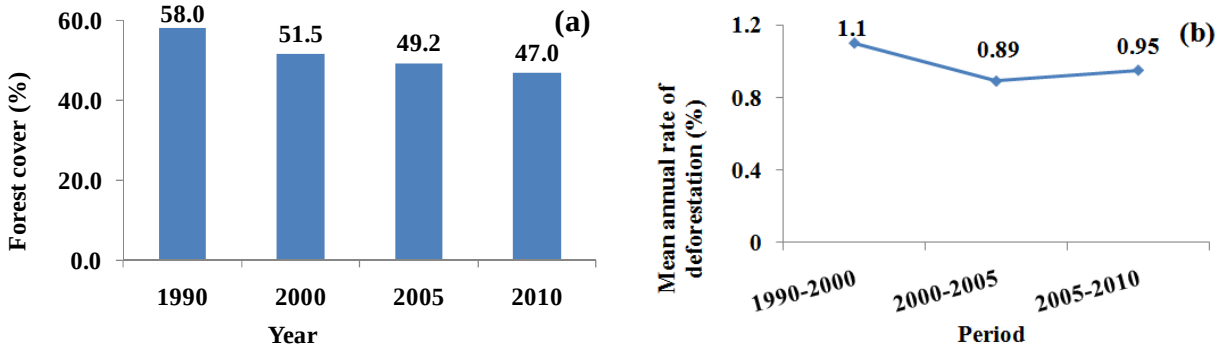

Figure 9. Forest Cover and Rate of Annual Deforestation in Myanmar from 1990 to 2010. a) Forest Covers Between 1990 and 2010; b) Mean Annual Rate of Deforestation Between 1990 and 2010.

Table 15. Forest Cover of Myanmar Derived from 2005-2007 Landsat Images.

Particular	Area (,000 ha)	% of total country area
Closed forest	13,445	19.87
Open forest	18,329	27.09
Total forest	**31,773**	**46.96**
Other wooded land	20,113	29.73
Others	13,869	20.50
Water body	1,903	2.81
Total	**67,658**	**100**

Source: Remote Sensing and GIS Section, Planning and Statistic Division, FD 2011.

Agricultural Expansion

Agricultural expansion includes unplanned and unrestricted agricultural expansion by rural populations but it can also take the form of commercial clear cutting for crops such as peanuts. Visual inspection of forest loss patterns suggests that agricultural expansion is taking place along the edges of large forested regions, such as along the northern edge of the Central Dry Zone and in the Ayeyawady and Myitha River valleys (Leimgruber *et al.* 2005). In part, agricultural expansion is driven by human population growth, and its effects on natural habitats are exacerbated by the lack of comprehensive land-use policies and planning.

Shifting Cultivation

In mountainous regions of Myanmar, ethnic minority communities frequently practise forms of shifting cultivation, typically involving rotational systems of swidden fields and regenerating fallows. Evidence from elsewhere in mainland Southeast Asia indicates that shifting cultivation can be both a productive and an environmentally sustainable way of using land in lightly populated areas, which, under the correct conditions, can help to retain high levels of biodiversity (Pye-Smith 1997). While shifting cultivation may not necessarily result in net forest loss, it may result in an increase in fragmentation and an overall decrease in forest condition, making forest areas unsuitable for some species of conservation concern.

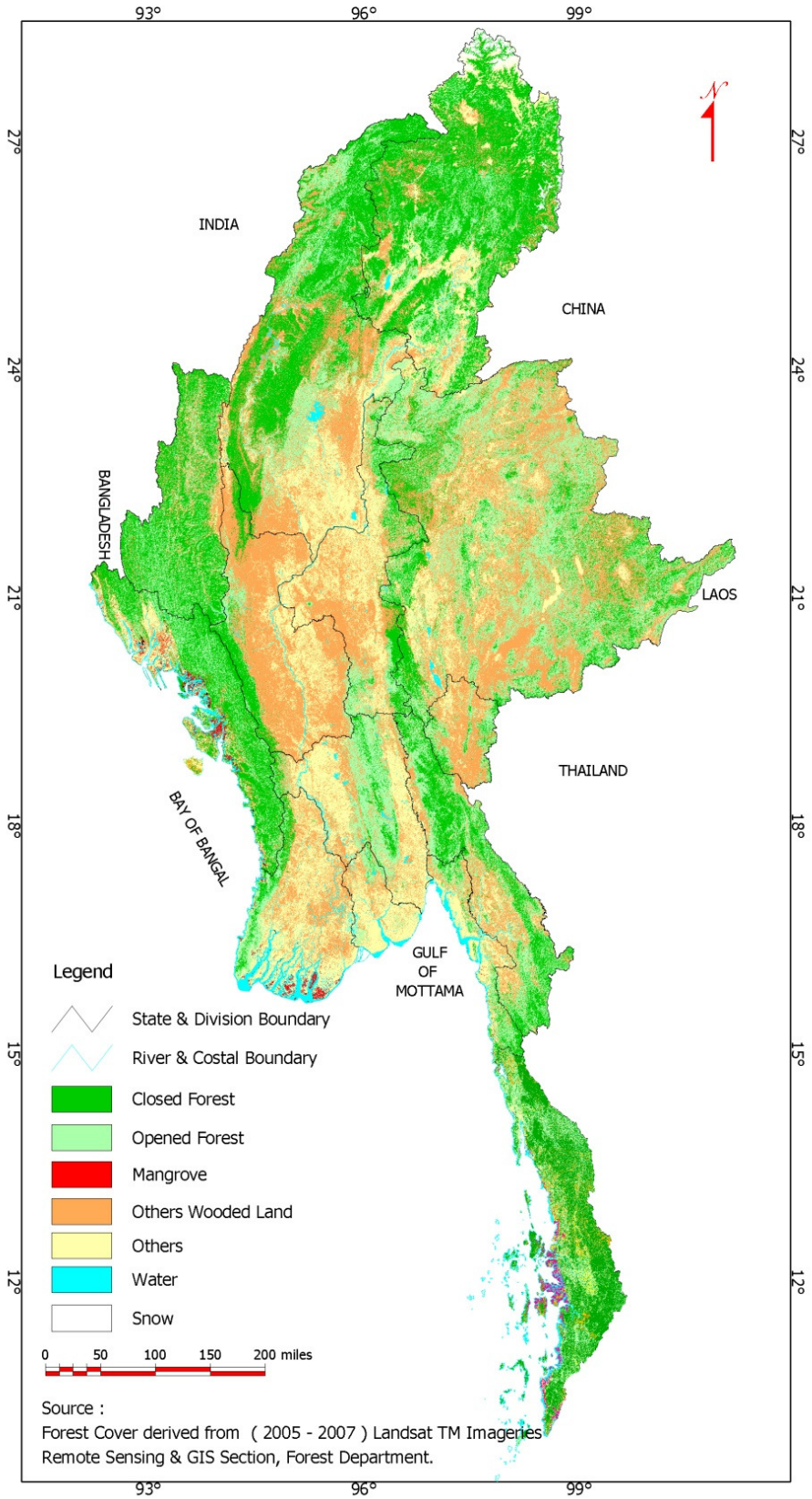

Figure 10. Forest Cover Status of Myanmar derived from 2005-2007 Landsat Images.

Source: Remote Sensing and GIS Section, Planning and Statistic Division, Forest Department 2011.

There is little detailed information available on the impacts of shifting cultivation on biodiversity in Myanmar, although a spatial analysis of forest cover change between 1990 and 2000 conducted by Leimgruber *et al.* (2005) revealed high rates of net forest loss in northern Chin State and Nagaland (northern Sagaing Region), which they attributed to intense shifting cultivation. The impact of shifting cultivation in southern Chin State is precipitating an environmental crisis where high population growth and dependency on natural resources have led to farming in increasingly marginal lands, resulting in deforestation and land degradation (MOPE 2002). In southern Chin State, shifting cultivation has destroyed most of the forests below 2,000 m asl, and is threatening Natmataung National Park (J.C. Eames pers. obs.). There is a need for further studies of the relationship between upland agricultural systems and biodiversity in Myanmar in order to determine how different systems can be integrated with conservation.

Conversion of Forest to Plantations

Conversion of forest to plantations is one of the major causes of habitat loss in Myanmar. In central Myanmar, there has been extensive replacement of natural forest by Teak while, in southern Taninthayi Region, lowland forest is being converted to oil palm plantations (Eames *et al.* 2005; Leimgruber *et al.* 2005). There are inevitably conflicts in land uses between the need to ensure self-sufficiency in certain foodstuffs, like edible oils, etc, and preservation and conservation of natural habitats. This has resulted in some areas, especially in the south of the country, witnessing large areas of natural habitats being converted into large-scale plantations. In addition to the direct loss of habitat resulting from conversion, construction of roads and other infrastructure and provision of employment opportunities are likely to encourage in-migration into hitherto sparsely populated parts of the country, and place additional pressure on natural resources.

Conversion of Coastal Habitats

Myanmar's coastal habitats are important for numerous elements of biodiversity, including migratory water birds, Mangrove Terrapin (Critically Endangered) and Estuarine Crocodile *Crocodylus porosus*, and several areas clearly meet the criteria for designation as Wetlands of International Importance under the Ramsar Convention. However, there are indications that coastal habitats, particularly mangrove, are currently experiencing some of the highest rates of loss in the country (Leimgruber *et al.* 2005). As shown in Figure 11, mangrove area in Ayeyawady delta in 1924 was 253,018 hectares but as of 2001, it only remained 111,939 hectares.

Almost, 56% of mangrove area was depleted during the last 6 decades. There are several reasons for the loss of mangrove in Ayeyawady delta. First and foremost, people from upstream areas migrated to mangrove areas for firewood collection and charcoal making. Once forests were clear-cut, they cultivated the land for growing paddy. When paddy yield declined, land was used for shrimp farming. Then shrimp farming was affected by increased acidification and water pollution, so people encroached into another mangrove area for repeating the process of mangrove exploitation. In this way, the entire mangrove ecosystem was heavily impacted by human activities and mangrove habitats were severely degraded.

Infrastructure Development

Most of the countries in mainland Southeast Asia are experiencing high rates of economic growth, which are fueling a boom in urban, industrial and infrastructure development. In many cases, in the absence of adequate mitigation measures, these developments are having severe impacts on the region's biodiversity. Road developments, for example, can cause fragmentation and loss of natural habitats, create barriers to the dispersal of wildlife, encourage human settlement in previously remote areas, and facilitate extraction and trade of natural resources. Road infrastructure development has been one of the policy priorities of the present

government and investment has been made substantially for construction of major highways as well as a road network for connecting one district to another. As of 2007, the total length of road network was 51,000 kilometers in Myanmar and total net increase of road network development during the last two decades was accounted for as 44% of 1988 level.

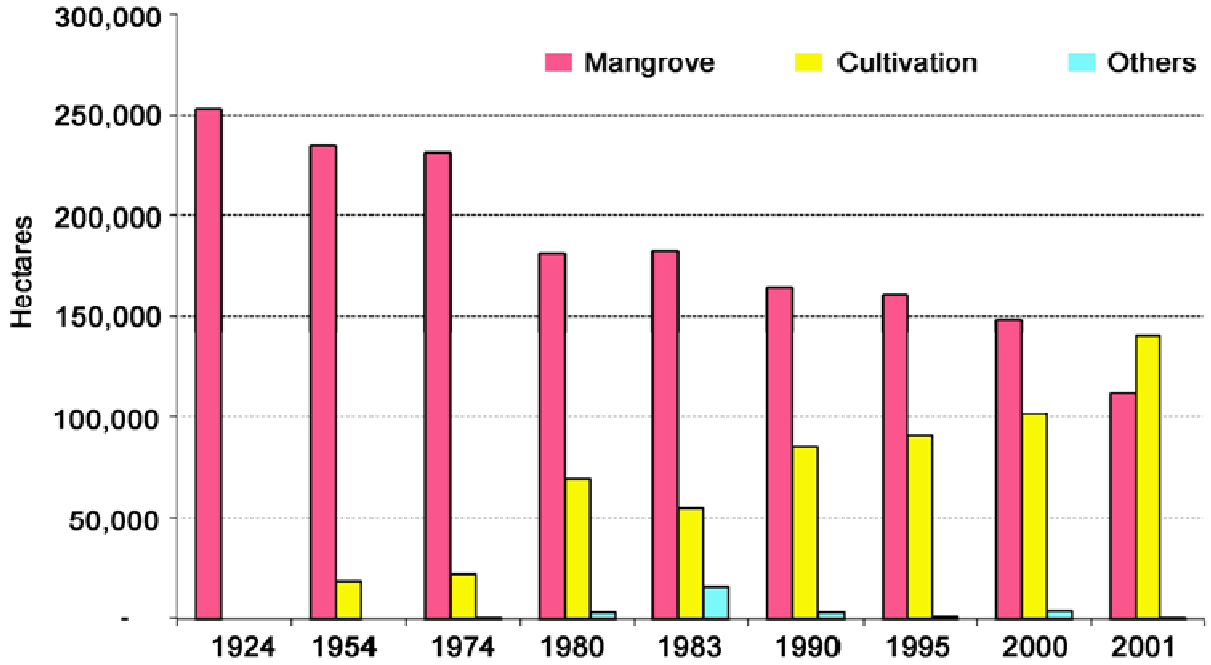

Figure 11. Trend of Mangrove Conversion in Ayeyawady Delta.

Dams are another type of infrastructure development with potentially major impacts on biodiversity. Dam construction can inundate riverine habitats upstream, and alter seasonal flow regimes and natural sedimentation processes downstream. In addition, dams can have direct impacts on fish migration routes and access to spawning grounds as lack of fish passes or strategies to maintain aquatic communities in downstream (Dudgeon 2000a, b). Migratory fish species particularly susceptible to the impacts of dams include cyprinids in the genera *Tor*, *Neolissochilus*, *Barbonymus*, *Scaphiodonichthys* and *Schizothorax*, and large bagrid catfishes in the genera *Hemibagrus*, *Sperata* and *Rita* (Kullander *et al.* 2004). Dam construction can also have indirect impacts on biodiversity, for instance relocation of human communities into areas where they place additional pressure on natural resources. Despite its relative economic isolation, Myanmar has not completely escaped the wave of infrastructure development that has swept over the rest of the region. For example, according to the official figures, there were only 138 dams built before 1988 but that has almost increased two fold reaching 233 dams by the end of 2010 (Hlaing 2011). However, because of the modest rate of rural development in the country, infrastructure developments that disrupt wildlife populations, such as roads, power lines and dams, have been relatively localized (Lynam, 2003). For example, only around 25% of PAs contain roads (Rao *et al.* 2002), and most of these are unsurfaced and for seasonal access only (Lynam 2003).

Nevertheless, the potential for the rate of infrastructure development to accelerate once Myanmar's economy begins to develop is great. For instance, a gas pipeline and rail road is being under construction between Myanmar and China; constructing road and rail road has been planned between Thailand and Daway deep seaport of Taninthayi region where highly diversed rain forests are existing. A series of dams is also planned for the Thanlwin catchment, with the objectives of water diversion and generation of hydroelectricity. A strategic environmental

assessment should be undertaken before commencement of any development plan. Development of mechanisms for integrating biodiversity considerations into the development planning processes of government, donors and the corporate sector is a high priority for conservation investment. This is likely to prove to be a far more effective means of minimizing the biodiversity impacts of infrastructure development than mitigating them after the event.

Invasive Species

Introduction of invasive species, both deliberate and accidental, has occurred at a number of locations in Myanmar, although, to date, there has been little research into the impacts of invasive species in the country. Invasive species are potentially a significant threat to some aquatic ecosystems. For example, two large introduced species, Grass Carp (*Ctenopharyngodon idellus*) and Rohu (*Labeo rohita*), are found in Inlay Lake, of which the former is considered to definitely pose a threat to the lake's ecosystem (Kullander *et al.* 2004). Invasive plant species are a major conservation issue in the Central Dry Zone, where introduced species such as *Prosopis juliflora* and *Euphorbia* spp. dominate the vegetation in some areas. In general, however, it has yet to be determined whether the impacts of invasive species are relatively localized or less severe than those of many other threats to biodiversity in the country. Due to lack of adequate field assessments, the problem is underrated.

Pollution

Urbanization, industrialization and agricultural intensification are all contributing to increased levels of pollution in Myanmar. There has been little research on the impacts of pollution on biodiversity in the country, and it is difficult to evaluate the importance of this threat. Extrapolating from other countries in the region, it can be predicted that increased use of agrochemicals is likely to become a major threat to biodiversity, through triggering severe declines in invertebrate and subsequently, bird populations in agricultural landscapes. Mining for gold, gems and other minerals is another major source of pollution in Myanmar. Moody (1999) (cited in Eberhardt 2003) identified the threat of pollution in 35 mines, both large and small scale, in Myanmar. The current Mining Law should be strengthened to include provisions for environmental impact assessments to be conducted for mines and ensure standards of good practice. Systematic monitoring of the implementation of these provisions should also be an important aspect of the law. Large-scale mines generate environmental waste and release toxins into the environment while extensive gold panning is releasing mercury into the upper reaches of the Ayeyawady and Chindwin Rivers (Eberhardt 2003), although the government has been taking action to control this.

3.9. Root Causes

Economic growth and increasing consumption

Economic growth and ever-increasing consumption by expanding human populations are the main underlying causes of biodiversity loss in Myanmar. Exploitation of the country's natural resources is being driven increasingly by economic growth and increasing demand from the neighboring countries.

Measures of the ecological footprint, or human demand on nature, show that, in 2000, consumption in Myanmar was significantly below ecological capacity, creating an ecological remainder of 0.24 global hectares per capita (Venetoulis *et al.* 2004). However, ecological remainders are typically occupied by the footprints of other countries, through export production, rather than kept in reserve, and this is very much the case in Myanmar, with its exports of natural gas, wood products and other natural resources. While growth of Myanmar's economy could be expected to contribute to increased pressure on the country's natural resources, it can also probably offer more resources for biodiversity conservation.

Poverty

The population of Myanmar is predominantly rural, and a significant proportion lives below the US$1 per day poverty threshold. Consequently, there are high levels of dependency on natural resources, particularly in upland areas. In many cases, use of natural resources by rural communities is at least potentially sustainable. However, various factors, including external economic forces, population growth, and loss of access to land, can lead to unsustainable levels of natural resource use, and degradation and loss of natural habitats. These problems have been compounded by decades of armed conflict in areas where several thousands of people have abandoned their land. Poverty and land degradation in the uplands of Myanmar are linked in a mutually reinforcing cycle that is difficult to break (Eberhardt 2003). There is a clear need to develop approaches to natural resource management that deliver significant benefits to local communities while meeting biodiversity conservation objectives. In many cases, such approaches will be dependent upon simultaneously addressing issues of institutional capacity and land-use policy and planning. Recently, the government has set up a mission, with a target to reduce poverty mainly in rural areas.

Capacity Constraints

Government institutions have the principal responsibility for conserving biodiversity but they are often severely constrained by shortages of financial resources and technical expertise. For instance, NWCD has insufficient financial, human and material resources to fulfill its mandate to manage PAs (Clarke 1999). Government institutions responsible for conservation often suffer from low staff morale, lack of incentives for good performance, and lack of training. These constraints represent opportunities for NGOs and academic institutions to play a role in strengthening the capacity of key government institutions responsible for conservation.

Lack of Environmental Safeguards

In the absence of other sources of foreign exchange, the Government of Myanmar views natural resource exploitation as its best option for maintaining hard currency reserves (Eberhardt 2003). The government is pursuing a number of export-oriented policies, including commercial logging, hydroelectricity generation and aquaculture development. In implementing export-oriented policies, appropriate mitigation measures for biodiversity conservation should be seriously considered. The Environmental Law is being drafted and, with the promulgation of this law, it is hoped that the current lack of environmental safeguards in the formulation of policies and programs will be remedied. Thorough environmental impact assessments should be conducted and their findings taken into account. Integration of biodiversity considerations into government decision making is urgently needed, particularly in the agriculture, forestry, fisheries, mining and energy sectors.

Lack of Comprehensive Land-use Policies and Planning

All land in Myanmar belongs to the state, and land-use rights are granted for specific periods, dependent upon use (Eberhardt 2003). Land-tenure systems in most upland areas are based on customary rights under local institutions (Eberhardt 2003), which are not upheld under national law. As a result, rural communities are vulnerable to losing access to land through such processes as establishment of commercial plantations by agribusinesses, and appropriation of land for other uses, under the self-reliance policy. This is further compounded by a lack of a specific land-use policy to settle disputes over land tenure (Eberhardt 2003). Loss of land can force local communities to shorten fallow cycles, or cultivate steeper, less productive slopes, which are more susceptible to environmental degradation (Eberhardt 2003). Moreover, unplanned expansion of commercial plantations, such as oil palm and cassava, can lead to large-scale conversion of forest. Introduction of comprehensive land-use policies and land-use planning, consistent with sustainable rural livelihoods and biodiversity conservation, is a pressing need.

Undervaluation

Throughout the world, market prices tend to reflect only the direct use values of natural resources, ignoring indirect use, option use and existence values. In general, natural resources tend to be severely undervalued. This is broadly the case in Myanmar, where decisions about natural resource use are typically based only on direct use values, such as timber or hydroelectricity revenues. Generally, it is perceived that the immediate benefits of exploiting a natural resource is more attractive than the long-term benefits accrued from conservation of a resource, such as water catchment protection, soil erosion control or other ecological services. Many of the most important values of natural resources, particularly existence values, may not be easily quantifiable. A previous global study estimated the combined value of 17 different ecosystem services, including climate regulation, water supply and food production, is between US$16 and 54 trillion per year (Costanza ***et al***. 1997). In addition, a number of projects in Asia have demonstrated the economic values of natural resources, including a review of the role of PAs in development in Cambodia, Lao PDR, Thailand and Vietnam (ICEM 2003), and a review of the roles of natural vegetation in China (MacKinnon ***et al.*** 2001). Such approaches could be adopted in Myanmar, to promote a fuller accounting of the values of natural resources in decision-making processes. In particular, there may exist opportunities to ensure that existing and future foreign investors compensate the full economic costs of their investments, for instance through a natural resources tax or through appropriate mitigation measures. Moreover, financial mechanisms could be developed that enable the beneficiaries of dispersed ecosystem services provided by Myanmar's natural ecosystems to contribute to their conservation, such as carbon offset payments, payment for ecosystem services and debt-for-nature swaps.

Lack of Grassroots Support for Conservation

Although, in general, the people of Myanmar are supportive of conservation objectives, rural people living in close proximity to PAs may not be supportive of conservation efforts, such as protected area management (Clarke 1999). Reasons for this may include less awareness of people about the objectives of conservation, lack of mechanisms for local communities to benefit from PAs, and lack of opportunities for grassroots participation in conservation activities. There are several ways through which NGOs and academic institutions could build grassroots support for conservation, including: changing public perceptions towards conservation through awareness raising; promoting conservation approaches that deliver benefits to rural livelihoods without detriment to the biodiversity; acting as a bridge between government conservation initiatives (such as PAs) and local communities; developing non-formal approaches to site-based conservation that maximize grassroots participation; and strengthening the capacity of protected area managers in community outreach and participation.

Global climate change

There have been no studies on the impacts of global climate change on biodiversity in Myanmar but Myanmar is likely to be faced with temperature rising in several areas (Figure 12). Studies in other parts of the world suggest that the impacts of climate change are already being experienced by some ecosystems, and that any eventual climatic equilibrium may be preceded by a period of increased variability (IPCC 2001). Global climate change should be considered to be an emerging threat, with potentially severe implications for biodiversity in Myanmar. According to climate scenario analysis done by an initial national communication project under the UNFCCC, temperature is going to increase over 1 degree celsius in most part of the country within the next 30 years and it will have potential effects on agriculture, forestry, biodiversity, water resources, natural disasters and human health. In 2008, Cyclone Nargis hit the lower part of Myanmar and over 100,000 people died in this natural disaster. Mangrove forests in the Ayeyawady delta were also severely affected and the biological balance was seemingly destroyed. As a result, rat populations in mangrove villages significantly increased

and the damage of paddy fields by rat infestation aggravated food insecurity in storm-affected villages. Therefore, precautionary approaches and measures are required for biodiversity conservation to increase the potential for adaptation in response to climate change in the near future. If global climate change continues in its current direction, high altitude habitats may be especially threatened.

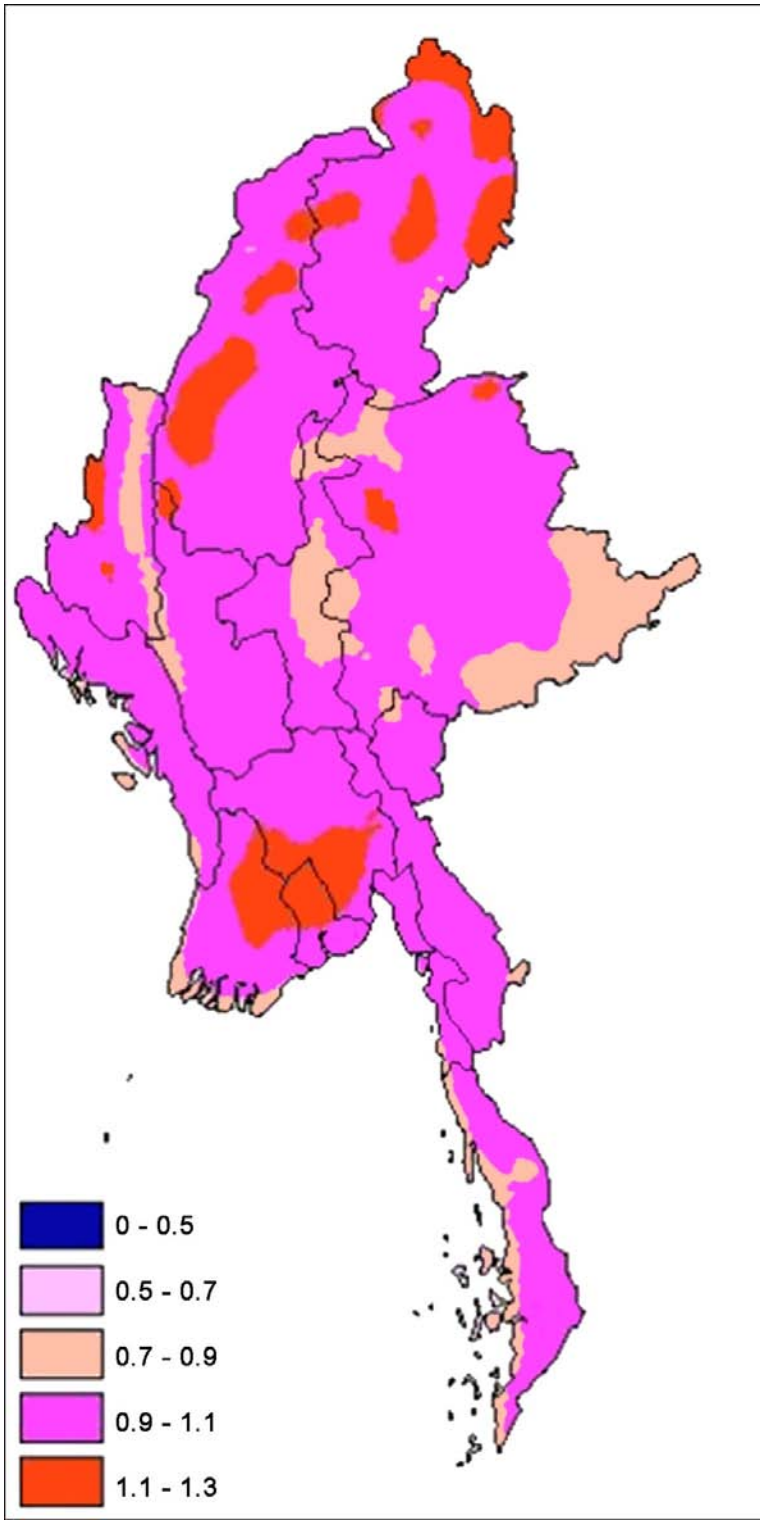

Figure 12. Potential Temperature Rise in Myanmar During 1970 and 2039. *Source: NCEA (2011).*

CHAPTER 4: CONSERVATION PRIORITIES AND MAJOR THREATS

4.1. Conservation Priorities

Strategically, it is essential for prioritizing areas for effective biodiversity conservation in order to make the best use of available resources and invest in the long-term management of biological resources. Prior to the formulation of the NBSAP, two stakeholder workshops were conducted in 2003 and 2004 by a multi-disciplinary expert team of NGOs, academic institutions, government institutions and donor agencies in order to analyze the conservation priorities in Myanmar (Birdlife International 2005). Those workshops were the best and most comprehensive efforts conducted for biodiversity conservation in Myanmar. The Conservation Outcomes identified by those workshops were reviewed and adopted in the formulation of Myanmar's NBSAP.

Conservation Outcomes are adopted as the basis for identifying biological priorities for conservation investment in Myanmar. Conservation Outcomes are the quantifiable suite of species, sites and corridors (landscapes of inter-connected sites) that must be conserved to maximize the long-term persistence of global biodiversity. Conservation Outcomes allow more effective targeting of conservation resources by presenting quantitative and justifiable targets against which the success of investments can be measured. Conservation Outcomes are set at three levels: "Extinctions Avoided" (Species Outcomes), "Areas Protected" (Site Outcomes) and "Corridors Created" (Corridor Outcomes).

Conservation Outcomes are set sequentially, with Species Outcomes set first, then Site Outcomes, and finally, Corridor Outcomes. Since Species Outcomes are extinctions to be avoided at the global level, they are set for globally threatened species (in the IUCN categories of Critically Endangered, Endangered and Vulnerable). This definition excludes Data Deficient species, which are considered to be priorities for further research but not necessarily for conservation action *per se*. It also excludes species threatened locally but not globally. These are considered to be national or regional conservation priorities but not global priorities. Species Outcomes are met when a species' global threat status improves or ideally, when it is removed from the IUCN Red List.

Because Conservation Outcomes are targets for the conservation of global biodiversity, it is essential that they should be based on a global standard. The drafting team adopted the global threat assessments contained within the *2004 IUCN Red List of Threatened Species* (IUCN 2004) as the basis for defining Species Outcomes for Myanmar because these represent the best available source of data on the global conservation status of species at the time of stakeholder consultation workshops. The draft lists of globally threatened species in Myanmar were prepared based on this source and the stakeholders then reviewed them to confirm which species occur in the country. Because many species are best conserved through the protection of a network of sites at which they occur, the next stage was to prepare a list of Key Biodiversity Areas (KBAs), which are important for the conservation of species. The most important criterion used to define KBAs was the regular occurrence of significant numbers of one or more globally threatened species. In the absence of detailed data on population size and minimum area requirements, it was usually necessary to make a provisional assessment of whether a particular species occurred regularly in significant numbers, based on a consideration of its ecological requirements, density and home-range size, and the availability of suitable habitat at the site.

KBAs were also defined on the basis of the occurrence of restricted-range and congregatory species. Sites regularly supporting significant populations of restricted-range species were considered to be global conservation priorities because there are few or no other sites in the world for which conservation action for these species can be taken. This criterion was only used to define KBAs for birds as this is the only group for which the concept of

restricted-range species has been quantitatively defined: species with a global breeding range of less than 50,000 km^2 (Stattersfield ***et al.*** 1998). Sites supporting a high proportion of the total population of one or more congregatory species at a particular time of year (for example, breeding, wintering and staging sites for migratory water birds) were considered to be global conservation priorities because these species are particularly susceptible to threats at these sites. Again, this criterion was only used to define KBAs for birds as this is the only group for which comprehensive population estimates for congregatory species are available (Wetlands International 2002); for congregatory water birds, a threshold of 1% of the Asian biogeographic population was used while for congregatory seabirds, a threshold of 1% of the global population was used.

A Site Outcome was set for each KBA in Myanmar. Site Outcomes are met when a KBA is protected, through improved management or expansion of an existing conservation area, or creation of a new conservation area. Improved management involves changing management practices for a KBA to ensure the long-term existence of species' populations and the ecosystem. Expansion of an existing conservation area involves increasing the proportion of a KBA under conservation management to meet area requirements of species or include previously excluded species or habitats. Creation of a new conservation area involves designating all or part of a KBA as a conservation area, and initiating effective long-term management. Conservation areas are not limited to actual or potential PAs but also include sites that could potentially be managed for conservation by local communities, private landowners or other stakeholders.

It has also adopted the network of Important Bird Areas (IBAs) in Myanmar (BirdLife International 2004) as the starting point for defining KBAs. IBAs are internationally important sites for bird conservation, defined on the basis of their importance for globally threatened, restricted-range, biome-restricted and/or congregatory bird species. It was necessary to supplement the IBA network through the definition of additional KBAs for other taxonomic groups, and this was done through consultation with stakeholders, complemented by review of published and unpublished data. Due to data limitations, it was only possible to prepare a preliminary list of KBAs, based on the sites that are most likely to meet the criteria.

The long-term conservation of biodiversity requires the protection of conservation corridors, which are landscapes of inter-connected sites. A Corridor Outcome was set for each conservation corridor in Myanmar. Corridor Outcomes are met when a conservation corridor maintains intact biotic assemblages and natural processes. A prerequisite for maintaining intact biotic assemblages is the conservation of landscape species. Landscape species have wide home ranges, low natural densities, migratory behavior or other characteristics that make them unlikely to be conserved by site-based interventions alone (Sanderson ***et al.*** 2001). The stakeholders selected the following list of landscape species for Myanmar: Takin, Asian Elephant, Irrawaddy Dolphin, Tiger, Rufous-necked Hornbill, Plain-pouched Hornbill, White-bellied Heron, sandbar-nesting birds, vultures and large water birds. Maintaining natural processes involves achieving the long-term sustainability of intact ecological and evolutionary processes such as migration and dispersal of species and annual flooding cycles.

To facilitate the persistence of biodiversity, conservation corridors must be anchored on core areas, embedded in a matrix of natural and/or anthropogenic habitats (Soulé and Terborgh 1999). Based on this theory, conservation corridors are anchored on KBAs, with the remainder comprising areas that have the potential to become KBAs in their own right (through management or restoration) and/or areas that contribute to the ability of the corridor to support biodiversity in the long-term.

The stakeholders prepared a preliminary list of conservation corridors by using KBAs as the starting point. First, the stakeholders were asked to define conservation corridors wherever

maintaining connectivity between two or more KBAs is necessary to facilitate long-term conservation of landscape species. Next, they were asked to define additional conservation corridors wherever maintaining a larger area of natural habitat is necessary to maintain evolutionary and ecological processes. Definition of conservation corridors was constrained by time and data limitations and the absence of detailed criteria. Because of those constraints, the stakeholders concentrated on defining large blocks of relatively contiguous natural habitat that they assessed as being potentially capable of sustaining populations of landscape species and full faunal and floral communities in the long-term. The stakeholders defined the boundaries of the conservation corridors.

In Myanmar, global threat assessments have only been conducted for mammals, birds, amphibians, some reptiles (turtles and crocodiles), some plants, some invertebrate species and a few marine species. Furthermore, recent information on the status of most globally threatened species in Myanmar accounts to a few survey records from a few sites where surveys were possible. National status survey has been attempted only for Tiger. For many species, there are no recent field records from Myanmar. Consequently, it was only possible to prepare preliminary lists of globally threatened species, KBAs and conservation corridors. As more information becomes available, it will be necessary to revise the Conservation Outcomes for Myanmar.

4.1.1. Species Outcomes

According to the 2004 IUCN Red List, excluding species restricted to marine ecosystems, a total of 163 globally threatened species occur in Myanmar, of which 28 are Critically Endangered, 42 are endangered and 83 are vulnerable (IUCN 2004) (Figure 13).

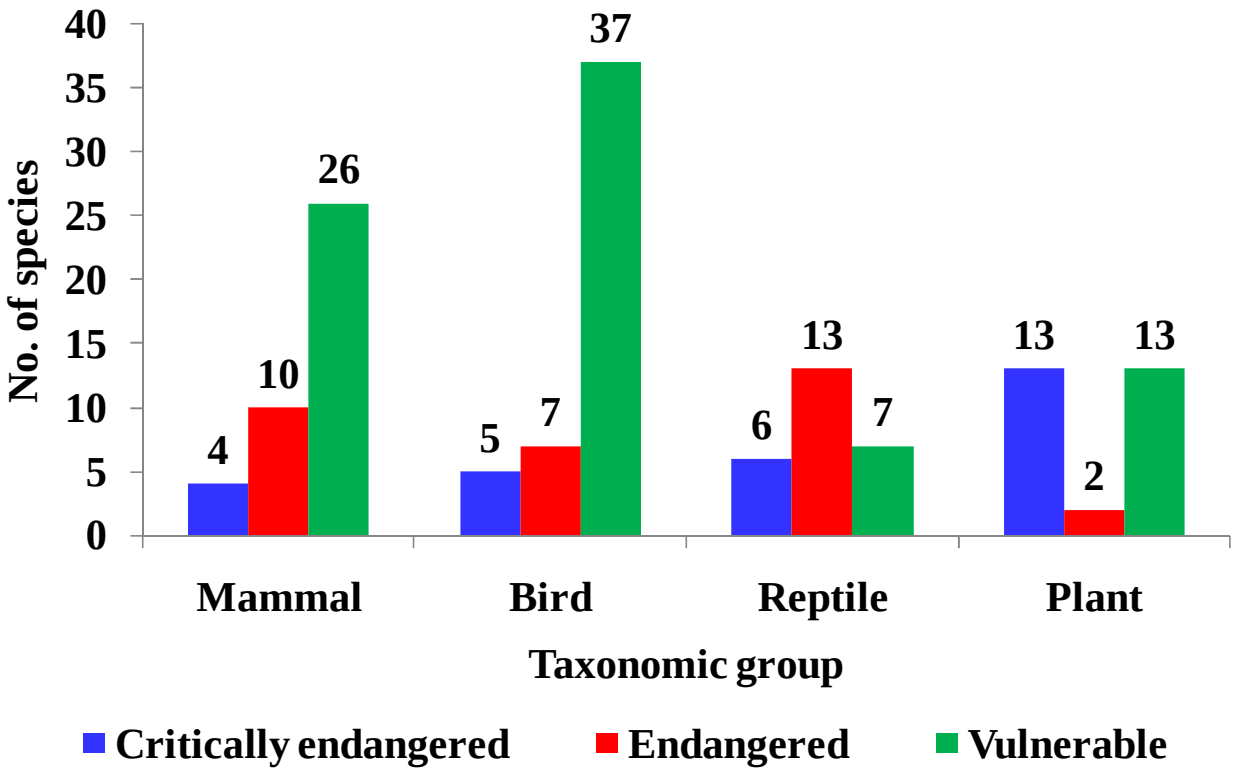

Figure 13. Number of Globally Threatened Species in Myanmar in 2004.

The globally threatened species comprise 40 mammal species, 49 bird species, 26 reptile species, one invertebrate species and 43 plant species; nine of these species are endemic to Myanmar (Table 16).

For reptiles, fish, invertebrates and plants, the actual figures are probably significantly lower than the number of species threatened with global extinction currently reported in Myanmar, because global threat assessments are incomplete for these groups. For amphibians, although a comprehensive global threat assessment has recently been conducted (IUCN-SSC and CI-CABS 2003); no globally threatened species has been confirmed to occur in Myanmar.

Table 16. Globally Threatened Species Endemic to Myanmar.

Species	Global Threat Status
Joffre's Pipistrelle (*Pipistrellus joffrei*)	Critically endangered
Anthony's Pipistrelle (*Pipistrellus anthonyi*)	Critically endangered
Burmese Star Tortoise (*Geochelone platynota*)	Critically endangered
Arakan Forest Turtle (*Heosemys depressa*)	Critically endangered
Burmese Roofed Turtle (*Kachuga trivitatta*)	Endangered
Burmese Eyed Turtle (*Morenia ocellata*)	Endangered
Burmese Frog-faced Softshell Turtle (*Chitra vandijki*)	Endangered
Burmese Peacock Softshell (*Nilssonia formosa*)	Endangered
White-browed Nuthatch (*Sitta victoriae*)	Endangered

Myanmar's four Critically Endangered mammal species comprise Lesser One-horned Rhinoceros, Hairy Rhinoceros, Anthony's Pipistrelle and Joffre's Pipistrelle, all of which were found in the country historically, although there have been no confirmed records of any in recent years (Corbet and Hill 1992). All four species are high priorities for surveys to establish their status and identify remaining populations.

Myanmar's four Critically Endangered bird species comprise: Gurney's Pitta, an endemic species to southern Myanmar and peninsular Thailand, which is highly threatened by clearance of its lowland forest habitat; Slender-billed Vulture and White-backed Vulture, two species that have undergone precipitous declines across their global ranges, although recent survey results indicate that significant populations persist in Myanmar; and Pink-headed Duck, a species that previously occurred in Myanmar and northern India, although there have been no confirmed records from anywhere in its range for over 50 years (BirdLife International 2003).

Myanmar's four Critically Endangered reptile species comprise Estuarine Crocodile (*Crocodylus porosus*), Mangrove Terrapin (*Batagur baska*), Burmese Star Tortoise and Arakan Forest Turtle. The latter two are endemic to Myanmar, and all four are severely threatened by over-exploitation. Thirteen Critically Endangered plant species are also known to occur in Myanmar. All are members of the Dipterocarpaceae family: *Anisoptera scaphula*, *Dipterocarpus baudii*, *D. dyeri*, *D. gracilis*, *D. grandiflorus*, *D. kerrii*, *D. turbinatus*, *Hopea apiculata*, *H. helferi*, *H. sangal*, *Parashorea stellata*, *Shorea farinosa* and *Vatica lanceaefolia*. All of these are tree species, and severely threatened by commercial logging and/or conversion of lowland forest.

4.1.2. Site Outcomes

A preliminary list of 76 KBAs was prepared (Figure 14 and Annex 5). Twenty-nine of these KBAs (equivalent to 38% of the total) were defined for globally threatened mammal species, 55 (72%) were defined for globally threatened, restricted-range or congregatory bird species, 10 (13%) were defined for globally threatened reptile species and eight (11%) were defined for globally threatened plant species. The number of KBAs defined would probably be considerably higher if more detailed data were available on the distribution of the conservation status and distribution of species in Myanmar. Especially Shan State represents a significant gap in the coverage of KBAs, in large part due to the lack of recent biological survey data from most

parts of the State. Shan State should be considered a high priority for baseline biodiversity surveys, particularly areas along the international borders with China and Lao PDR.

Only 25 (33%) of Myanmar's KBAs are designated or officially proposed as PAs, in whole or in part; the remaining 51 (67%) are still unprotected. This indicates that there may be a need to review and, where necessary, extend the national PAS, in order to increase the coverage of under-represented species and habitats. As well as extending the national PAS, there may be opportunities to develop alternative site conservation approaches at some unprotected KBAs, such as community-based conservation or conservation concessions.

Ten KBAs are known to support globally threatened species endemic to Myanmar (Table 17). In this context, Gurney's Pitta is considered to be endemic to Myanmar, since approximately 90% of the global population is found in the country, and the known population in Thailand is small and possibly not viable. These KBAs should be considered particularly high conservation priorities, as there exist few or no other sites in the world at which conservation action for these species can be taken. Only four of these KBAs are designated or officially proposed as PAs.

4.1.3. Corridor Outcomes

A preliminary list of 15 conservation corridors was prepared, covering a total area of 293,400 km^2, equivalent to 43% of the country's land area (Annex 6 and Table 18). These corridors range in size from 5,300 km^2 (Ayeyawady Delta) to 53,000 km^2 (Rakhine Yoma Range). The full list of KBAs within each conservation corridor is presented in Table 19.

Table 17. KBAs Known to Support Globally Threatened Endemic Species of Myanmar.

KBA	Species
Central Taninthayi Coast	Burmese Eyed Turtle
Chaungmon-Wachaung	Gurney's Pitta
Kaladan Estuary	Burmese Roofed Turtle
Karathuri	Gurney's Pitta
Minzontaung*	Burmese Star Tortoise
Myaleik Taung	Burmese Star Tortoise
Natmataung (Mount Victoria)*	White-browed Nuthatch
Ngawun	Gurney's Pitta
Rakhine Yoma*	Arakan Forest Turtle
Shwesettaw*	Burmese Star Tortoise

Note: * = PAs

The conservation corridors contain 52 KBAs (equivalent to 68% of the total). Two conservation corridors, Central Ayeyawady River and Sundaic Subregion, support significantly greater numbers of KBAs than other corridors. In the Central Ayeyawady River corridor, these KBAs are situated within a largely anthropogenic affected landscape, in contrast to the Sundaic Subregion corridor, which constitutes a largely primary landscape. The coverage of globally threatened species within the conservation corridors is very good: almost all the globally threatened species are likely to occur regularly in significant numbers in one or more conservation corridors. The two species with insufficient data within the conservation corridors are Pallas's Fish Eagle (*Haliaeetus leucoryphus*) and Slender-billed Vulture; the former is not likely to have a globally significant population within Myanmar while the latter is a priority for species-focused conservation and has been selected as a Priority Species.

Table 18. Summary of Conservation Corridors in Myanmar.

Conservation Corridor	Area (km^2)	No. of KBAs
Ayeyawady Delta	5,300	1
Bago Yoma Range	17,800	2
Central Ayeyawady River	18,000	13
Central Myanmar Dry Forests	15,000	2
Central Myanmar Mixed Deciduous Forests	7,600	2
Central Thanlwin River	11,000	0
Chin Hills Complex	23,900	5
Kayah-Kayin Range	13,000	1
Lower Chindwin River	8,400	1
Naga Hills	5,500	1
Nan Yu Range	20,500	0
Northern Forest Complex	25,800	3
Rakhine Yoma Range	53,000	5
Sundaic Subregion (Taninthayi)	44,200	12
Upper Chindwin Lowlands	24,400	4

Table 19. Priority Corridors and Priority Sites for Conservation Investment in Myanmar.

Priority Corridor	Priority Sites	Area (km^2)
Central Myanmar Dry Forests	Chatthin; Shwesettaw	15,000
Central Myanmar Mixed Deciduous Forests	Alaungdaw Kathapa; Mahamyaing	7,600
Chin Hills Complex	Bwe Pa; Kennedy Peak; Kyauk Pan Taung; Natmataung (Mount Victoria); Zeihmu Range	23,900
Lower Chindwin River	Uyu River	8,400
Northern Forest Complex	Hkakaborazi; Hponkanrazi; Khaunglanpu	25,800
Rakhine Yoma Range	Kaladan Estuary; Nat-yekan; Ngwe Taung; Northern Rakhine Yoma; Rakhine Yoma	53,000
Sundaic Subregion (Taninthayi)	Central Taninthayi Coast; Chaungmon-Wachaung; Htaung Pru; Karathuri; Kawthaung District Lowlands; Lampi Island; Lenya; Ngawun; Pachan; Pe River Valley (Mintha Ext RF); Taninthayi National Park; Taninthayi Nature Reserve	44,200
Upper Chindwin Lowlands	Bumphabum; Htamanthi; Hukaung Valley; Tanai River	24,400
Additional Priority Sites		
None	Minzontaung	22
None	Myaleik Taung	50
None	Shwe U Daung	326

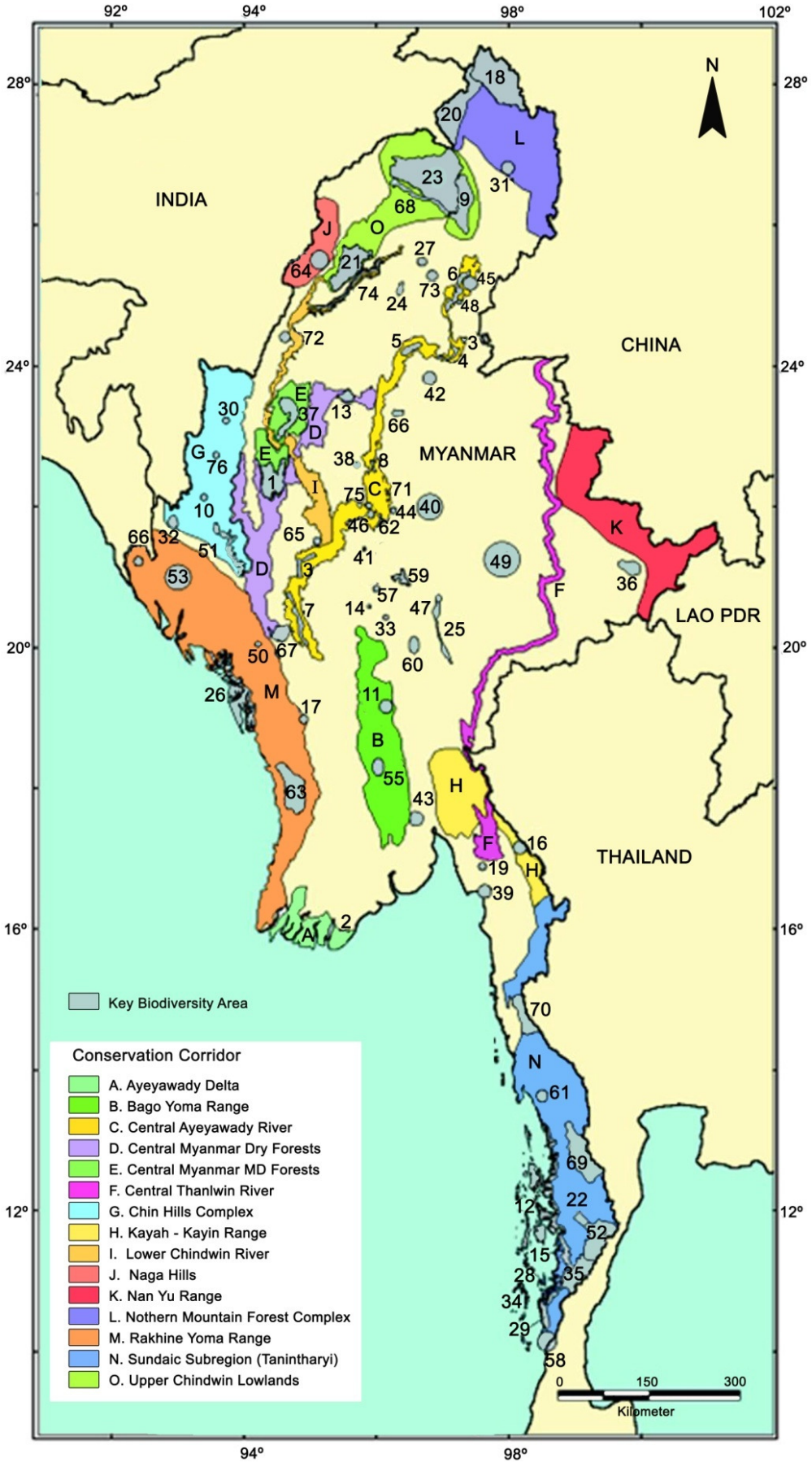

Figure 14. Site and Corridor Outcomes in Myanmar.

4.1.4. Priority Outcomes for Conservation Investment

To maximize the impact of future conservation investment in Myanmar, it is necessary to refine the full suite of Conservation Outcomes into a focused set of Priority Outcomes. The Priority Outcomes represent a consensus among stakeholders on the Priority Species, Sites and Corridors for conservation investment over the next five years. Priority Sites and Corridors are used to target investments in site-based and landscape level conservation at the highest geographical priorities. Priority Species are used to target investments in species-focused conservation of globally threatened species with conservation needs that cannot be addressed by site-based and landscape-level action alone. The stakeholders employed four criteria to select Priority Corridors from among the preliminary list of conservation corridors in Myanmar: (i) importance for the conservation of Critically Endangered and Endangered animal species; (ii) importance for the conservation of landscape species; (iii) importance for the conservation of unique or exceptional ecological and evolutionary processes; and (iv) need for additional conservation investment. The application of the selection criteria to the conservation corridors is summarized in Annex 6. The stakeholders employed three criteria to select Priority Sites from among the preliminary list of KBAs in Myanmar: (i) occurrence within a Priority Corridor; (ii) importance for the conservation of globally threatened species endemic to Myanmar; and (iii) need for additional conservation investment. The application of the selection criteria to the KBAs is summarized in Annex 5.

The stakeholders employed three criteria to select Priority Species from among the preliminary list of globally threatened species in Myanmar: (i) global significance of the Myanmar population (i.e. migrants, rare winter visitors and species with very marginal occurrence could not be selected as Priority Species); (ii) need for species-focused conservation; and (iii) need for additional conservation investment.

For all Priority Outcomes, the most important selection criterion was needed for additional conservation investment. Only species, sites and corridors for which current or projected levels of investment (even if significant) considering highly insufficient to meet their conservation needs were selected as Priority Outcomes. Given the currently very low levels of conservation investment in Myanmar relative to immediate conservation needs in the country, a very large proportion of Conservation Outcomes were assessed as having a high need for additional investment.

The participants at the first stakeholder workshop prepared draft lists of Priority Species, Sites and Corridors. The lists were then revised by the drafting team, through reference of published and unpublished data and further consultations with stakeholders. The revised lists were then fed back at the second workshop, where they were finalized in consultation with the stakeholders.

Eight of the 15 conservation corridors in Myanmar were selected as Priority Corridors (Table 19 and Figure 15). The Priority Corridors cover a total area of 202,300 km^2, equivalent to approximately 30% of the country's land area.

By definition, all KBAs located within Priority Corridors are Priority Sites. Additional Priority Sites were also selected, outside the conservation corridors, to increase the coverage of globally threatened species endemic to Myanmar that require site-based conservation. Of the 11 KBAs known to support globally threatened species endemic to Myanmar (Table 17), eight are included within a Priority Corridor. Two of the remaining three support Burmese Star Tortoise (Critically Endangered), a species for which site-based conservation is a high priority, and the remaining one, Shwe U Daung used to be a habitat for critically endangered species of Hairy Rhinoceros (*Dicerorhinus sumatraensis*), and the conservation priority for this site will be critical for restoring this rhinoceros. All three KBAs were assessed as having a high need for additional conservation investment, and were selected as additional Priority Sites (Table 19 and Figure 15).

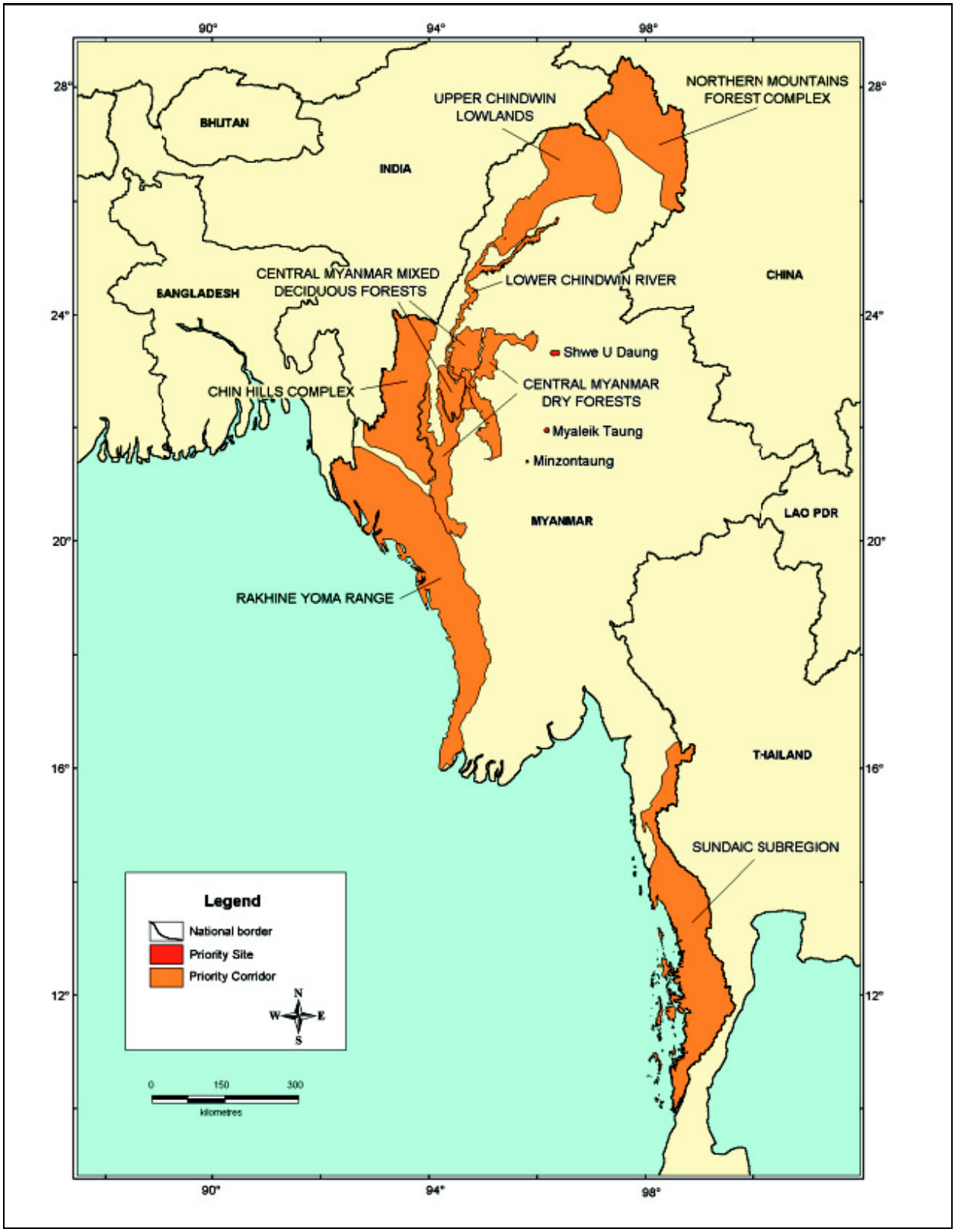

Figure 15. Priority Corridors and Additional Priority Sites for Biodiversity Conservation in Myanmar.

Only 18 of the 37 Priority Sites are designated as PAs or officially proposed for protection, equivalent to about 49% of the total. The eight Priority Corridors cover a total area of 202,300 km^2, equivalent to about 30% of Myanmar's land area. It is likely that the Priority Sites and Corridors do not contain all elements of globally important biodiversity for which site-based

and/or landscape-level conservation actions are a high priority. Additional Priority Sites and Corridors need to be defined as additional information becomes available.

The eight Priority Corridors and three additional Priority Sites represent all of the major ecosystems and habitat types in Myanmar. They also include some of the best remaining examples of three of the most threatened ecosystems in the Indo-Myanmar (Indo-Burma) Hotspot as a whole: coastal; riverine; and lowland evergreen forest ecosystems. Across the hotspot, rates of natural habitat conversion in these ecosystems have been high in recent decades, largely because they coincide with areas of high human population density and/or are attractive for alternative land-uses, such as cash-crop cultivation in the case of lowland evergreen forest ecosystems, or shrimp aquaculture in the case of coastal ecosystems. The rate of habitat conversion has been compounded by the under-representation of these ecosystems within national PAS in the hotspot, partly because of the perception that designating PAs in these ecosystems would mean foregoing economic development, and partly because of a limited appreciation of their biodiversity values (particularly in the case of coastal and riverine ecosystems). Priority Corridors that are particularly important for the conservation of representative examples of these ecosystems comprise the Lower Chindwin River (for riverine ecosystems), the Rakhine Yoma Range (for coastal ecosystems), the Sundaic Subregion (Taninthayi) (for lowland wet evergreen forest and coastal ecosystems), and the Upper Chindwin Lowlands (for riverine ecosystems).

The Priority Corridors and additional Priority Sites also support some of the best remaining examples of three of the least protected and most threatened habitat types in Myanmar (albeit not necessarily highly threatened globally): deciduous dipterocarp forest; freshwater swamp forest; and mangrove. Priority Corridors that are particularly important for the conservation of these habitats include the Central Myanmar Dry Forests (for deciduous dipterocarp forest), the Sundaic Subregion (Taninthayi) (for mangrove) and the Upper Chindwin Lowlands (for freshwater swamp forest).

The key biodiversity values of the eight Priority Corridors and three additional Priority Sites are briefly summarized below:

Priority Corridor 1 - Central Myanmar Dry Forests. The Priority Corridor includes some of the few remaining areas of natural habitat remaining within the Central Dry Zone, including isolated remnants of deciduous dipterocarp forest. The largest intact example of this habitat type is included in Chatthin Wildlife Sanctuary and surrounding areas. The Priority Corridor supports several species endemic to Myanmar, most notably Burmese Star Tortoise (Critically Endangered), White-throated Babbler, Hooded Treepie and Burmese Bushlark. The Priority Corridor also supports the largest known wild population of Eld's Deer (Vulnerable) in the world. Major threats to biodiversity in the Priority Corridor include: agricultural expansion, including large scale conversion of forests to commercial plantations by agribusinesses; loss of forest due to fuel wood consumption; trade-driven hunting; and infrastructure development.

Priority Corridor 2 - Central Myanmar Mixed Deciduous Forests. The Priority Corridor includes extensive areas of mixed deciduous forest on hills to the north and west of the Central Dry Zone, especially within Alaungdaw Kathapa National Park and proposed Mahamyaing Wildlife Sanctuary. The Priority Corridor supports populations of several globally threatened species, including Hoolock Gibbon (*Bunipithecus hoolock*), Capped Leaf Monkey (*Trachypithecus pileatus*), Asian Elephant and Banteng (*Bos javanicus*) (all are endangered species). Agricultural expansion, hunting for the wildlife trade, over-exploitation of NTFPs and livestock grazing are among the threats to biodiversity in the Priority Corridor.

Priority Corridor 3 - Chin Hills Complex. The Priority Corridor comprises the Chin Hills, a range of high mountains, which extends south from the international border with India. The Chin Hills contain large areas of hill and montane evergreen forest habitats, which support several globally threatened species, including important populations of Hume's Pheasant and Rufous-necked Hornbill (both are Vulnerable). Most notably, the southern Chin Hills is the only place on the Earth known to support White-browed Nuthatch (Endangered). There are two designated PAs within the Priority Corridor: Natmataung National Park and proposed Kyauk Pan Taung Wildlife Sanctuary. The main threats to biodiversity in the Priority Corridor include hunting for subsistence and trade, over-exploitation of NTFPs and shifting cultivation, which has transformed much of the landscape, especially below 2,000 m asl and throughout the southern Chin Hills.

Priority Corridor 4 - Lower Chindwin River. The Priority Corridor comprises the Lower Chindwin River and its flanking habitats, from Htamanthi Wildlife Sanctuary to the confluence with the Ayeyawady River, as well as the Uyu River, a major tributary of the Chindwin. Apart from the lower section, which flows through the Central Dry Zone, the Chindwin River supports significant stretches of relatively undisturbed riverine habitats, including sandbars, sandbanks, ox-bow lakes and riverine forest. Although the Lower Chindwin River is less well studied than the more heavily disturbed Ayeyawady River, it supports a number of species that have been lost from most other wide, slow-flowing, lowland rivers in mainland Southeast Asia. The Priority Corridor is known to be important for White-rumped Vulture (Critically Endangered) and may also support a number of other globally threatened species, including the nationally endemic Burmese Frog-faced Softshell Turtle (Endangered). The Lower Chindwin River forms an ecological corridor, connecting the Central Ayeyawady River, Central Myanmar Dry Zone and Upper Chindwin Lowlands conservation corridors. The Priority Corridor is entirely unprotected, and faces a number of significant threats to biodiversity, including dredging for gold, pollution from gold mining, formation of sandbars, hunting of birds and degradation of riverine forest through timber and bamboo extraction.

Priority Corridor 5 - Northern Forest Complex. The Priority Corridor comprises the high mountains in the extreme north of Myanmar, along the international borders with India and China, and associated foothills and valleys to the south. The Priority Corridor contains an elevational gradient of over 5,000 m, from the summit of Hkakaborazi, Myanmar's highest mountain, to the valleys of tributaries of the Ayeyawady River. The Priority Corridor includes a correspondingly wide range of natural habitat types, from alpine meadows, through sub-alpine, montane and hill evergreen forest, to lowland evergreen forest. The Northern Forest Complex supports a very high floristic diversity, including a large number of species endemic to the country (Kingdon-Ward 1944-5). The Mountain Forest Complex also supports a number of animal species that are characteristics of the eastern Himalayas, including Red Panda (Endangered), Takin, Sclater's Monal and Blyth's Tragopan (all are Vulnerable), as well as populations of the little-known Black Muntjac (*Muntiacus crinifrons*) (Vulnerable) (Rabinowitz *et al.* 1998) and the recently described Leaf Deer (Amato *et al*. 1999). In addition, the Priority Corridor supports important populations of Hoolock Gibbon and White-bellied Heron (both are Endangered). The Northern Forest Complex represents one of the largest contiguous wilderness areas in the country, and the existence of contiguous forest areas in China and India, such as Namdapha National Park, present opportunities for transboundary conservation initiatives. The Mountains Forest Complex contains two large PAs: Hkakaborazi National Park and Hponkanrazi Wildlife Sanctuary. Most of the area under protection lies in the northwestern part of the corridor, and there is a need to establish PAs in the northeastern part, especially in areas close to the international border with China, which lie within the Yunnan Mountains EBA. The main threats to biodiversity in the Priority Corridor are shifting cultivation, hunting and timber

extraction (including associated road construction). The latter two threats are driven by the high demand from China.

Priority Corridor 6 - Rakhine Yoma Range. The Priority Corridor is centered on the Rakhine Yoma Range, which lies inland of the Bay of Bengal, between the international border with Bangladesh and the Ayeyawady Delta. The mountains of the Rakhine Yoma Range support a large, contiguous block of semi-evergreen, evergreen and mixed deciduous forest. The Priority Corridor also includes a large stretch of coastline, with extensive areas of intertidal mudflats and mangrove, most notably in the Kaladan Estuary. The Priority Corridor supports important populations of two endemic turtle species: Arakan Forest Turtle (Critically Endangered) and Burmese Roofed Turtle (Endangered). The Mehu area, in the north of the Priority Corridor, is identified as one of the most important areas in Myanmar for the conservation of Asian Elephant (Endangered). The Priority Corridor is also reported to support a number of other globally threatened mammal species, including Hoolock Gibbon, Tiger, Banteng (all are Endangered), Asian Black Bear, Asian Golden Cat, Clouded Leopard and Gaur (all are Vulnerable) (U Tin Than 2004). Part of the Priority Corridor is included within Rakhine Yoma Elephant Range, a PA, although the majority is currently unprotected. The main threats to biodiversity in the Priority Corridor include timber extraction, trade-driven hunting, agricultural expansion and clearance of mangrove.

Priority Corridor 7 - Sundaic Subregion (Taninthayi). The Priority Corridor comprises the Sundaic Subregion, an extremely large block of natural habitat, which includes small parts of Mon and Kayin States plus the vast majority of Taninthayi Region. The Sundaic Subregion includes the largest areas of lowland wet evergreen forest remaining in the Indo-Myanmar (Indo-Burma) Hotspot. The Priority Corridor also includes a significant portion of coastline, a large number of offshore islands and significant areas of key wetland habitats, including mangrove and intertidal mudflat. Although the Priority Corridor has received little recent biological study, there are indications that it supports rich lowland evergreen forest communities and globally threatened wildlife, such as Asian Tapir (*Tapirus indicus*) and Plain-pouched Hornbill (both are Vulnerable). Coastal habitats support Mangrove Terrapin (Critically Endangered) and are thought to be important for migratory water birds. Of greatest significance, the Priority Corridor supports the bulk of the world population of Gurney's Pitta (Critically Endangered), a species endemic to Taninthayi Region and a small part of peninsular Thailand (Anon. 2003, Eames *et al.* 2005). Moreover, the Priority Corridor is thought to support a relatively large population (approximately >50 individuals) of Tiger (Endangered) (Lynam 2003). The potential of the Sundaic Subregion for the long-term conservation of landscape species, such as Asian Elephant, Tiger and Plain-pouched Hornbill, is enhanced by the existence of significant areas of contiguous natural habitat in western and peninsular Thailand. Within the Indo-Myanmar (Indo-Burma) Hotspot, the Priority Corridor has unparalleled importance for the conservation of the wet evergreen forest ecosystem of the Sundaic lowlands. The lowland wet evergreen forests of the Sundaic Subregion are significantly under represented within the national PAS, and are under severe immediate threat of conversion to oil palm plantations. The mangroves of the Sundaic Subregion are similarly under represented within PAs, and are threatened by conversion to aquaculture, although their global significance is not so great as that of the corridor's lowland wet evergreen forests. Other threats to biodiversity in the Priority Corridor include hunting, mining, timber extraction and over-exploitation of NTFPs.

Priority Corridor 8 - Upper Chindwin Lowlands. The Priority Corridor comprises a large block of natural habitat in the upper catchment of the Chindwin River. The Priority Corridor contains the upper section of the Chindwin River plus several of its major tributaries, such as the Tanai, Tawang and Palaunglanbum Rivers. These rivers are important for a number of landscape species, including sandbar-nesting birds and, potentially, White-bellied Heron. Significant sections of these rivers have associated ox-bow lakes and other non-flowing wetlands, which are

important for White-winged Duck (Endangered), Masked Finfoot and Lesser Adjutant *Leptoptilos javanicus* (both are Vulnerable). In addition, these wetlands possibly support Pink-headed Duck (Critically Endangered), continued occurrence of this species has been reported by local people (personal communication). The Priority Corridor also supports extensive areas of lowland evergreen, semi-evergreen and mixed deciduous forest, which may support significant populations of several globally threatened species, including Asian Elephant and Capped Leaf Monkey, and certainly support significant populations of Hoolock Gibbon (all are Endangered). Information from recent mark-recapture studies indicates that there could possibly be 7 to 71 Tigers (Endangered) in the core of Hukaung Tiger Reserve (Lynam *et al.* 2009). With appropriate management, the Priority Corridor has the potential to support a higher population. The coverage of the Upper Chindwin Lowlands within the national PAS is greater than that of any other Priority Corridor. The newly created Hukaung Tiger Reserve alone covers 21,890 km^2, making it not only the largest PA in Myanmar but also the largest tiger reserve in the world. The Priority Corridor also includes Bumphabum and Htamanthi Wildlife Sanctuaries. All these PAs face shortages of personnel and resources as PAs elsewhere in Myanmar, and threats to biodiversity within the Priority Corridor are steadily increasing, particularly hunting, mining, agricultural conversion and human settlement, which is a particular problem along the Ledo Road, which bisects Hukaung Tiger Reserve.

Priority Site 1 - Minzontaung. The Priority Sites comprise of Minzontaung Wildlife Sanctuary, which supports a relatively undisturbed example of the dry forest ecosystem characteristic of central Myanmar. The Priority Site supports several species endemic to Myanmar, including White-throated Babbler and Hooded Treepie. Most significantly, the site supports a significant population of Burmese Star Tortoise (Critically Endangered).

Priority Site 2 - Myaleik Taung. Another priority site is Myaleik Taung, an area of dry forest and agricultural habitats near Mandalay, which supports the largest known population of Burmese Star Tortoise. Although the Priority Site is not designated as a PA, local beliefs that protect the Star Tortoises confer a significant level of protection on the species.

Priority Site 3 – Shwe U Daung. The Priority Sites also consist of Shwe U Daung Wildlife Sanctuary. Shwe U Daung used to be a habitat for critically endangered species of Hairy Rhinoceros (*Dicerorhinus sumatraensis*), and the conservation priority for this site will be critical for restoring this rhinoceros. In addition, Shwe U Daung Wildlife Sanctuary serves as an important habitat for Asian elephant (endangered).

In addition to the Priority Corridors and Sites, the stakeholders selected 48 Priority Species (Table 20), representing 33% of the preliminary list of globally threatened species in Myanmar. The Priority Species comprise 22 mammal species, 11 bird species and 16 reptile species, and include all nine globally threatened species endemic to Myanmar and all 11 Critically Endangered animal species known to occur in the country. Due to a lack of information on the status and conservation needs of globally threatened invertebrate and plant species in Myanmar, no Priority Species were selected among these taxonomic groups.

A large proportion of the Priority Species, including Tiger, Asian Black Bear and 16 species of turtle, were selected because conservation action is required to address the threat of trade-driven hunting. Other Priority Species, including two species of *Gyps* vulture and several species of water bird, were selected because they occur at low densities over large areas (at least for part of the year) and require species-focused action throughout their ranges, in order to address such threats as disturbance and loss of key habitats. Many Priority Species were selected because they are high priorities for status survey. These include Lesser One-horned Rhinoceros, Hairy Rhinoceros, Pink-headed Duck and several other species with no recent confirmed records from Myanmar, the updated and accurate information on their status and distribution is greatly required before conservation action can be taken in any meaningful way.

Table 20. Priority Species for Biodiversity Conservation in Myanmar.

Priority Species	Species-focused Action(s) Required
MAMMALS	
Kitti's Hog-nosed Bat - *Craseonycteris thonglongyai*	Status survey
Joffre's Pipistrelle - *Pipistrellus joffrei*	Status survey
Anthony's Pipistrelle - *Pipistrellus anthonyi*	Status survey
Capped Leaf Monkey - *Trachypithecus pileatus*	Status survey; control of hunting
Hoolock Gibbon - *Bunipithecus hoolock*	Status survey
Asian Black Bear - *Ursus thibetanus*	Status survey; control of hunting
Red Panda - *Ailurus fulgens*	Status survey; control of hunting
Asian Golden Cat - *Catopuma temminckii*	Status survey
Marbled Cat - *Pardofelis marmorata*	Status survey
Clouded Leopard - *Neofelis nebulosa*	Status survey
Tiger - *Panthera tigris*	Control of hunting
Asian Elephant - *Elephas maximus*	Status survey; control of hunting; mitigation of human -elephant conflict
Asian Tapir - *Tapirus indicus*	Status survey
Lesser One-horned Rhinoceros - *Rhinoceros sondaicus*	Status survey
Eld's Deer - *Cervus eldii*	Status survey; control of hunting
Black Muntjac - *Muntiacus crinifrons*	Status survey
Wild Water Buffalo - *Bubalus bubalis*	Status survey; control of hunting
Takin - *Budorcas taxicolor*	Status survey
Red Goral - *Naemorhedus baileyi*	Status survey
BIRDS	
Green Peafowl - *Pavo muticus*	Control of hunting
White-winged Duck - *Cairina scutulata*	Control disturbance and habitat loss across range
Pink-headed Duck - *Rhodonessa caryophyllacea*	Status survey
Sarus Crane - *Grus antigone*	Control disturbance and habitat loss across range
Masked Finfoot - *Heliopais personata*	Control disturbance and habitat loss across range
White-rumped Vulture - *Gyps bengalensis*	Control disturbance across range
Slender-billed Vulture - *Gyps tenuirostris*	Control disturbance across range
White-bellied Heron - *Ardea insignis*	Control disturbance and habitat loss across range
Lesser Adjutant - *Leptoptilos javanicus*	Control disturbance and habitat loss across range
Gurney's Pitta - *Pitta gurneyi*	Status survey
White-browed Nuthatch - *Sitta victoriae*	Status survey
REPTILES	
Estuary Crocodile - *Crocodylus siamensis polosus*	Status survey
Burmese Star Tortoise - *Geochelone platynota*	Status survey; control of hunting
Elongated Tortoise - *Indotestudo elongata*	Status survey; control of hunting
Asian Giant Tortoise - *Manouria emys*	Status survey; control of hunting
Impressed Tortoise - *Manouria impressa*	Status survey; control of hunting
Mangrove Terrapin - *Batagur baska*	Status survey; control of hunting

Table 20. Priority Species for Biodiversity Conservation in Myanmar (Cont'd).

Priority Species	Species-focused Action(s) Required
REPTILES	
Arakan Forest Turtle - *Heosemys depressa*	Status survey; control of hunting
Spiny Turtle - *Heosemys spinosa*	Status survey; control of hunting
Yellow-headed Temple Turtle – *Hieremys annandalii*	Status survey; control of hunting
Burmese Roofed Turtle - *Batagа trivittata*	Status survey; control of hunting
Burmese Eyed Turtle - *Morenia ocellata*	Status survey; control of hunting
Keeled Box Turtle - *Pyxidea mouhotii*	Status survey; control of hunting
Big-headed Turtle - *Platysternon megacephalum*	Status survey; control of hunting
Asiatic Softshell Turtle - *Amyda cartilaginea*	Status survey; control of hunting
Burmese Frog-faced Softshell Turtle - *Chitra vandijki*	Status survey; control of hunting
Burmese Peacock Softshell - *Nilssonia formosa*	Status survey; control of hunting
Asian Giant Softshell Turtle - *Pelochelys cantorii*	Status survey; control of hunting

In addition to the Priority Species listed in Table 20, the stakeholders selected eight provisional Priority Species (Table 21). While none of these species was assessed as globally threatened by IUCN (2004), they were all considered to be potentially of global conservation concern and to require species-focused conservation. If any of these species is reassessed as globally threatened, it should immediately become a Priority Species.

The provisional Priority Species include four species of orchids listed in Appendices I or II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). All four species are highly threatened by over-harvesting for domestic sale and export to China. The provisional Priority Species also include Leaf Deer and three species were assessed as data deficient by IUCN (2004): Sun Bear (*Helarctos malayanus*); Irrawaddy Dolphin and Burmese Flapshell Turtle.

Table 21. Provisional Priority Species for Biodiversity Conservation in Myanmar.

Priority Species	Species-focused Action(s) Required
MAMMALS	
Sun Bear - *Helarctos malayanus*	Status survey; control of hunting
Irrawaddy Dolphin - *Orcaella brevirostris*	Status survey; control of incompatible fishing techniques
Leaf Deer - *Muntiacus putaoensis*	Status survey
REPTILES	
Burmese Flapshell Turtle - *Lissemys scutata*	Status survey; control of hunting
PLANTS	
Blood Red Orchid - *Dendrobium cruentum* Lindl.	Control of over-exploitation
Lady's Slipper Orchid - *Paphiopedilum wardii* Summerh.	Control of over-exploitation
Fire Orchid - *Renanthera imschootiana* Rolfe	Control of over-exploitation
Blue Vanda - *Vanda coerulea* Griff.Ex.Lindl.	Control of over-exploitation

4.2. Issue of Sustainable and Equitable Use of Biological Resources

Without sustainable and equitable use of biological resource, effort made in biodiversity conservation will fail. As a matter of fact, the concept and practice of sustainable production has been adopted in forestry and fishery sectors for many years. For instance, the Myanmar

Selection System (MSS) was developed in the 1860s and teak bearing forests were managed under this system for sustaining a consistent timber production level. The key to the success of this practice for over a century is decentralized forestry planning at the local level for adjusting forest productivity in any given environment towards ecological sustainability without affecting the natural regeneration capacity and health of the forest. However, the globally well-known and accepted practice of MSS was distorted when forestry planning was centralized during the socialist period (1974-1988). Centrally planned economic growth demanded the increase of timber production levels exceeding the level that natural forest could ecologically produce its yield on a sustainable basis. As a result, stocking density in natural forest has been changed and sustainable yield is now difficult to regulate. The situation was exacerbated when the country was opened to the market economy and timber trade was liberalized for the private sector. Unregulated and under reported logging activities have been growing along with the private sector's involvement in forest concessions and this severely affects the management of forest for sustainable use. Therefore, following the prescription of MSS is now urgently needed to overcome the challenges faced in sustaining forest resources.

One significant development in forest management is the introduction of the concept of people-centered forestry into the national forest policy and development of the community forestry instructions (CFI) in 1995. CFI recognizes the rights of communities to have equitable use of forest adjacent to their villages because of its importance to their livelihoods. In compliance with CFI, the FD can issue a community forestry certificate to the forest user group (FUG) of the community for a 30 years leasehold of forest. To qualify for a community forestry certificate, a FUG must commit itself to manage the forest systematically, according to the forest management plan they develop. Benefits to the members and the rest of community must be equitable. To date, approximately 50,000 hectares of forestland have been officially handed over by the FD to approximately 600 FUGs nationwide for the sustainable and equitable use of forest based biological resources. However, community forestry activity is only effective in areas where the FD can exercise its jurisdiction under the law. If a proposed community forestry site is not in an area that is under the jurisdiction of the FD, the community has to apply to the Settlement and Land Records Department (SLRD) for permission to use the land for community forestry. In such cases, the community is not likely to get land since the major drive of the SLRD is to use the land for agricultural production and commercial agriculture plantations like rubber, edible palm oil, etc. Therefore, implementation of community forestry in remote ethnic regions is relatively weak and the potential of integrating biodiversity conservation into community forestry management is marginalized. In parallel to the community forestry initiative, NWCD under the FD have adopted the principles of buffer zone management in PAs. Within a PA managed for the conservation of biodiversity, NWCD can establish a buffer zone area for developing appropriate management plans to enable local communities to access biological resources that are essential for their subsistence. Local communities are also responsible for participating in the management of the buffer zone for its effectiveness and efficiency in nature conservation. Piloting of this community based natural resource management (CBNRM) has been initiated in cooperation with the Wildlife Conservation Society (WCS), an international NGO, in the northern forest complex and the success of this approach needs to be disseminated to other conservation areas.

Similar to the FD, the DOF has introduced the management system for sustainable marine fisheries production. Based on a technical assessment, the maxim sustainable yield is 1.05 million tons per year. Licensing of annual marine fisheries concessions has been strictly regulated not to exceed this limit to ensure the sustainable use of marine biological resources. However, DOF is constrained by the limited resources and capacity to control illegal fishing efficiently. In the case of inland freshwater fisheries, existing law allows local community subsistence-fishing rights in communal fishing areas while larger fishing concessions are

annually auctioned to the private sector. In some areas where environmental degradation is accelerating, communal fishing grounds are becoming smaller and local communities are experiencing difficulties in accessing fishery resources for self-sufficiency. Therefore, this system should be adjusted for the assurance of the sustainable and equitable use of fisheries resource for effective biodiversity conservation. This includes Marine Protected Areas, Integrated Coastal Management and leasable fisheries.

In regard to plant genetic resources, the Myanmar Seed Bank is adopting the Standard Material Transfer Agreement (SMTA) a multilateral system of access and benefit sharing for the sustainable and equitable use of PGR with international institutions according to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). As of mid-2011, 16,237 accessions of 17 crop species have been distributed under the multilateral system of access and benefit sharing.

CHAPTER 5: STRATEGIES AND ACTION PLANS FOR BIODIVERSITY CONSERVATION IN MYANMAR

One way to achieve sustainable and equitable use of biological resources described in Chapter 4 is by formulating and effectively implementing the National Biodiversity Strategy and Action Plan (NBSAP). This chapter consists of two parts; strategic plan and action plan. The section 5.1 outlines the overall strategies for biodiversity while the section 5.2 provides the five-year action plans. NBSAP is formulated for the period of 2012-2020.

5.1. Outline of Overall Strategies for Biodiversity Conservation

For setting the strategic directions of the NBSAP, the stakeholder consultation process established five criteria for selecting priorities. These are:

1) supporting the conservation of Priority Species, Site or Corridor,
2) addressing an urgent threat to biodiversity,
3) fulfilling a gap in conservation investments by national governments and other organizations,
4) providing an opportunity for effective engagement of NGOs and/or academic institutions in conservation and
5) being cost effective.

A set of strategic direction and priorities for intervention are described in Table 22, and explanations are given in the following section.

Table 22. Strategic Directions and Priorities for Intervention.

Strategic Directions	Priorities for Intervention
1. Strengthen conservation of Priority Sites	1.1 Review and support the expansion of the national protected area system to address gaps in coverage of globally threatened species and Key Biodiversity Areas.
	1.2 Strengthen protected area management at Priority Sites.
	1.3 Pilot alternative approaches to formal protected area management at Priority Sites.
	1.4 Support strengthening of the legal framework for protected area management and species conservation.
2. Mainstream biodiversity into other policy sectors	2.1 Integrate biodiversity into decision-making processes for land-use and development interventions in the Priority Corridors.
	2.2 Conduct targeted advocacy and awareness raising for decision makers in government, donor agencies and the corporate sector.
	2.3 Implement sectoral activities that are formulated in the context of National Sustainable Development Strategy.
	2.4 Forge partnerships between biodiversity conservation and rural development initiatives.
	2.5 Cooperate with other concerned departments to raise awareness on the trade-off between biodiversity conservation and sustainable development.

Table 22. Strategic Directions and Priorities for Intervention (Cont'd).

Strategic Direction	Priorities for intervention
3. Implement focused conservation actions for Priority Species	3.1 Establish an illegal wildlife trade monitoring system for Priority Species and use results to strengthen enforcement at national and regional levels. 3.2 Take range-wide conservation actions for certain widely dispersed Priority Species. 3.3 Conduct status surveys of Priority Species, where there is a need for greatly improved information on their status, distribution and ecology, and link results to conservation. 3.4 Conduct biodiversity surveys for freshwater taxa and apply results to conservation planning.
4. Support local NGOs and academic institutions to engage in biodiversity conservation	4.1 Strengthen the capacity of local NGOs and academic institutions to develop and implement conservation projects. 4.2 Develop mechanisms for coordination and information sharing among NGOs and academic institutions. 4.3 Support the development of conservation curricula at academic institutions.
5. Create capacity to coordinate conservation investment in Myanmar	5.1 Initiate monitoring programs for Conservation Outcomes. 5.2 Establish a mechanism to manage information on Conservation Outcomes, Priorities investment and coordinated conservation actions.
6. Scale up the implementation of in-situ and ex-situ conservation of agriculture, livestock and fishery biodiversity and genetic resource management	6.1 Upgrade National Seed Bank and PGR management. 6.2 Initiate variety selection, on-farm conservation and sustainable use. 6.3 Initiate micro-credit scheme for in-situ conservation of domestic animal breeds. 6.4 Establish livestock Gene Bank. 6.5 Initiate community based fishery resource conservation and development.
7. Promote the initiative to manage IAS	7.1 Commission a national survey and assessment on the economic, environmental, human health and biodiversity impacts of invasive species. 7.2 Develop a National Invasive Species Strategy and Action Plan for preventing and managing IAS. 7.3 Initiate the awareness programs for decision makers as well as the general public on the negative impacts and other risks of invasive species. 7.4 Build capacity on IAS prevention as well as effective control measures (combinations of mechanical, chemical and bio-control agents), and support local initiatives to reduce the associated negative impact on environment, production systems and human livelihoods.

Table 22. Strategic Directions and Priorities for Intervention (Cont'd).

Strategic Direction	Priorities for intervention
	7.5 Develop GEF and other sources of funding for establishing national framework/projects on prevention, control and management of IAS in Myanmar.
8. Facilitate the legislative process of environmental protection and environmental impact assessment	8.1 Form an inter-ministerial task force for environmental legal framework. 8.2 Advocate for enacting Myanmar Environmental Law and Rules. 8.3 Development of regulatory measure for environmental impact assessment and pollution control. 8.4 Build capacity for the conduct of EIA and pollution control.
9. Enhance communication, education and public awareness on biodiversity conservation	9.1 Develop information, education and communication materials. 9.2 Develop networking and capacity building for public awareness. 9.3 Support public awareness raising programs.

5.1.1. Strengthening Conservation of Priority Sites

Compared with other countries in the Indo-Myanmar (Indo-Burma) Hotspot, Myanmar has been the focus of relatively little government or donor investment in site-based conservation. The country's PAS is relatively under-developed, both in terms of coverage and management effectiveness (Rao *et al*. 2002). Few alternative approaches to formal protected area management have been developed, despite the fact that such approaches have met with initial success elsewhere in the hotspot.

A number of international NGOs, most notably WCS, have been supporting the expansion of the national PAS in Myanmar, while other organizations active such as Bird Life International have experience of protected areas planning and/or strengthening PA management. A number of local NGOs and international development NGOs are well positioned to build grassroots support for conservation and pilot alternative PA management.

This Strategic Direction is consistent with the goals of *Myanmar Agenda 21* (NCEA 1997), particularly 15.1.3, which recognizes that the "existing protected area system does not cover the whole range of variation of the ecosystems and the species of actual or potential socio-economic value" in the country and recommends that "the present protected areas need to be more broad-based and representative, comprising all natural ecosystems", and 15.1.7, which identifies a need to "strengthen existing protected areas and develop new protected areas to enhance biodiversity conservation".

5.1.1.1. Review and support the expansion of the national protected area system to address gaps in coverage of globally threatened species and Key Biodiversity Areas

A global gap analysis (Rodrigues *et al.* 2003) identified major gaps in the coverage of existing PAS with regard to species, and found that the most urgent priorities for expansion are concentrated disproportionately in Asia. These findings were reflected in the message from Fifth World Parks Congress to the CBD, which stated that, while much progress has been made in developing the global PAS, there remain serious gaps in the coverage of many important species and biomes.

In Myanmar, 5.6% of the national land area is currently included within PAs. Of the eight Priority Corridors, only the Northern Forests Complex and the Upper Chindwin Lowlands are relatively well represented within the national PAS. Additionally, only 17 of the 37 Priority Sites are designated or officially proposed as PAs. Moreover, many of Myanmar's older PAs, such as Pidaung Wildlife Sanctuary, have little effective on-the-ground management and have largely degraded areas within them. There is a critical need, therefore, to review the existing PAS both for representativeness and effectiveness, and to expand it to address gaps in coverage of globally threatened species and KBAs.

Under Article 8 of the CBD, the government has a commitment to "establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity". Given the track record of several NGOs and academic institutions involved in PA planning, there exists a great opportunity for them to support the government to fulfill this commitment. It is essential that the national PAS should be expanded systematically, based on scientific analyses. Similar analyses have led to the systematic expansion of PAS elsewhere in the Indo-Myanmar (Indo-Burma) Hotspot, including those conducted by the Lao-Swedish Forestry Cooperation Programme in Lao PDR (Berkmüller *et al.* 1993, 1995), Kasetsart University in Thailand (Kasetsart University 1987), and BirdLife International in Vietnam (Wege *et al.* 1999), in collaboration with government counterparts. In addition to work at the national level to promote and guide expansion of the system, there is also a need to work at individual sites, to conduct feasibility studies, to prepare management plans, and to build a constituency of support among key stakeholders.

5.1.1.2. Strengthen Protected Area Management at Priority Sites

While reviewing and expanding Myanmar's PAS is a high priority for conservation investment, PA designation does not, by itself, guarantee the conservation of a site. Seventeen Priority Sites are designated or officially proposed as protected areas, including some of the most important sites for global biodiversity conservation in the country. At all of these sites, protected area managers face severe constraints, in terms of personnel, equipment, financial resources and staff capacity. As a result, these PAs experience human activities incompatible with their conservation objectives, including extraction of NTFPs, grazing, hunting and fuel wood extraction (Rao *et al.* 2002), and lead to deforestation and forest degradation (Htun *et al.* 2010). There is an urgent need to strengthen protected area management at these Priority Sites to ensure the attainment of Site Outcomes.

A few Priority Sites have been the focus of initiatives to strengthen PA management, including: Alaungdaw Kathapa National Park, where the FD, FREDA and WildAid implemented the ***Surviving Together Programme***; Chatthin Wildlife Sanctuary, where the Smithsonian Institution, in collaboration with the FD, conducted capacity building for protected area staff; and Hkakaborazi National Park, Hponkanrazi Wildlife Sanctuary and Hukaung Tiger Reserve, where WCS is implementing a program of targeted research and protection, together with the FD. Despite these initiatives, there is a high need for additional conservation investment in strengthening management effectiveness at all Priority Sites designated or officially proposed as PAs.

Experience from Myanmar suggests that sustained training at specific sites can be a good way to improve management effectiveness at individual PAs. Experience also shows that the effectiveness of training programs can be enhanced by follow-up implementation exercises and projects, which allow trainees to put the training into practice.

5.1.1.3. Pilot Alternative Approaches to Formal Protected Area Management at Priority Sites

Establishment and management of formal PAs has been the principal approach to site-based conservation employed in Myanmar to date. While this approach should remain the cornerstone of site-based conservation efforts in the country, it is not appropriate in every situation. For example, where a site has a large human population or experiences high levels of human use, formal PA designation may result in significant negative impacts on local communities, or entail high opportunity costs, in terms of foregone economic benefits. By failing to secure grassroots support, the prospects for successful long-term conservation may be fatally undermined. There is a strong need to develop and pilot alternative approaches to formal PA management, which can be introduced at Priority Sites outside the national PAS. This is recognized in the Seventh Conference of the Parties to the CBD's Decision on PAs, which "underlines the importance of conservation of biodiversity not only within but also outside PAs" and suggests that parties "recognize and promote a broad set of PA governance types which may include areas conserved by indigenous and local communities."

Twenty Priority Sites are not included within formal PAs. While formal PA designation may be appropriate for some, there are many opportunities to introduce non-formal approaches at others. Such approaches could include: developing local conservation regulations and initiating community patrol groups; engaging local stakeholders, such as grassroots organizations, tourism companies or religious and informal leaders, in site stewardship; or developing voluntary agreements with private land owners or concessionaires to conserve key species and habitats. As well as being more appropriate in certain situations, such approaches to site conservation can also be more cost effective than formal PA management, and more sustainable, because they focus on building local capacity and structures.

In recent years, a variety of alternative approaches to formal PA management have been developed in the Indo-Myanmar (Indo-Burma) Hotspot, including village-protected Fish Conservation Zones in Lao PDR (Baird 2001) and, community-based primate conservation groups in Vietnam (e.g. Swan and O'Reilly 2004). These represent a valuable source of experience for developing similar approaches in Myanmar. Within Myanmar, a number of community-based natural resource management approaches have already been developed, such as field-based application of the Community Forestry Instructions, government regulations that promote local participation in reforestation. The potential exists to extend these approaches to conservation of Priority Sites, thereby attaining Site Outcomes.

5.1.1.4. Support Strengthening of the Legislative Framework for Protected Area Management and Species Conservation

In addition to shortages of personnel, equipment, financial resources, and staff capacity, effective management of Myanmar's PAs is constrained by the lack of a clear and comprehensive legislative framework. The principal piece of legislation governing the establishment and management of PAs is the "1994 Protection of Wildlife and Protected Areas Law". There are several significant weaknesses in this legislation, particularly a lack of clarity on which activities are allowed and prohibited in different PA categories. The current legislative framework also places severe constraints on species conservation efforts in Myanmar. Although Myanmar acceded to CITES in 1997, national legislation has not yet been brought in line with this convention. In particular, the Protection of Wildlife and Protected Areas Law does not enable the effective enforcement of international laws regulating international trade in wildlife and wildlife products. Without a framework of laws and regulations supportive of conservation efforts by PA managers and wildlife protection officials, the effectiveness of conservation investments in PAs management and species conservation will be diminished. Therefore,

stakeholder consultation should be carried out for reviewing the existing laws in order to improve them as necessary.

5.1.2. Mainstream Biodiversity into Other Policy Sectors

Site-based conservation, whether via formal PA management or alternative approaches, can be an effective means of addressing immediate threats to biodiversity. However, site-based conservation is often undermined by incompatible initiatives of other policy sectors, for example infrastructure developments that result directly in habitat loss and facilitate natural resource exploitation, or land-use decisions that promote conversion of lowland evergreen forest into oil palm plantations or mangrove into aquacultural ponds. The underlying causes of these threats include pursuit of economic policies inconsistent with biodiversity conservation and inadequate environmental safeguards in government and donor policies and programs. These underlying causes should not be viewed as unassailable obstacles but, rather, as opportunities for mainstreaming biodiversity into other policy sectors, thereby mitigating potential threats before they occur and leveraging sufficient support for conservation success. This is in-line with Millennium Development Goal No. 7 of the United Nations, which sets a target for the global community to "integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources".

Although Myanmar has remained somewhat insulated from the economic forces that have driven rapid changes in social, economic and natural landscapes across the Asia Region, the level of donor and private sector investment in the country is likely to increase significantly at some point in the future. There is a need, therefore, for mechanisms that balance economic development with biodiversity conservation. Given that Myanmar's economy is heavily natural resource based, there is a particular need to mainstream biodiversity into the agriculture, forestry, fisheries, mining and energy sectors.

5.1.2.1. Integrate Biodiversity into Decision-making Processes for Land-use and Development Interventions in the Priority Corridors

Some threats to biodiversity, such as conversion of forest to plantations and infrastructure development, do not often originate from local communities but from land-use and infrastructure development decisions made at sub-national and national levels. A major underlying cause of these threats is the limited integration of biodiversity considerations into land-use and development decision making. In Agenda 21, a recommendation was made to form the national land commission for steering the process of sustainable land use management. It will take time to make this happen, as political endorsement is required for such an institutional reform and development at the national level. The NBSAP also advises to develop baseline information such as land capability and land suitability maps, and to coordinate among stakeholders for integrated land use and land management plans in Priority Corridors. NGO and academic institutions also play a crucial role in this process in terms of providing technical support and facilitating participation at the community level. Community needs and concerns about proposed land use and biodiversity conservation should be taken into consideration.

5.1.2.2. Conduct Targeted Advocacy and Awareness Raising for Decision Makers, in Government, Donor Agencies and the Corporate Sector

Without the support of key decision makers of national and local governments, institutions, donor agencies and the corporate sector, it is very difficult to successfully mainstream biodiversity into other policy sectors. There is, therefore, a need for concerned agencies such as the NWCD of the FD to undertake targeted advocacy and awareness raising for key decision makers at the national and sub-national level. Effective approaches to advocacy include persuading policy makers through localized pilot initiatives, documenting and sharing successes, and disseminating information on national and regional examples of best practice.

Advocacy and awareness raising for decision makers should also focus on the importance of biodiversity and socio-economic values of natural ecosystems in Myanmar, and the practical steps that can be taken to maintain these values. In addition to creating a supportive environment for biodiversity mainstreaming, targeted advocacy and awareness raising can generate political support for other conservation measures, such as enforcement of wildlife protection laws, expansion of the national PAS, or control of illegal logging. To have the maximum impact, advocacy and awareness initiatives must be informed by the results of relevant research. In this context, research into economic valuation of biodiversity or studies on the contribution of PAs to socio-economic development could be very useful. Collaboration with NGOs, academic institutions and public media is definitely needed for effective advocacy and communication.

5.1.2.3. Implement Sectoral Activities that are Formulated in the Context of National Sustainable Development Strategy

The National Sustainable Development Strategy (NSDS) was developed in Myanmar as a framework for integrating environmental considerations into future national development plans. Several sectoral development activities were formulated for the assurance of sustainable development within the sectors and implementation of these activities will contribute to effective biodiversity conservation as well. The NSDS activities related to biodiversity conservation are sustainable forest resource management, sustainable nature and biodiversity conservation, sustainable freshwater resource management, sustainable management of coastal, marine and island ecosystems, sustainable management of land resources, sustainable management of eco-tourism, sustainable management for mineral resource utilization and sustainable management of agriculture, livestock and fisheries.

5.1.2.4. Forge Partnerships between Biodiversity Conservation and Rural Development Initiatives, Maximize Synergies and Mitigate Risks

High levels of dependency on natural resources among rural communities in Myanmar, particularly in upland areas, are contributing to land degradation and biodiversity loss. In many areas, for conservation efforts to be successful, there is a clear need to address livelihood issues. Very recently, Myanmar has set up eight major tasks to reduce poverty, especially in rural areas, to achieve the objectives of the UN millennium goals. These eight major tasks will lead to the harmonization of biodiversity conservation with improving the livelihoods of marginalized people. In this context, it is important for conservation organizations to forge partnerships with development organizations, to jointly develop approaches to natural resource management that deliver significant benefits to local communities while, at the same time, meeting biodiversity conservation objectives.

Opportunities to link biodiversity conservation with rural development exist in many parts of Myanmar. For example, local communities in Mon and Kayin States protect caves with large bat populations, because of their economic importance as a source of guano (Bates 2004). Similarly, community forestry and reforestation activities around the northern and western edges of the Central Dry Zone have the potential to deliver livelihood benefits while, at the same time, alleviating the extremely high human pressure on forests in these areas. Other opportunities are presented by two integrated multi-sectoral community development projects currently being implemented by UNDP, which aim to enhance the capacity of the poor to address their needs through establishment of self-reliance groups. Both projects have potential linkages with conservation initiatives in PAs and other KBAs, particularly with regard to promoting grassroots participation in conservation. As well as maximizing synergies, forging partnerships with rural development initiatives can enable conservation organizations to identify and mitigate activities with potential negative impacts on biodiversity, such as increasing of land-use that threatens the integrity of KBAs or conservation corridors. Since 2010, a multi-donor trust fund, which is known as LIFT (Livelihood Improvement on Food Security Trust Fund) has been launched in

Myanmar and grants have been given to NGOs and development agencies for improving food security in Myanmar. Partnerships need to be developed with LIFT in order for the trust fund to support community based natural resource management project activities that include an element of biodiversity conservation as well as livelihood improvement of rural inhabitants, particularly for those living around Priority Corridors.

5.1.2.5. Cooperate with Other Concerned Departments at All Levels to Raise Awarenes of the Trade-off between Biodiversity Conservation and Sustainable Development

Inclusiveness of all stakeholders is crucial for the success of biodiversity conservation. All government agencies and departments at different hierarchies need to be aware of the national effort made in biodiversity conservation so that they can adjust their course of actions in line with conservation needs. Since this needs to be done all the time for reviewing the strengths and weaknesses of conservation activities at all levels – national, sub-national, district and township – joint efforts should be made between the FD and the Planning Department for cooperating with other concerned departments to raise awareness of the trade-offs between biodiversity conservation and sustainable development.

5.1.3. Implement Focused Conservation Actions for Priority Species

Species-focused conservation is a major funding gap in Myanmar. The stakeholders selected 48 Priority Species for species-focused conservation. While some of these species require specific conservation actions, to address their particular conservation needs, the majority fall into suites of species with common conservation needs, requiring similar conservation actions.

Within Myanmar, as elsewhere in the hotspot, many species, particularly those with a high demand in trade, are undergoing significant declines, even in extensive areas of suitable habitat, and the "empty forest syndrome" is common throughout the country. There is an urgent need to address hunting and trade of many Priority Species. Other Priority Species require species-focused conservation because they are widely distributed at low densities, and can only be conserved by addressing disturbance, habitat loss and other threats across their ranges.

For many Priority Species, there is a need for greatly improved information on their status, distribution and ecology, as a guide to future conservation efforts. For many Priority Species, insufficient information is available about their distribution to allow appropriate conservation measures to be taken, including revision of the national PAS.

The need for greatly improved information is not only limited to Priority Species but there is also a need for baseline information on the status and distribution of all taxonomic groups, to guide conservation planning. Some of this information was collected, through such initiatives as the *Botanical Exploration in Myanmar Project*, collaboration among the Smithsonian Institution, the FD and Yangon University. Baseline information on the distribution and presence of butterflies, reptiles and amphibians has also been collected for several years on a countrywide basis by collaborations among CAS, the Smithsonian Institution and the FD. However, there remain a number of major gaps in baseline information regarding other taxa, most significant of which, from a conservation planning perspective, is a severe shortage of information on freshwater biodiversity in the country.

Many NGOs and academic institutions active in Myanmar have experience and capacity to implement species-focused conservation actions. Species-focused conservation presents many opportunities for collaboration among national and international NGOs, academic institutions and government institutions. In particular, there exist many opportunities to both build on and build up local capacity in species-focused conservation, as a basis for attaining Species Outcomes.

5.1.3.1. Establish a Wildlife Trade Monitoring System for Priority Species and Use the Results to Strengthen and Better Target Enforcement at National and Regional Levels

Many Priority Species are severely threatened by hunting, which is usually, but not always, driven by high demand from the international wildlife trade. In many cases, for example Tiger, trade demand threatens to drive populations to extinction even within PAs (Rabinowitz 1998, Bennett and Rao 2002, Lynam 2003). For these species, therefore, site-based conservation must be complemented by measures to reduce wildlife trade and, thereby, alleviate pressure on wild populations.

There is a need for a coordinated program of conservation actions, aimed at controlling the trade in wildlife, with a particular focus on Priority Species. Some of the key actions required must be taken by government, particularly revision and enforcement of wildlife protection law and prosecution of offenders. At present, a wildlife law enforcement national task force has been formed and functions to coordinate government agencies in order to control wildlife trade. This task force needs to be further strengthened in terms of improving effective communication, information sharing and building capacity of law enforcers at the operational level. An additional opportunity identified at the stakeholder workshops is to establish a wildlife trade monitoring system for Priority Species, and use the results to strengthen and better target enforcement at national and regional levels. The illegal wildlife trade monitoring system has been linking to ASEAN-WEN, and sharing information on the illegal wildlife trade, which is very useful in implementing more effective law enforcement across the region.

5.1.3.2. Take Range-wide Conservation Actions for Certain Widely Dispersed Priority Species

Seven Priority Species occur at low densities over large areas: White-bellied Heron; White-winged Duck; Sarus Crane; White-rumped Vulture; Slender-billed Vulture; Masked Finfoot; and Lesser Adjutant. All of these are bird species characteristic of wetland and/or open country habitats. While few of these species are specifically targeted by hunters, they are often threatened by disturbance or loss of key habitats, such as nesting sites or feeding areas. While some of these species may occur in PAs with significant populations, at least during certain times of the year, few PAs are of sufficient size to maintain viable populations over the long term. Consequently, in addition to site-based protection, these Priority Species require conservation actions throughout their ranges. These actions include education and awareness raising among rural communities to encourage people not to disturb the species, and promotion of grassroots participation in the conservation of key habitats. For some species, other actions may be required, for instance supplementary feeding to restore severely depressed populations, in the case of White-rumped Vulture and Slender-billed Vulture.

5.1.3.3. Conduct Status Surveys of Priority Species, Where There is a Need for Information on Their Status, Distribution and Ecology, and Link Results to Conservation Management

For five Priority Species, there has been no recently confirmed record from the wild in Myanmar: Hairy Rhinoceros; Lesser One-horned Rhinoceros; Anthony's Pipistrelle; Joffre's Pipistrelle; and Pink-headed Duck. The current information of their status and distribution are greatly required before meaningful conservation actions for them can be taken. The priority action for all of these species is to identify extant populations (if any remain), investigate their status, ecology and threats, and feed the results into conservation planning, including, where necessary, revision of the national PAS. Relatively small amounts of investment in status surveys can potentially leverage significant additional resources for the conservation of Priority Species, thereby attaining Species Outcomes. The stakeholders recommended that status surveys

are also a high priority for 34 other Priority Species. While most of these species are known to occur at some sites in Myanmar, there is an urgent need for surveys to identify additional sites for each species, so that these can be placed under appropriate protection. Such action is a particularly high priority for turtle species, which are threatened by trade-driven over-exploitation throughout the country, and for which identification of a network of core areas that can form the focus of intensive protection efforts would be an essential short-term conservation measure, while complementary actions to reduce pressure from the wildlife trade take effect.

5.1.3.4. Conduct Baseline Biodiversity Surveys for Selected Freshwater Taxa, and Apply Results to Conservation Planning

Freshwater species provide wetland products that are critical to many of the rural poor throughout the Indo-Myanmar (Indo-Burma) Hotspot. Freshwater species are also among the most threatened in the country, as a result of unsustainable fishing practices, and habitat alteration and loss. However, the taxonomy, status and distribution of freshwater taxa in Myanmar, as elsewhere in the region, are very little studied.

A lesson learned from experience elsewhere in mainland Southeast Asia is that, because the available scientific information on the status and distribution of freshwater biodiversity is typically less comprehensive than that on terrestrial biodiversity, the conservation needs of freshwater biodiversity tend not to be taken fully into account during conservation planning. As a result, the coverage of terrestrial ecosystems within national PAS and networks of non-formal conservation areas is generally much better than that of freshwater ecosystems. In Myanmar, it is still possible to avoid repeating this mistake, by collecting baseline information on the taxonomy, status and distribution of freshwater taxa and incorporating it into conservation planning at a stage when the window of opportunity to expand the national PAS is still open, and while there are opportunities to integrate biodiversity considerations into the decision-making processes of other policy sectors.

Baseline biodiversity inventories and status surveys are a priority for all taxonomic groups in Myanmar, not only freshwater taxa. However, survey and inventory initiatives are already underway for plants and terrestrial vertebrates, most notably the collaborative programs of CAS, the Smithsonian Institution, the FD and Yangon University. Nevertheless, the status of freshwater biodiversity remains largely unknown. In order to coordinate efforts in Myanmar with initiatives elsewhere in the region, the following freshwater taxa should be prioritized for baseline surveys: fish, crustaceans, molluscs and odonates. A critical constraint on baseline surveys for freshwater taxa is the shortage of materials and specialists. Therefore collaborative initiatives to study existing collections, enable specialists to access collections and build capacity among national specialists are at least as important as continued collections.

5.1.4. Support Local NGOs and Academic Institutions to Engage in Biodiversity Conservation

Despite limited funding opportunities and, until recently, limited encouragement and support from the international conservation community, a small number of local NGOs active in biodiversity conservation have emerged in Myanmar. Typically, these organizations benefit from committed personnel and constructive relationships with government. The same can be said for a number of local academic institutions, particularly Yangon and Mandalay Universities, which are beginning to develop programs in conservation biology and are starting to play a more active role in biodiversity conservation. Partnerships with international academic institutions and NGOs can accelerate this process.

Local NGOs and academic institutions have limited experience and expertise in developing and implementing international-donor-funded projects, and capacity building is required in this area if the potential for these organizations to take a leading role in future

conservation initiatives in the country. Another need is for strong networks of NGOs and academic institutions, including both local and international organizations. As well as facilitating exchange of information and experience, and providing mutual support, such networks could enable coordinated and collaborative conservation action, particularly where each organization is able to contribute different skills and experiences. Such networks could also provide a mechanism for broadening the constituency for biodiversity conservation in Myanmar, through engaging grassroots organizations, development NGOs and private businesses.

5.1.4.1. Strengthen the Capacity of Local NGOs and Institutions to Develop and Implement Conservation Projects

Although local NGOs and academic institutions in Myanmar harbor many well-educated and dedicated professionals, knowledge of international standards and thinking on sustainable development is still required in strengthening the capacity. A number of local organizations, including NGOs and academic institutions, have been involved in implementing major international-donor funded projects, and several of these organizations have entered into informal or formal partnerships with international NGOs or academic institutions. Such collaborations have often involved the transfer of technical skills from international to local organizations, particularly in the area of biodiversity survey. In general, however, the potential to use these collaborations, as a way to strengthen the capacity of local NGOs and academic institutions to develop and implement conservation projects, has not been fully realized. With relatively modest funding, there are many opportunities for international NGOs and academic institutions to actively strengthen the capacity of local organizations in such areas as administration, financial management, proposal development, communication and strategic planning. Such investments could be separate initiatives or they could form part of collaborative projects with broader objectives.

5.1.4.2. Develop Mechanisms for Coordination and Information Sharing Among NGOs and Academic Institutions Active in Myanmar

Each NGO and academic institution active in Myanmar has particular areas of programmatic focus and expertise. However, many of the major threats to biodiversity in the country can only be effectively addressed through coordinated programs of conservation action at several levels, from data collection and grassroots engagement of communities, through institutional capacity building, to awareness raising and advocacy for decision makers. In order to effectively address these threats, there is often a need to bring the skills and experience of different organizations to bear in a coordinated function. There is also a need for improved communication among NGOs and academic institutions, to facilitate information exchange. For instance, networks that linked grassroots organizations with NGOs active at the national level would be well positioned to monitor the impacts of land-use and development decisions on biodiversity, and feed the results into national-level advocacy. Similarly, conservation partnerships among NGOs, academic institutions and PA managers could enable sharing the information of biodiversity, threats and conservation actions generated at the site level to guide conservation actions at the national level, and facilitate more effective targeting of capacity building for PA staff. Improved communication would also allow lessons learned by NGOs and academic institutions to be shared with other organizations, so that mistakes would be less likely to be repeated and best practice approaches could be replicated elsewhere. As well as improving coordination and communication among organizations already engaged in biodiversity conservation, effective networks could also help to engage other organizations. For instance, development NGOs with experience in natural resource management or community empowerment could be engaged in site-based conservation initiatives, while private businesses could enter into NGO-corporate sector partnerships.

5.1.4.3. Support the Development of Conservation Curricula at Local Academic Institutions

A major constraint on the ability of local NGOs and academic institutions to engage in biodiversity conservation is the shortage of trained conservationists and field biologists in Myanmar. This constraint arises from the lack of conservation training and education programs in high schools and tertiary institutions. Very few students and researchers are interested in conservation science or field biology, because wildlife training and biodiversity conservation are virtually non-existent from the teaching syllabus and they have few role models to follow. The shortage of suitably trained individuals is also a major factor contributing to the low capacity of government institutions responsible for managing the country's biodiversity. While some international academic institutions and NGOs, including CI and the Smithsonian Institution, have already initiated some programs of graduate study and research at local academic institutions, there is a great need for a full overhaul of undergraduate and graduate biological science curricula, in order to equip the next generation of PA managers, field biologists and conservationists with appropriate skills, and expose them to international ideas and approaches. The need for modern curricula on conservation biology is greatest at Yangon and Mandalay Universities, which are most active in field biology, and the University of Forestry at Yezin, which is bearing graduated foresters who would eventually become PA managers.

5.1.5. Create Capacity to Coordinate Conservation Investment in Myanmar

The geographical, species and thematic priorities for conservation investment presented in this document are determined by the current conservation situation in Myanmar and available information. These priorities are likely to change, even within the next few years, as the conservation situation on the ground changes, and, especially, as more information becomes available. It is essential that conservation investment in Myanmar is responsive to such changes, so that new opportunities are taken, and redundant effort is avoided. To this end, there is a need for a mechanism to coordinate conservation investment, linked to a monitoring program for Conservation Outcomes. This would allow Investment Priorities to be continually re-evaluated, investment to be redirected to other priorities as Conservation Outcomes were attained and successful conservation approaches to be documented and replicated.

5.1.5.1. Initiate Standardized Monitoring Programs for Conservation Outcomes

Reliable information on the status of, the nature and severity of threats, and the type and effectiveness of conservation actions for globally threatened species, KBAs and conservation corridors is essential to the success of a number of priority conservation actions in Myanmar. These include review and expansion of the national PAS, integration of biodiversity considerations into the decision-making processes of other sectors, and targeted advocacy and awareness raising for key decision makers. Such information is needed to guide conservation investments in the country, and ensure that limited conservation resources remain focused on the highest geographical, species and thematic priorities. Monitoring of Conservation Outcomes allows conservation success to be measured, which can help to leverage additional resources for conservation efforts in the country.

Baseline data are already available for some Conservation Outcomes in Myanmar, and additional data will be generated through status surveys of Priority Species, baseline surveys of freshwater biodiversity and other initiatives. Monitoring programs are currently in place for only a handful of Species and Site Outcomes, and these are not standardized or effectively linked to conservation planning and advocacy at the national level. There is a need to initiate standardized programs for monitoring Conservation Outcomes, following the Pressure-State-Response model. Standardized protocols for site-based monitoring already exist, and could be adopted for use in Myanmar, such as the PA Management Effectiveness Tracking Tool developed by the World Bank and WWF (Stolton *et al.* 2003). However, standardized protocols may need to be

developed for monitoring Species and Corridor Outcomes. To ensure comparability, monitoring programs developed in Myanmar should be compatible with those being developed elsewhere in the Indo-Myanmar (Indo-Burma) Hotspot. As far as possible, monitoring should be integrated into other conservation initiatives, and not be a standalone activity. In this way, there will be greater opportunities to link monitoring results to site management, conservation planning and advocacy. There is a need to develop monitoring programs jointly with the FD, in order to facilitate sharing of information and to form a basis for collaborative action. Networks of NGOs and academic institutions organizations could also play an important role in monitoring Conservation Outcomes, by providing a link between grassroots data collection and engagement in policy and planning processes at national and sub-national levels.

5.1.5.2. Establish a Mechanism to Manage Information on Conservation Outcomes and Investment Priorities, Coordinate Conservation Actions, and Leverage Additional Funding

During the preparation of this document, most of the stakeholders consulted the need for conservation investments in Myanmar to be coordinated, in order to maximize their impact. An essential precondition for effective coordination of conservation investments is the availability of reliable and up-to-date information on Conservation Outcomes and Investment Priorities. While standardized monitoring programs will generate such information, it needs to be collated and evaluated, and to use the results to reach a consensus on conservation priorities among NGOs, academic institutions, government institutions and donor agencies. With such a consensus in place, conservation actions by different organizations can be coordinated, both at the national level and within individual Priority Corridors. Another important function of a coordination mechanism would be engaging NGOs and academic institutions in biodiversity conservation, by making them aware of funding opportunities, identifying opportunities for capacity building, and building partnerships. Such a mechanism could also act as a focal point for donors wishing to invest in conservation in Myanmar, and could play an important role in actively leverage additional funding.

If sufficient resources are available, the coordination mechanism will be able to provide small amounts of investment directly to local NGOs, academic institutions and individuals, to enable them to undertake small scale, cost effective initiatives, such as piloting innovative approaches to conservation, or conducting targeted research. In addition, such small-scale financial support could be used to strengthen the capacity of local NGOs and academic institutions, for instance by enabling individuals to attend training courses, or funding the preparation of technical manuals.

5.1.6. Enhance Capacity for Participatory In-situ and Ex-situ Conservation of Agriculture, Livestock and Fishery Biodiversity, and Genetic Resource Management

To some extent, sectoral activities have been implemented in conserving agriculture, livestock and fishery biodiversity, and genetic resource management in Myanmar. What is needed for effective biodiversity conservation is to scale up the existing activities and introduce participatory development into these activities.

5.1.6.1. Upgrading National Seed Bank and PGR Management

There is a need to upgrade the facility and equipment of the national seed bank that was established by the Department of Agriculture Research (DAR) at the Central Agriculture Research Institute (CARI) in Yezin, Pyinmana. Human resources have been developed within DAR for effective operation of the National Seed Bank and genetic resource management. Human resources need to be developed further for sustaining the National Seed Bank’s performance.

5.1.6.2. Initiate Participatory Variety Selection and On-farm Conservation and Sustainable Use

In conjunction with the PGR management activities carried out by DAR, participatory variety selection should be initiated at the community level in order to promote the conservation of local seeds that are important for local consumption and potentially adaptive to climate change. DAR should collaborate with other organizations, institutes and NGOs in this respect for conducting participatory exercises at the grassroots level. On farm trials should also be initiated in cooperation with local farmers in order to examine the performance of the local varieties selected. Depending on the result, a plan should be developed for the development of local varieties and biodiversity conservation.

5.1.6.3. Micro-credit Scheme for Participatory In-situ Conservation of Domestic Animal Breeds

At present, the Livestock Breeding and Veterinary Department has been implementing in-situ conservation of domestic animal breeddings that are considered endangered in Myanmar. To scale up this activity, a micro-credit facility should be developed in consultation with appropriate commercial or government banks.

5.1.6.4. Establish Livestock Gene Bank

Similar to the MOAI, the MOLF should also make an effort to establish a livestock Gene Bank for promoting both in-situ and ex-situ conservation of livestock breedings whose populations are declining. They should collaborate with international technical agencies such as FAO and JICA for obtaining technical assistance to implement this activity.

5.1.6.5. Initiate Community Based Fishery Resource Conservation and Development

In cooperation with the WCS, the DOF has initiated community based biodiversity conservation of the Ayeyawady Dolphin in the upper section of the Ayeyawady River. Similar efforts should be made for other important species and habitats that will improve conservation of fish diversity. Participatory biodiversity conservation of marine turtles, coral reefs, etc. would be a good start for this initiative.

5.1.7. Expedite the Process of Implementing National Biosafety Framework

A National Biosafety Framework has been developed in recent years and will be enacted under the Biosafety Law. As Myanmar is within the transition period of political reform, the legislative process of the Biosafety Law is somewhat delayed. Thus, attempts need to be made for expediting the process of implementing national biosafety framework and forming an inter-ministerial task force for policy advocacy, capacity building, public awareness raising, systematic joint research study and assessment, and the development of an early warning system for biosafety.

5.1.7.1. Form an Inter-ministerial Task Force for Biosafety

According to the draft National Biosafety Framework, it is required to set up the national biosafety committee as a competent authority to implement the Biosafety Law. Representatives from the MOECAF, MOLF, MOAI, Ministry of Science and Technology, Ministry of Commerce and Ministry of Health are supposed to be involved in the National Biosafety Committee. The committee will undertake the necessary measures, particularly regulating the use of genetically modified organisms and other materials that may potentially have a negative impact on biosafety and human health. Technical protocols, standards, and step-wise procedures should be developed for undertaking regulatory measures for biosafety. Therefore, there is a need to form the task force in advance, composed of technical expertise from various ministries in order to facilitate the process of enacting Biosafety Law as well as developing the regulatory

measures and procedures ahead. The MOECAF and the MOAI should take a lead to form an inter-ministerial task force for this purpose.

5.1.7.2. Advocate for Enacting National Biosafety Law

The inter-ministerial task force mentioned in sub-section 5.1.7.1 should take responsibility in advocating to concerned authorities to expedite the process of enacting National Biosafety Law. The technical round table discussion and communication with concerned legislative bodies are important to take place on a regular basis and concerted effort is needed for facilitating this process.

5.1.7.3. Capacity Building of Concerned Government Agencies on Biosafety

Since biosafety is relatively new to Myanmar, it will require building the capacity of staff from concerned agencies and departments. The inter-ministerial task force should develop a set of guidelines for technical and management aspects of regulating biosafety in the country and training should be given to agencies involved.

5.1.7.4 Initiate National Database and Early Warning System on Biosafety

In recent years, capacity has been built in Myanmar to combat the transboundary issues of communicable diseases that are found in chickens and pigs. What is needed for the long run is to establish an early warning system for effective biosafety measures and this requires developing a national database and information network that can be utilized to develop an early warning system. The inter-ministerial task force should also take responsibility in designing the database and piloting the early warning system.

5.1.8. Promote the Initiative to Manage IAS

Little has been done so far on controlling the invasive alien species (IAS) that have an impact on livelihood and environment. However, experiences from worldwide highlights the needs of actions to tackle the negative impacts of IAS on the native biodiversity, environment and livelihoods in Myanmar. Therefore, NBSAP strongly sees the need for undertaking initiatives for managing IAS in order to reduce the negative impacts of IAS. In this respect, two priorities for interventions are set for formulating related programs and activities.

5.1.8.1. Commission a Joint Assessment Study on IAS

As mentioned in the earlier section of 3.8 of this NBSAP, little is known about the existence of IAS, its pathways, and associated impacts on local livelihoods and the environment in Myanmar. A few studies were undertaken by the Forest Research Institute on forestry related plant species but many other species, that might potentially be associated with the agriculture, livestock and fishery sectors, remain largely unknown. Therefore, there is a need to commission a comprehensive study, with a joint-effort by the concerned ministries on this matter. The MOECAF should take a lead in facilitating the study.

5.1.8.2. Develop Guidelines for Managing IAS and Monitor Pathways and Trends of IAS

Following the comprehensive study jointly conducted by various ministries, guidelines for how these IAS to be controlled and managed, for reducing their associated negative impacts on humans and environment should be developed. These guidelines should be disseminated to all concerned parties for follow up actions for managing IAS at the ground level. At the same time, inter-ministerial coordination should be sought to develop a monitoring system for IAS. So far, plants, pests and living organisms imported or transported via air, land and water routes are inspected at the point of entry but the functionality of phyto-sanitory clearance by existing laws in the agriculture and livestock sector are still needed. However, there is no clear legal framework and inspection mechanism for forest plant and wildlife species. Therefore, efforts

should be made to improve the existing monitoring and control mechanisms of IAS for forest plant and wildlife species as well.

5.1.8.3. Support Local Initiatives and Innovations to Reduce the Associated Negative Impact on Environment and Livelihoods

There are some initiatives by local entrepreneurs to use IAS species like water hyacinth for making furniture and decorative products. This sort of innovation should be further encouraged and supported for wider implementation. Participatory action research should be developed in collaboration with the private sector and interested local communities and findings should be disseminated to the public for wider use and application.

5.1.9. Facilitate the Legislative Process of Environmental Protection and Environmental Impact Assessment

Myanmar has already drafted the National Environmental Law for regulating environmental quality, and assuring effective environmental protection and biodiversity conservation. While still preparing to enact the National Environmental Law, there is a need to develop the environmental quality standards and regulatory measures for enforcing this law. The NBSAP needs to formulate a strategy for promulgating the drafted environmental law. Considering the constraints and potentials under the given socio-political conditions, the best strategy is fostering a collective institutional entity to facilitate the process of environmental protection and environmental impact assessment.

5.1.9.1. Form an Inter-ministerial Task Force for National Environmental Legal Framework

Similar to the task force mentioned in section 5.1.7.1, an inter-ministerial task force for the national environmental legal framework should be set up by including the representatives from various ministries. Experts from NGOs and academic institutions should also be included in the task force. This is preparatory work in order to facilitate the legislative process as well as to build capacity for law enforcement. The MOECAF should take a lead in formation of such an institutional entity.

5.1.9.2. Advocate for Enacting National Environmental Law

The National Environmental Law has been drafted and it was already technically passed by the Office of Attorney General. An inter-ministerial task force is to take a lead for reviewing the drafted law again for necessary adjustments and amendments to be compatible with the emergence of the decentralized public administration. There is also a need to provide technical expertise to the central government in order to get approval by the parliament, the highest legislative body in Myanmar under the 2008 National Constitution. In addition, advocacy is also required at the sub-national level in order to enhance awareness and understanding of stakeholders from regional government.

5.1.9.3. Development of Regulator Measures for Environmental Impact Assessment

To assure biodiversity and environmental sustainability, the conduct of environmental impact assessment (EIA) should be a compulsory requirement for any type of business, development project and activities before launching operations. The legal obligation for an EIA can only be made compulsory when the National Environmental Law is enacted and enforced. While attempts are made to facilitate the process of enacting the National Environmental Law, development of certain technical elements should be done in parallel. An inter-ministerial task force should take the lead in developing environmental quality standards, monitoring mechanisms, stepwise procedures for environmental quality enhancement (controlling air and water pollution, toxification and soil contamination) and a set of guidelines for enforcing regulatory measures.

5.1.9.4. Build Capacity for the Conduct of EIA and Pollution Control

To have effective law enforcement after enacting the National Environmental Law, it is essential to strengthen the in-house capacity of government agencies to be able to regulate environmental quality and the EIA process. At present, the institutional capacity is not high, and strenuous effort is needed to invest in building capacity for environmental management. Collaboration with international organizations is needed to get technical and financial support for building the capacity of managing the environment effectively at the national and local levels. Since capacity is not built over night, it is prudent to start the process of capacity building as soon as possible for environmental security and biodiversity conservation.

5.1.10. Enhance Communication, Education and Public Awareness on Biodiversity Conservation

Obviously, people's participation is a key to the success of biodiversity conservation activities. It is difficult to get people's active participation unless people are properly aware of and educated on the importance of biodiversity conservation for sustainable development. People will only be aware of changing their attitude for conserving biodiversity when they clearly realize the importance of biodiversity in fulfilling their short-term and long-term livelihood needs. Therefore, enhancing communication, education and public awareness on biodiversity conservation in relation to livelihood needs should be a strategic direction for the NBSAP; especially for conservation investments in the medium and long-term framework.

5.1.10.1. Develop Information, Education and Communication Materials

To enhance public awareness on biodiversity conservation, a greater effort is needed to sort out the important messages about conservation in responding to the needs of various audiences across the nation. This really requires assessing the information needs of various audiences and targeting the most effective communication channels for enhancing the understanding of the messages disseminated. Development of information, education and communication materials should be done based on the information needs and appropriate communication methods and channels. The MOECAF should strongly take a lead in coordinating with NGOs, academic institutions and public media in this case for effective communication on biodiversity conservation.

5.1.10.2. Networking and Capacity Building for Public Awareness

Among many communication channels, inter personal communication seems still the most effective mode and channel for effective communication on biodiversity. This is because the majority of people are living in rural and remote areas and their access to advanced communication channels such as TV and Internet are still limited. Therefore, the development of an information and communication network is important while building the capacity of social mobilizers for conducting public awareness raising campaigns that should be taken into consideration for effective communication. In this respect, a national level committee for environmental conservation would play a crucial role in facilitating the process of this important task, especially in coordination with NGOs, public media and the private sector.

5.1.10.3. Support Public Awareness Raising Programs

To enhance public awareness on biodiversity conservation, investment should be made for conducting public awareness raising programs nationwide. These should seek the opportunity of working together with international development agencies like UNDP, JICA and DFID for making support available to local actors who would like to carry out public awareness raising activity at the community level. National public awareness programs should also be launched in via national TV and Radio.

5.2. NATIONAL BIODIVERSITY ACTION PLAN (2011-2030)

For effective conservation, medium term framework actions are needed for various sectoral interventions for biodiversity conservation. Pursuit of sustainable development as guided by the Myanmar National Environmental Policy and Myanmar Agenda 21, which contribute to the biodiversity conservation directly and indirectly, an attempt is also made to develop a set of action plans by various sectors based on the strategic outlay set above and the recommendations that have been laid down in developing the NSDS for Myanmar.

5.2.1. Five-year Action Plan Toward Sustainable Forest Management

With the major focus on ensuring sustainability of forest resources both for the present and future generations, the following activities need to be completed within the next five-year implementation framework including on-going activities:

1. Determine the Annual Allowable Cut (AAC) based on the needs of the changing socio-economic, environmental and silvicultural considerations and limit harvesting of timber of all species to the specified AAC.
2. Monitor prescriptions in forest working plans for sustainable forest management.
3. Provide a mechanism for involvement of international/local institutions, local communities and NGOs, in forest planning, implementation, and evaluation.
4. Conduct Environmental Impact Assessment (EIA) of forestry projects.
5. Endorse and implement the National Code of Harvesting.
6. Impose effective law enforcement against encroachment, poaching, illicit logging and illegal extraction of forest products and effective monitoring along international boundaries against illegal trade of forest products, wildlife, etc.
7. Reforest watershed areas to restore forest cover in critical watersheds.
8. Establish a mechanism for benefit sharing in community forestry programs through preparation of statutory agreements and other legislative supports.

5.2.2. Five-year Action Plan Toward Sustainable Wildlife Conservation and Protected Area Management

With the major focus on promoting In-situ conservation and effective wildlife management, the following activities are aimed to be implemented within the next five years.

1. Promote conservation education programs.
2. Introduce buffer zone management in peripheral areas around PAs to achieve the harmonization between sustainability of biodiversity and sustainable development of local communities.
3. Strengthen ex-situ conservation and research roles of botanic and zoological gardens.
4. Conduct status surveys of priority species, studying their distribution and link results to conservation management.
5. Check loss of biodiversity outside PAs.
6. Strengthen conservation and management of biological diversity and promote sustainable use of biological resources in line with the CBD and national policies.
7. Promote local communities participation in biodiversity conservation and consider the benefits of local people in management to increase the positive perceptions and attitudes towards PAs and biodiversity conservation.
8. Monitor the ongoing process of NBSAP and implement it with participation of all stakeholders.
9. Promote regional coordination to protect the AHPs.

10. Collaborate with India, China, Thailand, Bangladesh and the CITES signatories to monitor illegal trade of forest and wildlife products along international boundaries.
11. Implement priority needs for mammals, reptiles, amphibians, birds and plants.
12. Monitor the impact of IAS on biodiversity.
13. Develop measures for managing IAS.

5.2.3. Five-year Action Plan Toward Sustainable Freshwater Resource Management

With the focus of enhancing management of integrated water resources and aquatic ecosystems including wetlands, the following activities are to be implemented within the next five years:

1. Implement integrated water resource management using a river basin approach.
2. Promote river training activities.
3. Establish proper sewage treatment systems.
4. Construct wastewater treatment facilities in selected cities and areas.
5. List more wetlands in the ASEAN's wetlands of international importance.
6. Increase participation in water resources program of the Mekong River Commission.

5.2.4. Five-year Action Plan Toward Sustainable Management of Coastal, Marine and Island ecosystems

With the focus of enhancing conservation of coastal, marine and island ecosystems and the sustainable harvesting of marine living resources, the following activities are to be implemented within the next five years:

1. Protect and check environmental damage to coastal areas of Myanmar.
2. Stop fishing for species at risk until they are restored to their normal numbers or status.
3. Ban destructive fishing practices such as dynamiting, poisoning, electrocution, and using unauthorized fishing methods and gears; develop new practices to replace them.
4. Conduct constant patrols and encourage research and long-term monitoring of unauthorized fishing.
5. Establish a coastal and marine research centre using university of marine science as a nucleus.
6. Conduct a survey of fish diversity.
7. Develop participatory approaches for community based fishery resource conservation and management.

5.2.5. Five-year Action Plan Toward Sustainable Management of Land Resources

Major threats to biodiversity and environmental protection are strongly related to mismanagement of land resources. Thus, it is critical to manage the land resources on a sustainable basis and, with the focus on strengthening land use policy, preventing land degradation and desertification, and promoting integrated mountain development. The following activities are to be implemented within the next five years:

1. Adopt a well-defined or clear-cut land use policy aiming at sustainable development and ensuring environmental sustainability.
2. Formulate an integrated land use plan that takes into consideration national priorities and goals based on scientifically categorized different land uses.
3. Establish a National Land Use Commission.

4. Practice EIA on conversion of land resources.
5. Increase knowledge of desert and mountain ecosystems and identify areas most at risk from floods, soil erosion, etc.
6. Encourage proper water management in the dry zone.
7. Promote the practising of permanent agriculture in shifting cultivation affected area.

5.2.6. Five-year Action Plan Toward Sustainable Management of Agriculture, Livestock and Fisheries (Linking with Agriculture and Livestock Biodiversity)

With the focus on improving sustainable food security, the following activities are to be implemented within the next five years:

1. Conduct environmental analysis as part of land use planning to ensure that environmentally valuable lands and sensitive areas are not encroached on for agriculture expansion and thus avoiding adverse environmental impacts.
2. Stop unsustainable agricultural and other land uses leading to deforestation, soil degradation and desertification and develop appropriate sustainable farming systems such as sloping agricultural land technology (SALT), practising appropriate cropping patterns, and take measures to implement them.
3. Monitor the use of chemical fertilizers and pesticides to prevent excessive overuse and soil and water pollution as well as destructive fishing practices.
4. Drive enforcement of laws, order, rules and regulations in fisheries.
5. Promote protection of fisheries in sustainable development.
6. Conduct research on sustainable means of food production, processing and utilization.
7. Provide farmer-to-farmer technical extension services for sustainable food production.
8. Drive increased agricultural production by raising productivity on existing lands rather than through opening up of new lands.
9. Develop activities related to sustainable pasture land use.
10. Commission a study on genetic diversity and conservation for local livestock breeds.
11. Promote organic farming and develop a national standard for certification.
12. Strengthen the institutional capacity and facility for national seed and gene bank at the DAR, Yezin.
13. Create public awareness for PGR conservation.
14. Develop ***sui generis*** system for protecting Myanmar's PGR.

5.2.7. Five-year Action Plan Toward Sustainable Ecotourism

Ecotourism has impacted negatively or positively on biodiversity conservation. Thus, it is essential to ensure the sustainable management of ecotourism. The following activities are to be implemented within the next five years:

1. Introduce conservation awareness and environmental education into the syllabus of tourism related courses conducted by the Ministry of Hotels and Tourism (MOHT) and other relevant ministries.
2. Develop an ecotourism policy that ensures benefits for local communities.
3. Train FD's staff to understand the essence of ecotourism as well as the needs of ecotourism operations in order to ensure the supporting of ecotourism for conservation.

4. Include visitor programs with conservation issues to promote conservation awareness rather than just facilitating recreational activities.
5. Encourage private tour operators to undertake day-to-day ecotourism activities abiding by the rules and regulations of the PAs.

5.2.8. Five-year Action Plan Toward Enhancing Environmental Quality Management and Biosafety

With the focus on enhancing environmental quality management and biosafety for sustainable livelihood and human health, the following activities are to be implemented within the next five years:

1. Set up a special task force for facilitating environmental quality management and biosafety.
2. Enact the drafted Myanmar Environmental Protection Law.
3. Develop national air quality standard taking into consideration the environmental standard in other ASEAN countries.
4. Promote air pollution monitoring sites.
5. Encourage training for technical persons on air quality management.
6. Develop public awareness to promote community involvement in monitoring and disposal of domestic wastes.
7. Strengthen sewage management systems and sewage treatment for domestic waste, especially in big cities.
8. Network with other ASEAN countries for sharing cleaner production technologies.
9. Educate the general public to promote environmentally sound waste management including waste reduction, recycling and composting.
10. Promote water quality management.
11. Promote people awareness on PoPs.
12. Enforce the Conservation of Water Resources and Rivers Law enacted in 2006.
13. Cooperate in carrying out River Water Qualities for ASEAN countries.
14. Advocate for enacting Biosafety Law.
15. Conduct training on biosafety.
16. Raise public awareness on biosafety and food safety.

5.2.9. Five-year Action Plan Toward Sustainable Management for Mineral Resource Utilization

With the focus on improving environmentally sound mining and mineral processing operations for environmental safeguards, the following activities are to be implemented within the next five years:

1. Introduce EIA during exploration work.
2. Undertake pilot projects for protection, rehabilitation and reclamation of mining areas.
3. Upgrade technical skills of those involved in mining operations.
4. Assign experts for effective monitoring systems.
5. Identify appropriate locations for solid waste management.

CHAPTER 6: MECHANISMS FOR AN EFFECTIVE NBSAP

6.1. Institutional Mechanisms for Coordination and Implementation of Biodiversity Conservation

Efficient institutional mechanisms are needed for the effective implementation of biodiversity conservation as outlined in this NBSAP. Within the given socio-political situation of the country, a national level committee should be immediately formed to oversee the progress made in implementation of NBSAP activities. A specific committee must be organized to oversee and monitor the Myanmar NBSAP actions. As appropriate, the thematic sub-committees should be formed for enhancing intersectoral coordination among the government ministries and departments. For each of the government agencies, which are described as the responsible institutions for implementing the biodiversity conservation strategy, it is required to appoint a focal point for coordinating matters related to biodiversity conservation. For the main agencies concerned with biodiversity conservation, e.g. MOAI, MOLF, it may be required to set up an internal biodiversity unit within the structure of the organization in order to ascertain the progress of implementation. The major agencies responsible for implementing the strategic direction of the NBSAP are mentioned in Table 23.

Table 23. Responsible Institutions for Implementing Strategy for Biodiversity Conservation.

Strategic Directions	Responsible Institution for Implementation of Strategy and Development of Appropriate Programs and Projects
1. Strengthen conservation of Priority Sites	FD, DOF, LBVD, SLRD, General Administration Department (GAD), Office of Attorney General (OAG), Academic institutions and NGOs
2. Mainstream biodiversity into other policy sectors	MOECAF, MOAI, MOLF, Ministry of National Planning and Economic Development (MONPED) and GAD
3. Implement focused conservation actions for Priority Species	Member organizations of Wildlife Law Enforcement National Task Force, FD, DOF, Academic Institutions and NGOs
4. Support local NGOs and academic institutions to engage in biodiversity conservation	MOECAF, MOAI and MOLF
5. Create capacity to coordinate conservation investment in Myanmar	MOECAF, MONPED, Academic Institutions and NGOs
6. Scale up the implementation of participatory in-situ and ex-situ conservation of agriculture, livestock and fishery biodiversity and genetic resource management	MOAI and MOLF
7. Expedite the process of implementing national biosafety framework	MOECAF, MOAI, MOLF, OAG, Ministry of Health (MOH) and NGOs
8. Promote the initiative to manage IAS	MOECAF, MOAI, MOLF and Academic & Research Institutions

Table 23. Responsible Institution for Implementing Strategy for Biodiversity Conservation (Cont'd).

Strategic Directions	Responsible Institution for Implementation of Strategy and Development of Appropriate Programs and Projects
9. Facilitate the legislative process of environmental protection and environmental impact assessment	OAG, MOECAF, MOAI, MOLF, Ministry of Transport (MOT) and NGOs
10. Enhance communication, education and public awareness on biodiversity conservation	MOECAF, MOAI, MOLF, Ministry of Information (MOINFO), Academic Institutions and NGOs

For implementation of the medium term framework for sustainable development in relation to biodiversity conservation, the agencies responsible are described in Table 24. At the local level, local authorities are important for influencing effective implementation. These authorities could participate in the sub-national committees of the national level committee for environmental conservation and could take a lead in their respective regions for enhancing coordination.

Table 24. Agencies Responsible for Implementing Medium Term Framework Action.

No.	Sustainable development framework action	Lead institution	Collaborative institution
1	Sustainable forest management	MOECAF	MOAI and NGOs
2	Sustainable wildlife conservation and protected area management	MOECAF	MOE, MOINFO, Academic Institutions and NGOs
3	Sustainable freshwater resource management	City Development Committees, MOBA	MOAI, MOT and NGOs
4	Sustainable management of coastal, marine and island ecosystem	MOECAF, MOLF	MOT, MOE and NGOs
5	Sustainable management of land resources	MOAI	MOECAF, MOLF and NGOs
6	Sustainable management of agriculture, livestock and fisheries	MOAI, MOLF	MOECAF and NGOs
7	Sustainable ecotourism	MOHT, MOECAF	MOBA, MOINFO, Ministry of Culture (MOCU) and NGOs
8	Enhancing environmental quality management and bio-safety		MOI, Ministry of Rail Transportation (MORT), Ministry of Energy (MOEN), Ministry of Mines (MOM), MOAI, MOECAF, NGOs and MOLF
9	Sustainable management for mineral resource utilization		MOM

Moreover, it is also necessary to seek opportunities for enhancing coordination with international development agencies on a multi-lateral and bilateral basis. In particular, effort should be made for Myanmar to actively participate in the regional environmental conservation work of ASEAN and the Greater Mekong Sub-region. The relationship with the United Nations agencies is also to be maintained for continued collaboration on biodiversity and environmental conservation matters of mutual interest.

6.2. Monitoring and Evaluation of NBSAP

At present, the system of Environmental Performance Assessment (EPA) has been developed and practised for the monitoring and evaluation of the effectiveness and efficiency of government policies and programs on addressing the most critical issues of environmental concern. Currently, there are eight environmental issues, namely: (1) deforestation, (2) land degradation, (3) threats to biological diversity, (4) water resource management, (5) solid waste management, (6) air pollution, (7) the impact of mining operations on environment and (8) climate change. A set of actions, states and measured indicators has been developed for monitoring the status of the issues concerned and for examining the adequacy of the influences over reducing negative impacts. This is found to be very relevant to the NBSAP, especially for the monitoring and evaluation of performance in biodiversity conservation at the national and sub-national level. Since this EPA exercise is to be carried out at regular intervals, it fits with the need for reviewing the progress and failure of implementing the NBSAP to improve the biodiversity status in Myanmar. The responsible institution for this EPA exercise would be the taskforce formed by the national level environmental conservation committee composed of various stakeholders. What is needed for comprehensive monitoring and evaluation of biodiversity conservation is to streamline the development of a few more relevant indicators to the NBSAP activities in addition to presently used ones such as the loss of critical ecosystems and habitat, the percentage of global threatened species in Myanmar, the percentage of PAs over total land extent, the percentage of forest cover over total land extent, and the percentage of expenditure on forest management and biodiversity conservation.

6.3. Sustainability of Actions under Myanmar NBSAP

Without political will, budget allocation and institutional commitment, it won't be possible to continue the efforts made in conserving biological diversity in Myanmar. In spite of responding to conservation issues on ad hoc basic, it is essential to create the enabling working environment for addressing the issues consistently in the long run. Therefore, it is necessary to submit the NBSAP to the highest legislative body of parliament for their approval on the course of actions and budget allocation for implementation. Therefore, the national steering committee of NBSAP should make strenuous efforts to submit the NBSAP report to higher authorities of the present administration for their approval and consensus. The NBSAP should go through the legislative process in parliament so they can endorse the strategic direction and priorities for intervention. This will help the concerned implementation agencies to develop future programs and projects as well as to secure future budget approval from the legislative bodies.

In addition, stakeholder consultation is required at the local level to enhance awareness and understanding of local authorities and society on the components of NBSAP and their responsibilities for mobilizing society to increase participation in biodiversity conservation. As NBSAP is not a one off exercise, it requires creating a process of reviewing and updating its situation by analyzing biodiversity status in the country and reformulating strategy and priorities according to the needs and changes in socio-economic and biophysical conditions.

In the meantime, partnerships need to be developed with private business as well as with international development agencies to increase conservation investment and collaborative management. Due to information gaps, limited capacity and resource constraints, the present

NBSAP would not necessarily integrate with the national targets in line with achieving global targets on biodiversity conservation. However, the quality of the NBSAP should be improved gradually in compliance with the global targets to be met. Although it is not comprehensive, formulation of this NBSAP is ground breaking for the tradition and practice of environmental conservation in Myanmar. This process is shifting away from sectoral intervention to a multi-sectoral approach for holistic biological diversity conservation and management. Keeping this momentum towards this paradigm shift will definitely contribute to the outputs and outcomes expected by the NBSAP.

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Annex 1. National Steering Committee for Formulating NBSAP.

No.	Designation	Organization	Remark
1	Director General	Planning and Statistics Department, Ministry of Environmental Conservation and Forestry (MOECAF)	Chairperson
2	Director General	Forest Department, MOECAF	Member
3	Deputy Director General	Department of Agriculture Planning, Ministry of Agriculture and Irrigation	Member
4	Director	Planning Department, Ministry of National Planning and Economic Development	Member
5	Director	Department of Fisheries, Ministry of Livestock Breeding and Fisheries (MOLF)	Member
6	Deputy Director	Livestock Breeding and Veterinary Department, MOLF	Member
7	Joint Secretary	National Commission for Environmental Affairs, Planning and Statistics Department, MOECAF	Member
8	Director	Nature and Wildlife Conservation Division, Forest Department, MOECAF	Secretary

Annex 2. Thematic Working Groups for Formulating NBSAP.

Working Group (1) Natural Resource Use: Sustainable Forestry, Agriculture, Biotechnology, Fisheries, Hunting and Plant Use.

No.	Name	Designation	Organization	Remark
1	U Tin Tun	Director	NWCD, Forest Department	Leader
2	U Saw Hlaing	Director	Department of Agriculture Planning	Member
3	U Win Naing Thaw	Deputy Director	NWCD, Forest Department	Member
4	Dr. Min Bo Thein	Deputy Director	Livestock Breeding and Veterinary Department	Member
5	U Soe Myint	Deputy Director	Progress of Border Areas and National Races Development Affairs Department	Member
6	U Myo Myint	Deputy General Manger	Myanma Timber Enterprise	Member
7	Dr. Zin Mar Aung	Assistant Director	Livestock Breeding and Veterinary Department	Member
8	Dr. Wine Nway Nway Oo	Lecturer	Department of Biotechnology, Mandalay University	Member
9	Daw Mya Mya	Assistant Director	Ministry of Energy	Member
10	U Zaw Aung	Assistant Director	Mining Department	Member
11	U Ohn Lwin	Assistant Director	Forest Research Institute	Coordinator
12	U Ngwe Thee	Staff Officer	Forest Department	Member
13	Dr. Thaung Naing Oo	Staff Officer	Forest Research Institute	Member
14	U Aung Htay Oo	Staff Officer	Department of Fisheries	Member
15	U Tint Naing Oo	Staff Officer	Department of General Administration	Member
16	Dr. Ye Tun Tun	Deputy Supervisor	Agricultural Research Institute	Coordinator
17	Daw Moe Moe Oo	Deputy Supervisor	Myanma Agriculture Services	Member

Annex 2. Thematic Working Groups for Formulating NBSAP (Cont'd).

Working Group (2) Conservation and Ecology.

No.	Name	Designation	Organization	Remark
1	Dr. Maung Maung Gyi	Professor	Department of Zoology, University of Yangon	Leader
2	Dr. Aye Phae	Professor	Department of Botany, University of Yangon	Member
3	Dr. Min Thant Zin	Associate Professor	University of Forestry	Coordinator
4	U Ye Htut	Assistant Director	NWCD, Forest Department	Member
5	Daw Wai Wai Than	Research Officer	Forest Research Institute	Member
6	U Mya Than Htun	Assistant Director	Department of Fisheries	Member
7	Dr. Yan Naing Soe	Assistant Director	Livestock Breeding and Veterinary Department	Member
8	U Hlaing Min Maung	Staff Officer	National Commission for Environmental Affairs	Member
9	Daw San San Nwe	Staff Officer	NWCD, Forest Department	Member
10	U Win Myo Thu	Executive Director	ECODEV	Member
11	U Kyaw Thinn Latt	GIS Specialist	Wildlife Conservation Society	Member
12	U Thet Zaw Naing	Secretary	Myanmar Birds and Nature Society	Member

Annex 2. Thematic Working Groups for Formulating NBSAP (Cont'd).
Working Group (3) Social and Economical: Sustainable Development and Econimics, Law, Institution, Public Awareness and Environmental Education.

No.	Name	Designation	Organization	Remark
1	U Tint Swe	Assistant Director	Forest Department	Leader
2	Dr. Soe Tint	Director	Department of Occupational Health, Ministry of Health	Member
3	U Bon Thein	Director	Department of Agriculture Planning	Member
4	Dr. Tin Ngwe	Professor	University of Veterinary Science	Member
5	U Khin Maung Linn	Chief Engineer	Road Transport Administration Department	Member
6	Dr. San Thwin	Associate Professor	University of Forestry	Member
7	U Khin Hlaing	Deputy Director	Forest Department	Member
8	Daw Ni Ni May	Deputy Director	Planning Department	Member
9	U Sein Htun	Deputy Director	Department of Water Resources and Improvement of River System, Ministry of Transportation	Member
10	U Aung Ngwe	Deputy Director	Information and Public Relations Department	Member
11	U Sann Lin	Deputy Director	Office of the Attorney General	Member
12	U Kyaw Swe	Assistant Director	Supreme Court	Member
13	U Kyaw Aung Lwin	Assistant Director	Custom Department	Member
14	Daw Khin May Than	Assistant Director	Department of Social Welfare	Member
15	U Ohn Kyaw	Assistant General Manager	Hotels and Tourism Service	Member
16	U Sein Aung Min	Staff Officer	NWCD, Forest Department	Member
17	U Sai Than Maung	Staff Officer	National Commission for Environmental Affairs	Coordinator
18	U Sit Naing	Staff Officer	Directorate of Trade	Member

Annex 3. List of Globally Threatened Species of Myanmar in 2010.

No.	Common names	Scientific names	Status	Population trend
Mammals				
1	Sumatran Rhinoceros	*Dicerohinus sumatrensis*	Critically Endangered	Decreasing
2	Javan Rhinoceros	*Rhinoceros sondaicus*	Critically Endangered	Unknown
3	Dhole	*Cuon alpinus*	Endangered	Decreasing
4	Asian Elephant	*Elephas maximus*	Endangered	Decreasing
5	Greater Marmoset Rat	*Hapalomys longicaudatus*	Endangered	Decreasing
6	Western Hoolock Gibbon	*Hoolock hoolock*	Endangered	Decreasing
7	Lar Gibbon	*Hylobates lar*	Endangered	Decreasing
8	Sunda Pangolin	*Manis javanica*	Endangered	Decreasing
9	Chinese Pangolin	*Manis pentadactyla*	Endangered	Decreasing
10	Black Musk Deer	*Moschus fuscus*	Endangered	Decreasing
11	Tiger	*Panthera tigris*	Endangered	Decreasing
12	Fishing Cat	*Prionailurus viverrinus*	Endangered	Decreasing
13	Eld's Deer	*Rucervus eldii*	Endangered	Decreasing
14	Malayan Tapir	*Tapirus indicus*	Endangered	Decreasing
15	Indochinese Lutung	*Trachypithecus germaini*	Endangered	Decreasing
16	Phayre's Leaf-monkey	*Trachypithecus phayrei*	Endangered	Decreasing
17	Shortridge's Langur	*Trachypithecus shortridgei*	Endangered	Decreasing
18	Red Panda	*Ailurus fulgens*	Vulnerable	Decreasing
19	Asian Small -clawed Otter	*Aonyx cinerea*	Vulnerable	Decreasing
20	Binturong	*Arctictis binturong*	Vulnerable	Decreasing
21	Blue Whale	*Balaenoptera musculus*	Vulnerable	Decreasing
22	Gaur	*Bos gaurus*	Vulnerable	Decreasing
23	Banteng	*Bos javanicus*	Vulnerable	Decreasing
24	Indian Water Buffalo	*Babulus arnee*	Vulnerable	Decreasing
25	Takin	*Budorcus taxicolor*	Vulnerable	Decreasing
26	Hog-nosed Bat	*Craseonycteris thonglongyai*	Vulnerable	Decreasing
27	Sun Bear	*Helarctos malayanus*	Vulnerable	Decreasing
28	Banded Civit	*Hemilagus derbyanus*	Vulnerable	Decreasing
29	Eastern Hoolock Gibbon	*Hoolock leuconedys*	Vulnerable	Decreasing
30	Smooth-coated Otter	*Lutrolage perspicillata*	Vulnerable	Decreasing
31	Stump-tailed Macaque	*Macaca arctoides*	Vulnerable	Decreasing
32	Northern Pig-tailed Macaque	*Macaca leonina*	Vulnerable	Decreasing
33	Red Goral	*Naemorhedus bayleyi*	Vulnerable	Decreasing
34	Chinese Goral	*Naemorhedus griseus*	Vulnerable	Decreasing
35	Clouded Leopard	*Neofelis nebulosa*	Vulnerable	Decreasing
36	Finless Porpoise	*Neophocaena phocaenoides*	Vulnerable	Decreasing
37	Bengal Slow Loris	*Nycticebus bengalensis*	Vulnerable	Decreasing
38	Irrawaddy Dolphin	*Orcaella brevirostris*	Vulnerable	Decreasing
39	Marbled Cat	*Pardofelis marmorata*	Vulnerable	Decreasing
40	Temminck's Flying Squirrel	*Petinomys setosus*	Vulnerable	Decreasing
41	Vordermann's Flying Squirrel	*Petinomys vordermanni*	Vulnerable	Decreasing
42	Sambar	*Rusa unicolor*	Vulnerable	Decreasing
43	Capped Langur	*Trachypithecus pileatus*	Vulnerable	Decreasing
44	Himalayan Black Bear	*Ursus thibetanus*	Vulnerable	Decreasing
45	Large-spotted Civet	*Viverra megaspila*	Vulnerable	Decreasing

Annex 3. List of Globally Threatened Species of Myanmar in 2010 (Cont'd).

No.	Common names	Scientific names	Status	Population trend
Birds				
1	White-bellied Heron	*Ardea insignis*	Critically Endangered	Decreasing
2	Spoon-billed Sandpiper	*Eurynorhynchus pygmeus*	Critically Endangered	Decreasing
3	Pink-headed Duck	*Rhodonessa caryophyllacea*	Critically Endangered	Unknown
4	Red-headed Vulture	*Sarcogyps calvus*	Critically Endangered	Decreasing
5	Baer's Pochard	*Aythya baeri*	Endangered	Decreasing
6	White-winged Duck	*Cairina scutulata*	Endangered	Decreasing
7	Masked Finfoot	*Heliopais personatus*	Endangered	Decreasing
8	Greater Adjutant	*Leptoptilos dubius*	Endangered	Decreasing
9	Scaly-sided Merganser	*Mergus squamatus*	Endangered	Decreasing
10	Green Peafowl	*Pavo muticus*	Endangered	Decreasing
11	Gurney's Pitta	*Pitta gurneyi*	Endangered	Decreasing
12	White-browed Nuthatch	*Sitta victoriae*	Endangered	Decreasing
13	Spotted Greenshank	*Tringa guttifer*	Endangered	Decreasing
14	Rufous-necked Hornbill	*Aceros nipalensis*	Vulnerable	Decreasing
15	Plain-pouched Hornbill	*Aceros subruficolli*	Vulnerable	Decreasing
16	Greater Spotted Eagle	*Aquila clanga*	Vulnerable	Decreasing
17	Indian Spotted Eagle	*Aquila hastata*	Vulnerable	Decreasing
18	Pale-capped Pigeon	*Columba punicea*	Vulnerable	Decreasing
19	Yellow-breasted Bunting	*Emberiza aureola*	Vulnerable	Decreasing
20	Lesser Kestrel	*Falco naumanni*	Vulnerable	Decreasing
21	Sarus Crane	*Grus antigone*	Vulnerable	Decreasing
22	Pallas's Fish-eagle	*Haliaeetus leucoryphus*	Vulnerable	Decreasing
23	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable	Decreasing
24	Sclater's Monal	*Lophophorus sclateri*	Vulnerable	Decreasing
25	Nicobar Megapode	*Megapodius nicobariensis*	Vulnerable	Decreasing
26	Wallace's Hawk-eagle	*Nisaetus nanus*	Vulnerable	Decreasing
27	Great Bustard	*Otis tarda*	Vulnerable	Decreasing
28	White-fronted Scops-owl	*Otus sagittatus*	Vulnerable	Decreasing
29	Straw-headed Bulbul	*Pycnonotus zeylanicus*	Vulnerable	Decreasing
30	Indian Skimmer	*Rynchops albicollis*	Vulnerable	Decreasing
31	Beautiful Nuthatch	*Sitta formosa*	Vulnerable	Decreasing
32	Giant Nuthatch	*Sitta magna*	Vulnerable	Decreasing
33	Black-headed Ibis	*Threskiornis melanocephalus*	Vulnerable	Decreasing
34	Blyth's Tragopan	*Tragopan blythii*	Vulnerable	Decreasing
35	Large Green-pigeon	*Treron capellei*	Vulnerable	Decreasing
36	Grey-sided Thrush	*Turdus feae*	Vulnerable	Decreasing
Reptiles				
1	Four-toed Terrapin	*Batagur baska*	Critically Endangered	
2	Leatherback	*Dermochelys coriacea*	Critically Endangered	Decreasing
3	Burmese Starred Tortoise	*Geochelone platynota*	Critically Endangered	
4	Arakan Forest Turtle	*Heosemys depressa*	Critically Endangered	
5	Hawksbill Turtle	*Eretmochelys imbricata*	Critically Endangered	Decreasing
6	Gharial	*Gavialis gangeticus*	Critically Endangered	Decreasing
7	Burmese Peacock Softshell	*Nilssonia formosa*	Endangered	
8	Frog-faced Softshell Turtle	*Pelochelys cantorii*	Endangered	

Annex 3. List of Globally Threatened Species of Myanmar in 2010 (Cont'd).

No.	Common names	Scientific names	Status	Population
Reptile				
9	Big-headed Turtle	*Platysternon*	Endangered	
10		*Enhydris vorisi*	Endangered	Unknown
11	Yellow-headed Tortoise	*Indotestudo elongata*	Endangered	
12	Burmese Roofed Turtle	*Batagur trivittata*	Endangered	
13	Green Turtle	*Chelonia mydas*	Endangered	Decreasing
14	Burmese Mountain Tortoise	*Manouria emys*	Endangered	
15	Indian Narrow-headed Softshell	*Chitra indica*	Endangered	
16	Jagged-shelled Turtle	*Cuora mouhotii*	Endangered	
17	Bengal Eyed Terrapin	*Morenia ocellata*	Vulnerable	
18	King Cobra	*Ophiophagus hannah*	Vulnerable	
19	Impressed Tortoise	*Manouria impressa*	Vulnerable	
20	Southeast Asian Softshell Turtle	*Amyda cartilaginea*	Vulnerable	
21		*Siebenrockiella crassicollis*	Vulnerable	
22	Olive Ridley	*Lepidochelys olivacea*	Vulnerable	
23	Southeast Asian Box Turtle	*Cuora amboinensis*	Vulnerable	
24	Giant Asian Pond Turtle	*Heosemys grandis*	Vulnerable	
Plants				
1		*Shorea farinosa*	Critically	Needs updating
2		*Anisoptera scaphula*	Critically	Needs updating
3		*Dipterocarpus turbinatus*	Critically	Needs updating
4		*Sonneratia griffithii*	Critically	Decreasing
5		*Vatica lanceaefolia*	Critically	Needs updating
6		*Dipterocarpus baudii*	Critically	Needs updating
7		*Dipterocarpus grandiflorus*	Critically	Needs updating
8		*Hopea apiculata*	Critically	Needs updating
9		*Dipterocarpus dyeri*	Critically	Needs updating
10		*Dipterocarpus gracilis*	Critically	Needs updating
11		*Dipterocarpus kerrii*	Critically	Needs updating
12		*Hopea helferi*	Critically	Needs updating
13		*Hopea sangal*	Critically	Needs updating
14	White Seraya	*Parashorea stellata*	Critically	Needs updating
15		*Afzelia xylocarpa*	Endangered	Needs updating
16		*Anisoptera costata*	Endangered	Needs updating
17		*Shorea gratissima*	Endangered	Needs updating
18	White Meranti	*Shorea henryana*	Endangered	Needs updating
19		*Vatica cinerea*	Endangered	Needs updating
20		*Shorea roxburghii*	Endangered	Needs updating
21		*Cleidiocarpon laurinum*	Endangered	Needs updating
22		*Dalbergia oliveri*	Endangered	Needs updating
23		*Dipterocarpus alatus*	Endangered	Needs updating
24		*Dipterocarpus costatus*	Endangered	Needs updating
25		*Heritiera fomes*	Endangered	Decreasing
26		*Hopea ferrea*	Endangered	Needs updating
27		*Picea farreri*	Endangered	Needs updating
28	Taiwania	*Taiwania cryptomerioides*	Vulnerable	Needs updating
29		*Cephalotaxus mannii*	Vulnerable	Needs updating
30		*Cycas siamensis*	Vulnerable	Decreasing
31		*Hopea odorata*	Vulnerable	Needs updating
32	Burmese Rosewood	*Pterocarpus indicus*	Vulnerable	Needs updating

Annex 3. List of Globally Threatened Species of Myanmar in 2010 (Cont'd).

No.	Common names	Scientific names	Status	Population trend
Plants				
33	Lign-aloes	*Aquilaria malaccensis*	Vulnerable	Needs updating
34		*Burretiodendron esquirolii*	Vulnerable	Needs updating
35		*Calocedrus macrolepis*	Vulnerable	Needs updating
36		*Cleidiocarpon cavaleriei*	Vulnerable	Needs updating
37		*Cycas pectinata*	Vulnerable	Decreasing
38		*Dipterocarpus retusus*	Vulnerable	Needs updating
39	Ocean Turf Grass	*Halophila beccarii*	Vulnerable	Decreasing
40		*Hopea griffithii*	Vulnerable	Needs updating
41	Moluccan Ironwood	*Intsia bijuga*	Vulnerable	Needs updating
42		*Magnolia nitida*	Vulnerable	Needs updating
43		*Magnolia rostrata*	Vulnerable	Needs updating

Annex 4. Key Protected Species by Protected Areas (Established and Proposed).

No.	Name	Bio Unit	Key species protected	Management status	Remark
1	Taunggyi Bird Sanctuary	10 b. Terrestrial; N 20º 45' & E 97º 04'	Avifauna	Managed under FD	- / -
2	Pidaung Wildlife Sanctuary	9 b. Terrestrial; Between N 25º 15' & 25º 35', Between E 97º 14' & 97º 20'	Barking deer, Wildboar, Avifauna, Reptiles	Managed under NWCD	Protected Area; Notification No. 243/1927 (1-11-1927) Renotified in 2006 Notification No. 1/2006 (3-1-2006)
3	Shwe-U-Daung Wildlife Sanctuary	10 b. Terrestrial; Between N 23º 5' & 22º 57', Between E 99º 5' & 96º 22'	Elephant, Gaur, Banteng, Sambar, Serow, Macaque, Avifauna	Managed under NWCD	Protected Area; Notification No. 243/1927 (1-11-1927)
4	Pyin-O-Lwin Bird Sanctuary	10 b. Terrestrial; N 22º 00' & E 96º 30'	Barking deer, Avifauna	Managed under FD	Protected Area; Notification No. 243/1927 (1-11-1927)
5	Moscos Islands Wildlife Sanctuary	4. Island marine	Barking deer, Sambar, Water birds	Managed under FD	Protected Area; Notification No. 243/1927 (1-11-1927)
6	Kahilu Wildlife Sanctuary	4. Terrestrial; N 17º 3' & E 97º 6'	Serow, Mouse deer, Hog deer	Managed under FD	Protected Area; Notification No. 188/1928 (2-9-1928)
7	Mulayit Wildlife Sanctuary	10 a. Terrestrial; N 16º 7' & E 98º 30'	Barking deer, Wildboar, Macaque, Avaifauna	Managed under FD	Protected Area; Notification No. 232/1935 (5-11-1935)
8	Wethtikan Bird Sanctuary	9 a. Wetland; N 20º 00' & E 96º 30'	Water birds	Managed under FD	Protected Area; Notification No. 275/1939 (5-7-1939)
9	Shwesettaw Wildlife Sanctuary	9 a. Terrestrial; N 20º 12' & E 94º 35'E	Eld's deer, Sambar, Barking deer, Wild dog, Wildboar, Macaque, Avifauna	Managed under NWCD	Protected Area; Notification No. 210/1940 (29-6-1940)
10	Chatthin Wildlife Sanctuary	9 a. Terrestrial; N 23º 36' & E 95º 32'	Eld's deer, Sambar, Barking deer	Managed under NWCD	Protected Area; Notification No. 177/1941 (19-6-1941)
11	Kelatha Wildlife Sanctuary	4. Terrestrial; N 17º 13' & E 97º 6'	Samber, Barking deer, Wildboar, Avifauna	Managed under FD	- / - Renotofied in 2002 Notification No. 23/2002 (15-3-2002)
12	Thamihla Kyun Wildlife Sanctuary	4. Marine; N 15º 5' & E 94º 17'	Marine turtle, Water birds	Managed under FD	Protected Area; Notification No. 289/1970 (12-10-1970)
13	Minwuntaung Wildlife Sanctuary	9 a. Terrestrial; N 22º 2' & E 95º 58'	Barking deer, Hog deer, Avifauna	Managed under FD	Protected Area; Notification No. 259/1971 (26-10-1971)
14	Htamanthi Wildlife Sanctuary	9 b. Terrestrial; N 25º 26' & E 95º 37'	Tiger, Leopard, Elephant, Gaur, Sambar, Wildboar, Barking deer, Bear, Macque, Avaifuna	Managed under NWCD	Protected Area; Notification No. 31/1974 (11-4-1974)
15	Inlay Wetland Bird Sanctuary	10 b. Wetland / Lake; Between N 19º 46' & 20º 38', Between E 96º 47' & 97º 6'	Water birds, Migratory birds, Crane	Managed under NWCD	Protected Area; Notification No. 15/1985 (30-1-1985) Renotified in 2001 Notification No. 97/2001 (31-3-2001)
16	Moeyongyi Wetland Bird Sanctuary	4. Wetland reservoir; N 17º 34' & E 96º 35'	Migratory birds	Managed under NWCD	Protected Area; Notification No. 93/1988 (22-4-1988)
17	Hlawga Park	4. Terrestrial; N 17º 01' & N 98º 05' E	Sambar, Barking deer, Hog deer, Eld's deer, Macaque, Migratory birds	Managed under FD	Enclosed wildlife park. 1-6-1989
18	Alaungdaw Kathapa National Park	9 a. Terrestrial; N 22º 30' & E 94º 20'	Tiger, Leopard, Elephant, Gaur, Sambar, Serow, Bear, Wildboar	Managed under NWCD	Protected Area; Notification No. 31/1989 (20-1-1989)
19	Popa Mountain Park	9 a. Terrestrial; N 20º 53' & E 95º 15'	Barking deer, Wildboar, Dusk leaf monkey, Avifuna	Managed under NWCD	Protected Area; Notification No. 385/1989 (24-8-1989)
20	Meinmahla Kyun Wildlife Sanctuary	4. Marine; N 16º 05' & E 95º 18'	Crocodiles, Sea birds	Managed under NWCD	Protected Area; Notification No. 91/1993 (5-1-1993)
21	Lawkananda Wildlife Sanctuary	9 a. Terrestrial; N 21º 15' E 94º 47'	Myanmar star tortoise, Eld's deer, Avifauna	Managed under NWCD	Protected Area; Notification No. 33/1995 (16-2-1995)

Annex 4. Key Protected Species by Protected Areas (Established and Proposed) (Cont'd).

No.	Name	Bio Unit	Key species protected	Management status	Remark
22	Lampi Marine National Park	7 b. Marine; Between N 10º 41.5' & 10º 95.3', Between E 98º 4.9' & 98º 18.3'	Pangolin, Macque, Water birds, Coral reefs, Lesser mouse deer, Marine biotics	Managed under FD	Protected Area; Notification No. 40/1996 (20-8-1996)
23	Loimwe Protected Area	10 b. Terrestrial; N 21º 8' & E 99º 45'	Bear, Pangolin, Avifauna	Managed under FD	Protected Area; Notification No. 2/1996 (30-1-1996)
24	Parsar Protected Area	10 a. Terrestrial; N 20º 29' & E 99º 53'	Jungle fowl, Chinese pangolin, Avifauna	Managed under FD	Protected Area; Notification No.4/1996(31-3-1996)
25	Hkakaborazi National Park	H d. Terrestrial; N 28º 05' & E 97º 44'	Takin, Musked deer, Red panda, Red goral, Leaf deer	Managed under NWCD	Protected Area; Notification No. 79/1998 (10-11-1998)
26	Kyaikhtiyoe Wildlife Sanctuary	4. Terrestrial; Between N 17º 24' & 17º 34', Between E 97º 01' & 97º 10'	Goral, Gaur, Sambar, Barking deer, Macque, Wildboar, Avifauna	Managed under NWCD	Protected Area; Notification No. 37/2001 (6-7-2001)
27	Minsontaung Wildlife Sanctuary	9 a. Terrestrial; N 21º 28' & E 95º 43'	Barking deer, Rabbit, Myanmar star tortoise, Jackal, Wild cat, Snakes	Managed under NWCD	Protected Area; Notification No. 14/2001(22-3-2001)
28	Rakhine Yoma Elephant Range	4. Terrestrial; N 17º 31' & E 94º 30'	Elephant, Gaur, Leopard, Sambar, Barking deer, Jackal, Bear, Wildboar, Macque, Avifauna	Managed under NWCD	Protected Area; Notification No. 21/2002 (5-2-2002)
29	Panlaung-pyadalin Cave Wildlife Sanctuary	10 b. Terrestrial; N 21º 10' & E 96º 28'	Elephant, Leopard, Golden cat, Clouded leopard, Serow, Gibbon, Avifauna	Managed under NWCD	Protected Area; Notification No. 20/2002(18-3-2002)
30	Hponkanrazi Wildlife Sanctuary	9 b. Terrestrial; N 27º 30' & E 97º 43'	Barking deer, Avifauna, Red Goral, Gibbon, Wild dogs, Mangooses	Managed under NWCD	Protected Area; Notification No. 53/2003(1-12-2003)
31	Indawgyi Wetland Wildlife Sanctuary	9 a. Wetland/ Lake; Between N 24º 56' & 25º 24', Between E 96º 0' & 96º 39'	Sambar, Serow, Goral, Water birds	Managed under NWCD	Protected Area; Notification No. 39/2004 (9-8-2004)
32	Hukaung Valley Wildlife Sanctuary	9 b. Terrestrial; N 26º 17' & E 97º 41'	Tiger, Elephant, Leopard, Gaur, Sambar, Bear, Wildboar, Serow	Managed under NWCD	Protected Area; Notification No. 34/2004 (3-6-2004)
33	Bumhpabum Wildlife Sanctuary	9 b. Terrestrial; N 26º 29' & E 97º 31'	Elephant, Leopard, Gaur, Serow, Clouded leopard, Jackal, Avifauna	Managed under NWCD	Protected Area; Notification No. 40/2004 (9-8-2004)
34	Taninthayi Nature Reserve	5 a. Terrestrial; N 12º 02' & E 97º 00'	Tiger, Elephant, Tapir, Gurney's Pitta, Bear, Leopard, Avifauna	Managed under FD	Protected Area; Notification No.18/2005(30-3-2005)
35	Natmataung National Park	9 c. Terrestrial; N 21º 12' & E 94º 00'	Gaur, Serow, Goral, Barking deer, Leopard, Clouded leopard, Wildboar, White-browed Nuthatch, Avifauna	Managed under NWCD	Protected Area; Notification No. 164/2010 (2.12.2010)
36	Hukaung Valley Wildlife Sanctuary (extension)	9 b. Terrestrial	Tiger, Elephant, Leopard, Gaur, Sambar, Bear, Wildboar, Serow	Managed under NWCD	Protected Area; Notification No. 719/2010 (27-5-2010)
37	Kyauk Pan Taung Wildlife Sanctuary	9 c. Terrestrial; Between N 21º 19' & 21º 24', Between E 92º 59' & 93º 4'	Seraw, Goral, Sambar, Leopard, Clouded leopard, Wild cats, Barking deer, Wildboar	Managed under FD	Proposed Protected Area; Notification No. 17/2001(18-4-2001)
38	Maharmyaing Wildlife Sanctuary	9 a. Terrestrial; Between N 22º 50' & 23º 45', Between E 94º 15' & 95º 00'	Sambar, Wildboar, Banteng, Gibbon, Jackal, Mangooses, Wild cat	Managed under FD	Proposed ; Protected Area; Notification No. 18/2002(15-3-2002)
39	Taninthayi National Park	5 a. Terrestrial; N 12º 02' & E 97º 00'	Tiger, Elephant, Leopard, Tapir, Sambar, Serow, Goral, Barking deer, Avifauna,	Managed under FD	Proposed Protected Area; Notification No. 19/2002 (18-3-2002)
40	Lenya National Park	7 b. Terrestrial; N 10º 48' & E 99º 20'	Tapir, Elephant, Macque, Barking deer, Sambar, Wildboar, Bear, Mouse deer, Wild cats, Pangolin, Avifauna	Managed under FD	Proposed Protected Area; Notification No. 21/2002 (18-3-2002)
41	Lenya National Park (extension)	7 b. Terrestrial	Elephant, Tapir, Gaur, Banteng, Sambar, Gurney's Pitta,	Managed under FD	Proposed Protected Area; Notification No. 43/2004 (14-10-2004)
42	Shinpin Kyatthaut Wildlife Sanctuary		Barking deer, Hog deer, Wildboar, Pangolin, Jackal, Reptiles	Managed under FD	Proposed Protected Area; Notification No. 49/2006 (13-7-2006)
43	Bawditahtaung Nature Reserve		Wild cat, Avifauna	Managed under FD	Proposed Protected Area; Notification No. 29/2008 (26-3-2008)

Source: Nature and Wildlife Conservation Division, FD 2011.

Annex 5. Preliminary List of KBAs in Myanmar.

No.	KBA	Mammals	Birds	Reptiles	Plants	Protected Area*	IBA†	Selection Criteria for Priority Sites	
								KBA within a Priority Corridor	Supports Globally Threatened Species Endemic to Myanmar
1	Alaungdaw Kathapa	+	+		+	PA	IBA	Central Myanmar Mixed Deciduous Forests	No
2	Ayeyawady Delta: Meinmahla Kyun		+	+		PA	IBA	No	No
3	Ayeyawady River: Bagan Section		+	+			IBA	No	No
4	Ayeyawady River: Bhamo to Shwegu Section		+				IBA	No	No
5	Ayeyawady River: Moda Section		+				IBA	No	No
6	Ayeyawady River: Myitkyina to Sinbo Section		+				IBA	No	No
7	Ayeyawady River: Sinbyugyun to Minbu Section		+				IBA	No	No
8	Ayeyawady River: Singu Section		+				IBA	No	No
9	Bumphabum	+	+			PA	IBA	Upper Chindwin Lowlands	No
10	Bwe Pa		+				IBA	Chin Hills Complex	No
11	Central Bago Yoma	+						No	No
12	Central Taninthayi Coast			+				Sundaic Subregion (Taninthayi)	Burmese Eyed Turtle
13	Chatthin	+	+			PA	IBA	Central Myanmar Dry Forests	No
14	Chaungmagyi Reservoir		+				IBA	No	No
15	Chaungmon-Wachaung		+				IBA	Sundaic Subregion (Taninthayi)	Gurney's Pitta
16	Dawna Range	+						No	No
17	Gyobin		+				IBA	No	No
18	Hkakaborazi	+	+		+	PA	IBA	Northern Forest Complex	No
19	Hpa-an	+						No	No
20	Hponkanrazi	+	+		+	PA	IBA	Northern Forest Complex	No
21	Htamanthi	+	+		+	PA	IBA	Upper Chindwin Lowlands	No
22	Htaung Pru	+						Sundaic Subregion (Taninthayi)	No
23	Hukaung Valley	+	+		+	PA	IBA	Upper Chindwin Lowlands	No
24	Indawgyi	+	+			PA	IBA	No	No
25	Inlay Lake		+	+		PA	IBA	No	No
26	Kaladan Estuary			+				Rakhine Yoma Range	Burmese Roofed Turtle
27	Kamaing		+				IBA	No	No
28	Karathuri		+				IBA	Sundaic Subregion (Taninthayi)	Gurney's Pitta
29	Kawthaung District Lowlands		+				IBA	Sundaic Subregion (Taninthayi)	No
30	Kennedy Peak		+				IBA	Chin Hills Complex	No

Annex 5. Preliminary List of KBAs in Myanmar (Cont'd).

No.	KBA	Mammals	Birds	Reptiles	Plants	Protected Area*	IBA†	Selection Criteria for Priority Sites	
								KBA within a Priority Corridor	Supports Globally Threatened Species Endemic to Myanmar
31	Khaunglanpu	+						Northern Forest Complex	No
32	Kyauk Pan Taung		+			PA#	IBA	Chin Hills Complex	No
33	Kyee-ni Inn		+				IBA	No	No
34	Lampi Island		+			PA	IBA	Sundaic Subregion (Taninthayi)	No
35	Lenya		+			PA#	IBA	Sundaic Subregion (Taninthayi)	No
36	Loimwe	+				PA		No	No
37	Mahamyaing	+	+		+	PA	IBA	Central Myanmar Mixed Deciduous Forests	No
38	Mahanandar Kan		+				IBA	No	No
39	Mawlamyine	+						No	No
40	Mehon (Doke-hta Wady River)		+				IBA	No	No
41	Minzontaung			+		PA		No	Burmese Star Tortoise
42	Momeik-Mabein	+						No	No
43	Moyingyi		+			PA	IBA	No	No
44	Myaleik Taung			+				No	Burmese Star Tortoise
45	Myitkyina-Nandebad-Talawgyi		+				IBA	No	No
46	Myittha Lakes		+				IBA	No	No
47	Nadi Kan		+				IBA	No	No
48	Nam Sam Chaung (Kachin State)		+				IBA	No	No
49	Nam San Valley (Shan State)		+				IBA	No	No
50	Nat-yekan		+				IBA	Rakhine Yoma Range	No
51	Natmataung (Mount Victoria)		+			PA	IBA	Chin Hills Complex	White-browed Nuthatch
52	Ngawun	+	+				IBA	Sundaic Subregion (Taninthayi)	Gurney's Pitta
53	Ngwe Taung		+				IBA	Rakhine Yoma Range	No
54	Ninety-six Inns		+				IBA	No	No
55	North Zarmayi		+		+		IBA	No	No
56	Northern Rakhine Yoma	+						Rakhine Yoma Range	No
57	Nyaung Kan-Minhla Kan		+				IBA	No	No
58	Pachan		+				IBA	Sundaic Subregion (Taninthayi)	No
59	Panlaung-Pyadalin Cave	+				PA		No	No

Annex 5. Preliminary List of KBAs in Myanmar (Cont'd).

No.	KBA	Mammals	Birds	Reptiles	Plants	Protected Area*	IBA†	Selection Criteria for Priority Sites	
								KBA within a Priority Corridor	Supports Globally Threatened Species Endemic to Myanmar
60	Paunglaung Catchment Area	+						No	No
61	Pe River Valley (Mintha Ext Reserve Forest)	+						Sundaic Subregion (Taninthayi)	No
62	Peleik Inn		+				IBA	No	No
63	Rakhine Yoma	+		+		PA		Rakhine Yoma Range	Arakan Forest Turtle
64	Saramati Taung	+						No	No
65	Shinmataung		+				IBA	No	No
66	Shwe U Daung			+		PA		No	
67	Shwesettaw	+	+	+		PA	IBA	Central Myanmar Dry Forests	Burmese Star Tortoise
68	Tanai River	+	+			PA	IBA	Upper Chindwin Lowlands	No
69	Taninthayi National Park	+	+			PA#	IBA	Sundaic Subregion (Taninthayi)	No
70	Taninthayi Nature Reserve	+				PA		Sundaic Subregion (Taninthayi)	No
71	Taung Kan at Sedawgyi		+				IBA	No	No
72	Thaungdut	+						No	No
73	Upper Mogaung Chaung Basin		+				IBA	No	No
74	Uyu River		+		+		IBA	Lower Chindwin River	No
75	Yemyet Inn		+				IBA	No	No
76	Zeihmu Range		+				IBA	Chin Hills Complex	No

Notes: * = KBA is designated or officially proposed as a protected area, in whole or in part; † = KBA meets the criteria for designation as an Important Bird Area.
Proposed PA

Annex 6. Preliminary List of Conservation Corridors in Myanmar.

No.	Conservation Corridor	KBAs	Area (km^2)	Selection Criteria for Priority Corridors			
				Important Populations of CR and EN Animal Species	Important Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Need for Additional Investment
1	Ayeyawady Delta	Ayeyawady Delta: Meinmahla Kyun	5,300	Mangrove Terrapin		Migration of shorebirds; recruitment of fish	High
2	Bago Yoma Range	Central Bago Yoma; North Zarmayi	17,800	Asian Elephant; Banteng	Asian Elephant		High
3	Central Ayeyawady River	Ayeyawady River: Bagan Section; Ayeyawady River: Bhamo to Shwegu Section; Ayeyawady River: Moda Section; Ayeyawady River: Myitkyina to Sinbo Section; Ayeyawady River: Sinbyugyun to Minbu Section; Ayeyawady River: Singu Section; Myitkyina-Nandebad-Talawgyi; Myittha Lakes; Nam Sam Chaung (Kachin State); Ninety-six Inns; Peleik Inn; Taung Kan at Sedawgyi; Yemyet Inn	18,000	White-bellied Heron; White-rumped Vulture; White-winged Duck	Irrawaddy Dolphin; Sandbar-nesting birds; vultures; White-bellied Heron	Migration of fish	High
4	Central Myanmar Dry Forests Central Myanmar	Chatthin; Shwesettaw	15,000	Burmese Star Tortoise; White-winged Duck Asian Elephant; Banteng;			High
5	Mixed Deciduous Forests	Alaungdaw Kathapa; Mahamyaing	7,600	Capped Leaf Monkey; Hoolock Gibbon	Asian Elephant		High
6	Central Thanlwin River		11,000		Sandbar-nesting birds	Migration of fish	High
7	Chin Hills Complex	Bwe Pa; Kennedy Peak; Kyauk Pan Taung; Natmataung (Mount Victoria); Zeihmu Range	23,900	White-browed Nuthatch; White-rumped Vulture	Rufous-necked Hornbill; vultures	Altitudinal migration of birds	High
8	Kayah-Kayin Range	Dawna Range	13,000	Kitti's Hog-nosed Bat			High
9	Lower Chindwin River	Uyu River	8,400	White-rumped Vulture	Sandbar-nesting birds; vultures	Migration of fish	High

Annex 6. Preliminary List of Conservation Corridors in Myanmar (Cont'd).

No.	Conservation Corridor	KBAs	Area (km^2)	Selection Criteria for Priority Corridors			
				Important Populations of CR and EN Animal Species	Important Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Need for Additional Investment
10	Naga Hills	Saramati Taung	5,500	Hoolock Gibbon			High
11	Nan Yu Range		20,500				High
12	Northern Forest Complex	Hkakaborazi; Hponkanrazi; Khaunglanpu	25,800	Hoolock Gibbon; Red Panda; White-bellied Heron	Rufous-necked Hornbill; Takin; White-bellied Heron	Altitudinal migration of birds	High
13	Rakhine Yoma Range	Kaladan Estuary; Nat-yekan; Ngwe Taung; Northern Rakhine Yoma; Rakhine Yoma	53,000	Arakan Forest Turtle; Asian Elephant; Banteng; Burmese Roofed Turtle; Hoolock Gibon	Asian Elephant; Rufous-necked Hornbill	Migration of shorebirds; recruitment of fish	High
14	Sundaic Subregion (Taninthayi)	Central Taninthayi Coast; Chaungmon-Wachaung; Htaung Pru; Karathuri; Kawthaung District Lowlands; Lampi Island; Lenya; Ngawun; Pachan; Pe River Valley (Mintha Ext RF); Taninthayi National Park; Taninthayi Nature Reserve	44,200	Asian Elephant; Gurney's Pitta; Mangrove Terrapin; Storm's Stork; Tiger,	Asian Elephant; Plain-pouched Hornbill; Tiger	Migration of shorebirds; recruitment of fish	High
15	Upper Chindwin Lowlands	Bumphabum; Htamanthi; Hukaung Valley; Tanai River	24,400	Asian Elephant; Capped Leaf Monkey; Hoolock Gibbon, Slender-billed Vulture; Tiger; White-bellied Heron; White-rumped Vulture; White winged Duck; Wild Water Buffalo	Asian Elephant; Tiger; White-bellied Heron; Sandbar-nesting birds	Altitudinal migration of birds; migration of fish	High

Back photos
Above: ***Landscape in Khakaborazi National Park***
Below: ***Seascape in Lampi Marine National Park***

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