GOVERNMENT OF THE UNION OF MYANAMR

MINISTRY OF FORESTRY

NATIONAL COMMISSION FOR ENVIRONMENTAL AFFAIRS

FOURTH NATIONAL REPORT TO THE UNITED NATIONS CONVENTION ON BIOLOGICAL DIVERSITY

March, 2009

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MARCH 2009

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TO THE UNITED NATIONS CONVENTION ON BIOLOGICAL DIVERSITY

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Executive Summary

Myanmar, with a total area of 676,557 Km^2, stretches form north to south and lies between latitudes 9° 32' N to 28° 32'N and longitudes 92° 10' E to 101° 11'E. Accordingly, the country is rich in biodiversity because of diverse ecosystems and of different elevations from sea level to high mountains with an elevation of near 6,000 meter. Biodiversity is vital resource for the sustainable development of human being in every corner of the world.

This report contains 4 main chapters. Chapter I deals with the overview of biodiversity status, trends and threats. Further, chapter I provides with biodiversity conservation in the areas of Mountain, Forest, Dry and Sub-humid Land, Agriculture, Inland Water and Coastal and Marine Biodiversity. It also explains how Myanmar has put the biodiversity conservation in national priorities.

Chapter II gives the account of the current status of national biodiversity strategies and action plans of Myanmar. In this chapter, development of NBSAP and existing MEA related strategies, and plans towards biodiversity conservation such as Myanmar Agenda 21, 30-year national Forest Master Plan, Dry Zone Greening Action Plan and National Biosafety Framework are touched upon with regard to their roles. Chapter III depicts the mainstreaming of biodiversity into agriculture, forestry, mine, trade, education, livestock, and fishery, Myanmar Agenda-21, and Myanmar commitments in Multilateral Environmental Agreements. Chapter IV summarizes the progress towards the goals and objectives of the strategic plan of the convention, future activities to meet the 2010 targets and challenges encountered in biodiversity conservation.

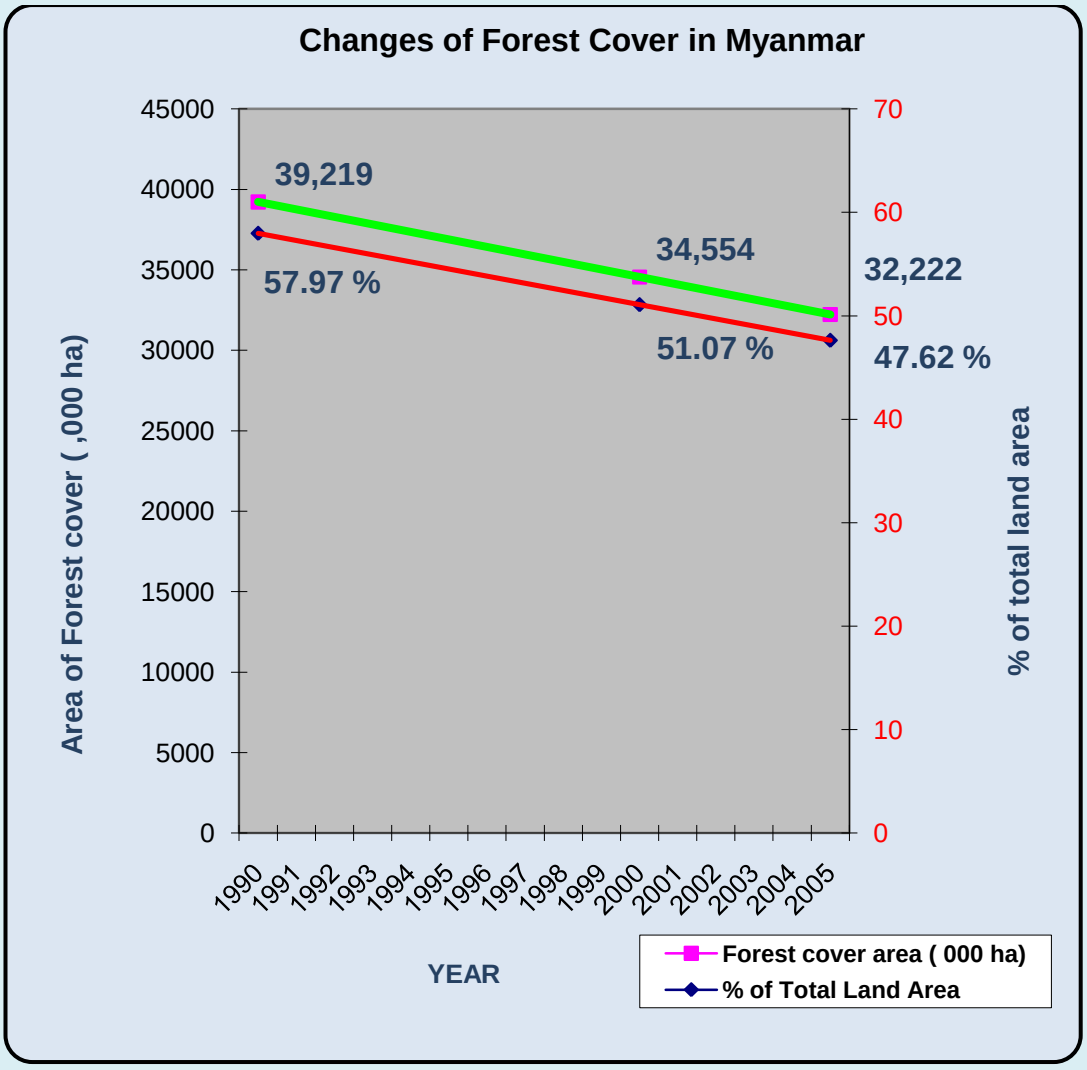
Conservation of the biological resources has been incorporated in the broader scope of nature and wildlife conservation which is regarded as one of the national priorities in the development of plans in Myanmar. For example, protection of soil, water, wildlife, biodiversity and the entire environment is identified as an important imperative not only in old days but until now. Myanmar ratified the Convention on Biodiversity on 9th November, 1994 and its first national report, but 3rd report to CBD, was made in 2005. This fourth national report is therefore the second report for Myanmar and it is prepared in accordance with the guidelines for the fourth national report. Biodiversity status by taxonomic groups is shown as species of vascular plants of gymnosperms and angiosperms at 11,800, mammals at 251, bird species at 1,056, reptiles 272, amphibian at 82, fresh water fish species at 310, marine water fish at 465, medicinal plants at 841, bamboo at 96 and rattan at 37.

In this report, the trend of biodiversity compared with that of the previous one can be concluded that it is in a downward trend. Like other developing countries, Myanmar is facing with the loss of biodiversity primarily due to the socio-economic pressure. The general trend of wild animal population is thus appeared to be decreasing compared with their relative abundance over the past 2-3 decades. The down-ward trend is apparent with

the population of large mammals such as tiger and elephant because of improper sex ratio and reduction of home range by human activities etc. There can also be decrease of wildlife population in areas where there is easy access to people.

Major threats identified in this report are hunting, habitat destruction (e.g forest depletion and degradation), forest fire and encroachment into the habitat areas. Market for wildlife and their parts and derivatives is growing in the neighboring countries and illegal wildlife trade is also direct threat to biodiversity. For example, the forest cover is dwindling due mainly to human pressure and forest cover changes between 1990 and 2005 are given.

Forest cover changes of Myanmar



Source: *Forest Resource Assessment,2005*

Similarly, close forest cover loss happened in Bago Yoma between 1995 and 2007 and it is shown in the table below.

Close forest area loss in Bago Yoma between 1995 and 2007

Land-use	Area(hectares)		
Classes	**ISDP 1995**	**FD 2007**	**Net + -**
Close Forest	428,663	384,629	-44,035
Open Forest	889,907	1,086,259	196,352
Water	36,114	87,933	51,820
Agriculture, Non Forest, Other Wooded Land and Bamboo	3,642,348	3,438,210	-204,137
	4,997,031	4,997,031	

Some minor threats are introduction of Invasive Alien Species, of Genetically Modified Organisms and climate change. Summary of globally threatened species in Myanmar are given.

Summary of globally threatened species in Myanmar

	Critically Endangered	Endangered	Vulnerable	Total
Mammal	4	9	26	39
Bird	4	8	33	45
Reptile	4	10	7	21
Invertebrate	0	0	1	1
Plant	13	12	13	38
Total	**25**	**39**	**80**	**144**

Key actions taken in support of the convention's three objectives and to achieve the 2010 target and goals and objectives of the strategic Plan of the Convention are implemented in the various fields of biodiversity conservation. Some examples are as follows;

- About 30 % of the country area has been established as Permanent Forest Estates (PFE).

- National Biosafety Framework and National Sustainable Development Strategy are being drafted.
- Myanmar Agenda 21 has been formulated.

The establishment of protected areas within past 100 years is expressed below. There is upward trend of protected areas and conservation of biodiversity.

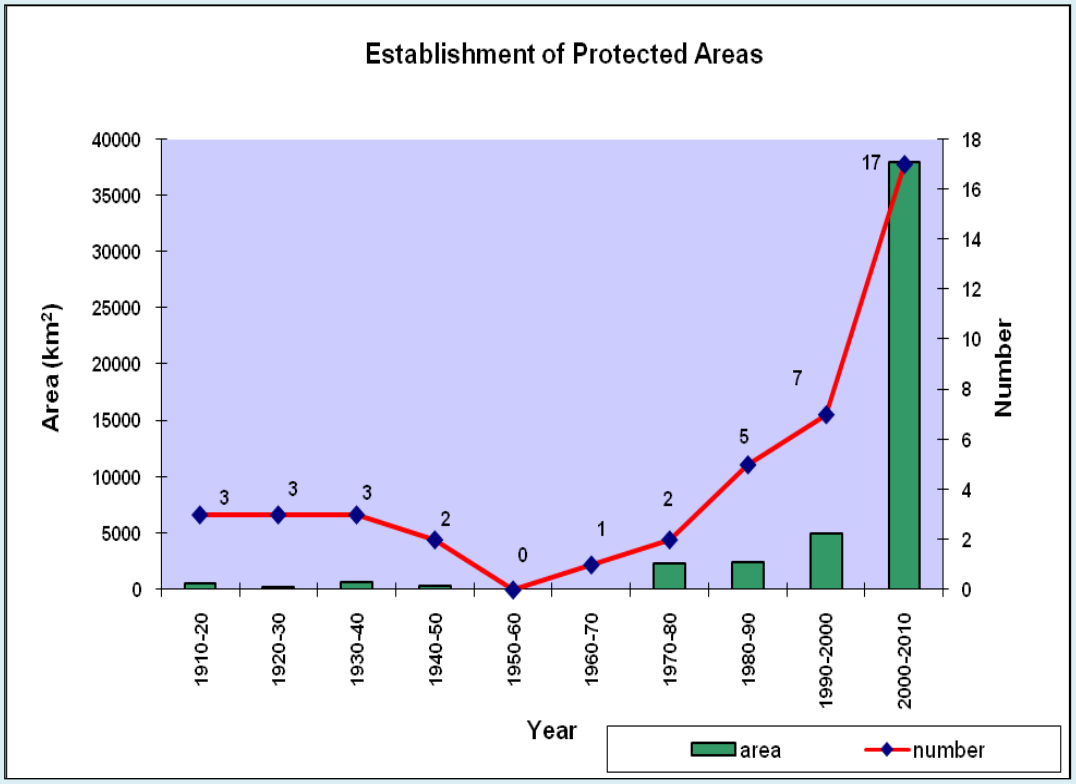
Permanent Forest Estates (PFE) in Myanmar

Category	Area (km^2)	% of land area
Permanent Forest Estate	**206,615**	**30.53**
1. Reserved Forests	121,911	18.02
2. Protected Public Forests	35,248	5.21
3. Protected Area Systems	49,456	7.30

Source: *Forest Department, 2008*

The trend of protected areas establishment is given;

Establishment of Protected Areas Systems in Myanmar



Source: *Forest Department*, 2008

To deal with effective national implementation for biodiversity conservation, due to several constraints, the proper implementation is appeared to be limited. Some areas where effective management and conservation of biodiversity are lacking are as follows;

- Urgent need for development of NBSAP and its implementation,
- Poor application of ecosystem approach,
- The need to develop a clear-cut national land-use policy and its implementation,
- Lack of mainstreaming biodiversity conservation into land-use practices,
- Gaps in scientific biodiversity conservation and management,
- Poor cross-sectoral coordination among stakeholders,
- Weakness in promotion of environmental awareness among the public and local authorities, concerned,
- Poor capacity building and institutional capabilities of biodiversity-related Institutions,
- Data based biodiversity conservation, management and assessment need to be upgraded, and
- The need to develop financial mechanism to ensure adequate financial supports for biodiversity conservation.

Regarding with major obstacles encountered in the effective implementation of CBD objectives, the issue is too complicated to clearly say whether it is concerned not only technical, but also social and physical dimensions. Some will identify as inadequate financial support or lack of advanced technologies or poor manpower planning or lack of capacity for production of competent persons, or lack of clear cut land use policy, etc.

The major challenges encountered pertaining to biodiversity conservation in Myanmar are as follows;

- Little or no provision of technical and financial assistance by outside agencies on the ground of Myanmar internal affairs,
- Budget and financial constraints in biodiversity conservation,
- Weakness in specialized units for biodiversity conservation plan and management at the national level,
- Poorness in the sense of ownership of local communities and stakeholders,
- Lack of promotion in effective and scientific management of terrestrial and marine protected areas to meet representative samples of ecosystems particularly to those of marine and coastal,

- In need of law enforcement to check the loss of biodiversity outside protected areas, and
- National Biodiversity Indicators have yet to be developed.

Finally, for effective implementation of the convention objectives in future, the following eight activities are identified and the activities will be conducted by biodiversity-related institutions and stakeholders.

- Resolve issues of biodiversity conservation by in cooperating with the schools and universities in the context of education and sustainable development.
- Build up institutional capacity for the existing biodiversity conservation programmes.
- Increase level of public awareness on environmental issues and motivate local communities to participate in nature conservation activities.
- Respect traditional knowledge in order to incorporate in the area of community based natural resource management.
- Increase mechanism for sustainable financial assistance for biodiversity conservation.
- Establishment of the network for biodiversity conservation among stakeholders.
- Transfer of technology on biodiversity, biotechnology and biosafety, and
- Exercise access to genetic resources and benefit sharing arising out of the utilization of the genetic resources.

The government of Union of Myanmar is striving the best to conserve Myanmar's biodiversity by its own resources, but the issue is to be tackled not only by the nation alone but also with the cooperation of outside agencies and partners. In particular, the current demand on natural resources of neighboring countries is one of the major threats to the long existence of biodiversity in Myanmar. A regional network on biodiversity conservation consisting of neighboring countries is thus advisable for long term biodiversity conservation.

CHAPTER I

OVERVIEW OF BIODIVERSITY STATUS, TRENDS AND THREATS

1.1. Introduction

The Union of Myanmar is geographically located in the north-west of the Indochina Region between latitudes 9° 32' N to 28° 32'N and longitudes 92° 10' E to 101° 11'E. Myanmar is bordered in the north and northeast by China, in the east and southeast by Laos and Thailand, in the south by Andaman Sea and the Bay of Bengal and in the west by Bangladesh and India. Myanmar extends a total area of 676,577 km^2 and a coastline of 2,832 km**.** It stretches for 805 km from east to west and 2,090 km from north to south. Due to a long range of latitudes from south to north and differences in elevation of sea level to snow capped mountains with over 5,800 meter high, Myanmar is endowed with striking different forests. Besides, complex arrays of plains along with the major rivers and plateaus running parallel to each other are of unique ecosystems supporting numerous lives. The interaction between varying climate and geo-physical components in the entire country Myanmar can be regarded as a country where a rich biodiversity is found. Biodiversity is a vital resource for the sustainable development of the nation. Almost all biodiversity observed in Myanmar as mentioned below;

- Mountain Biodiversity
- Forest Biodiversity
- Dry and Sub-humid land Biodiversity
- Inland Water Biodiversity
- Agriculture Biodiversity
- Marine and Coastal Water Biodiversity

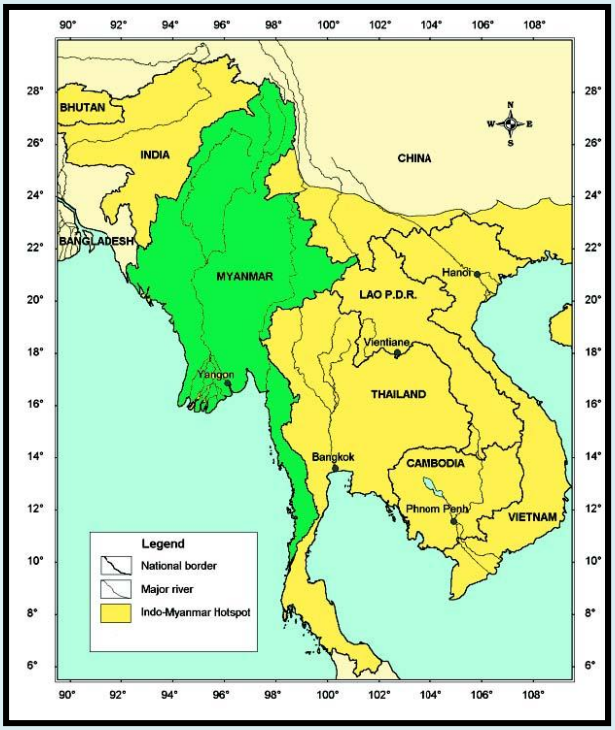


Figure 1. Location map of Myanmar

Besides, Myanmar is a country with small islands biodiversity of her west and south-west coastal line.

Under the guidance of the Government, laws related to biodiversity conservation are promulgated by all biodiversity related sectors. For example, the Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law is in place to protect the wild fauna and flora. The law stipulates to establish scientific reserves, national parks, marine parks, nature reserves, wildlife sanctuaries, national heritage sites, etc. as deemed necessary, in order to conserve, in perpetuity, wildlife, wild plants, scenic beauties, natural areas of geo-physical or cultural significance for prosperity.

Table 1. Laws relating to protected areas in Myanmar

Law/Act	Year	Major Aims / Notes
Wild Elephant Protection Act	1879	To safeguard the population of wild elephants vital in timber operations
Forest Act	1902	Responsibility for wildlife management empowered to Forest Department
Wildlife Protection Act	1936	Provides for designation of protected areas and protected species
Forest Law	1992	Can designate Reserved Forests for environmental and biodiversity conservation.
Protection of Wildlife and Wild Plant and Conservation of Natural Areas Law	1994	To implement the policies on protecting wild flora and fauna and natural areas, to fulfill international convention obligations; to enable to conduct research.
Forest Rules	1994	Provide articles to protect biodiversity
Forest Policy	1995	Provide basic fundamentals to preserve biodiversity
Protection of Wildlife and Wild Plant and Conservation of Natural Areas Rules	2002	To conserve natural ecosystems and protect wildlife species

Source: Forest Department

1.2. Status of Biodiversity in Myanmar

Myanmar possesses a flora and fauna of rich diversity. Various forest types of Myanmar are inhabited by a vast array of plants and wildlife species whereas rivers systems and tidal forests serve as breeding place for a wide range of aquatic species. Conservation of these biological resources has been incorporated in the broader scope of nature and wildlife conservation which is regarded as one of the national priorities in Myanmar. Protection of soil, water, wildlife, biodiversity and the entire environment is identified as an important imperative in the 1995 Myanmar Forest Policy.

Table 2. Wildlife status in Myanmar

Taxonomic Group	Species	Number
Species of vascular plants of gymnosperms and angiosperms		11,800
Mammal		251
Bird species		1056
Reptiles	*Snake*	153
	Lizard	87
	Turtle and tortoise	32
Amphibian		
	Frog and Toad	79
	Caecilians	2
	Salamander	1
Fresh water fish		310
Marine water fish		465
Medicinal plant		841
Bamboo		96
Rattan		37

Source: Forest Department,2008

According to the Protection Wildlife and Wild Plant and Conservation of Natural Areas Law (1994), wildlife species are categorized into three groups depending on their conservation status as given in Table 3.

Table 3. Taxa of fauna protected under the Protection Wildlife and Wild Plant and Conservation of Natural Areas Law (1994)

Taxonomic Group	Completely Protected Species	Protected Species	Seasonally Protected Species
Mammal	39	7 species, 2 genera, and 3 families. **Total= 31**	2
Bird	35 species, 14 families, and all shorebirds. **Total=312**	14 species, 10 genera, 3 groups, 1 subfamily, and 15 families. **Total= at least 225**	3 species, 2 genera, 2 sub-families, and 6 families. **Total= 135**
Reptile	9	1 species, 2 genera, and 3 families. **Total= at least 19**	0

Source: Forest Department

Table 4. Species endemic to Myanmar

Taxonomic Group	Common Name	Scientific Name
Mammal	1.Golden Deer	*Cervus eldi thamin*
Bird	1.White-throared Babler	*Turdoides gularis*
	2.Hooded Treepie	*Crypsirina cucullata*
	3.White-browed Nuthatch	*Sitta victoriae*
	4. Burmese Bushlark	*Mirafa microptera*
Reptile	1.Burmese Star Tortoise	*Geochelone platynota*
	2.Rakhine Forest Turtle	*Heosemys depressa*
	3.Burmese Roofed Turtle	*Batagur (Kachuga) trivitatta*
	4.Burmese Eyed Turtle	*Morenia ocellata*
	5.Burmese Frog-faced Softshell Turtle	*Chitra vandijki*
	6.Burmese Peacock Softshell	*Nilssonia formosa*
	7. Burmese Flapshell Turtle	*Lissemys scutata*
Plant	1. Black orchid	*Paphiopedilum wardii*
	2. ThawkaGyi	*Amherstia nobilis*
	3. Medow	*Potentilla montisvictoriae*
	4. Ground orchid	*Roscoea australis*
	5. Rhododendron	*Rhododendron burmanicum*
	6.Taung Thabye	*Tristania burmanica*
	7. Taung Tama	*Melia burmanica*
	8.Te	*Diospyros burmanica*

Source: *Forest Department*

Table 5. Summary of globally threatened species in Myanmar

Taxonomic Group	Global Threat Status			
	Critically Endangered	Endangered	Vulnerable	Total
Mammal	4	9	26	39
Bird	4	8	33	45
Reptile	4	10	7	21
Invertebrate	0	0	1	1
Plant	13	12	13	38
Total	**25**	**39**	**80**	**144**

Source: Birdlife International, 2005

1.3. Mountain Biodiversity

The topography of Myanmar can roughly be divided into three regions, the Eastern Hills, the Central Valley and the Western Hills. Myanmar exhibits extraordinary topographical diversity with the elevation ranging from nearly 6,000 m high Hkakaborazi summit in the north, the highest in South-East Asia, to the sea level in the south and south-west. The major mountain ranges in the country are given in Table 6.

Table 6. Major mountain ranges in Myanmar

Sr.No.	Range	Location
1	Eastern Himalayan	Northern part of country comprised eastern side of Himalayans
2	Chin Hills	Western part of country extends to south of India
3	Western Plateau	Between the Ayeyarwaddy River and Bay of Bengal
4	Bago Yoma	Between the Ayeyarwaddy and Thanlwin Rivers
5	Eastern Plateau	North-east of country bordering with China, Laos and Thailand
6	Tanintharyi	South of the country bordering with Thailand

Source: *Forest Department, 2008*

Box 1 : *Coelogyne ecarinata* from northern Myanmar that is rarely, if ever, cultivated

***Hurbert Kurtzweil and Saw Lwin* (November/December, 2008)**

During a trip to the Putao region of the northern Kachin State of Myanmar we came acro unusual species of *Coelogyne*. It had rich mahogany-red flowers with a black lip, which is most uncommon in this genus with predominantly white or cream flowers. We collected several plants and were later able to identify them positively as *Coelogyne ecarinata* Schweinf. It was discovered by the famous British naturalist Francis Kingdon-Ward, during the Vernay-Cutting Expedition in March1939. *C. ecarinata* is an epiphyte in subtropical mountain forest. We saw the plants growing both on shrubs and tall trees from 3–15m above the ground. Plants grew at various altitudes between 492–1,107m. *C. ecarinata* is known to occur in the northern Myanmar where the type was collected and where our own collections come from.

A plant of *Coelogyne ecarinata*

Coelogyne ecarinata has been referred to as endangered on the website of the New York Botanical Garden. During our trip we came across this species five times, once cultivated in the Hkakaborazi Environmental Education Centre in Putao, once in the field near Upper Shangaung on the southern edge of the Putao Valley, and three times while trekking from Putao to Naung Mung. The second author of this article also saw this species several times on the way to the Hponkan-razi mountain, which is also located just south of Putao, during a biological expedition in January and February 2002. *Coelogyne ecarinata* is apparently unknown in cultivation.

However, we think it has great potential because of its unusual flower color, both as a po

1.3.1. Status

The northern region of Myanmar is an area of exceptional biological and cultural diversity that comprises watersheds forming the two major rivers of the country – the Ayeyarwaddy and Chindwin. Myanmar Forest Department has started the establishment of the Northern Forest Complex (NFC) since 1996 to conserve unique ecosystems and protect wildlife species. NFC comprises totally four protected areas and some globally threatened wildlife species can be found in this area (Table7 and Table 8).

Table 7. Northern Forest Complex (NFC)

Sr. No.	Protected Area	Established Year	Area (km^2)	% of NFC
1.	Hkakaborazi National Park	1996	3,827	13
2.	Hponkanrazi Wildlife Sanctuary	2003	2,714	9
3.	Bumhpabum Wildlife Sanctuary	2004	1,862	6
4.	Hukaung Valley Tiger Reserve	2004	21,802	72
	Total		**30,105**	**100**

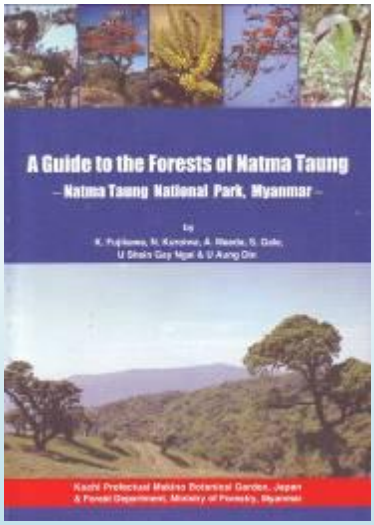
Source: *Forest Department ,2003*

Table 8. Some of major endangered wildlife species recorded in NFC

Sr. No.	Species	Scientific Name	Remark
1	Blue Sheep	*Pseudois nayaur*	new to Myanmar
2	Black Barking Deer	*Muntiacus crinifrons*	new to Myanmar
3	Stone Marten	*Martes fonia*	new to Myanmar
4	Leaf Deer	*Muntiacus putaoensis*	new to sciences
5	Tiger	*Panthera tigris*	
6	Red Panda	*Ailurus fulgens*	
7	Asian Elephant	*Elephas maximus*	
8	Takin	*Budorcas taxicolor*	
9	Southern Serow	*Naemorhedus sumatrensis*	
10	Hoolock Gibbon	*Hylobates hoolock*	
11	Asiatic Black Bear	*Ursus thibetanus*	
12	Clouded Leopard	*ParDOFelis nebulosa*	
13	Red Goral	*Naemorhedus baileyi*	
14	Rusty-bellied Short wing	*Brachypteryx hyperythra*	endangered
15	White-bellied Heron	*Andrea insignis*	endangered
16	Blyth's Tragopan	*Tragopan blythii*	endangered

Source: *Forest Department,WCS,WPA,2003*

Box 2 . A Guide to the Forests of Natma Taung (locally known Khaw-Nu-Tlang) **Natma Taung National Park, Myanmar**



Natma Taung National Park, was established in 1994. It possesses a diverse fauna and flora and hosts several unique ecosystems, ranging from lowland tropical vegetation complexes to subtropical coniferous forest and grassland. Forest Department has been conducting collaborative research on the useful plants of Myanmar- including those found growing naturally in Natma Taung National Park- together with the Makino Botanical Garden (MBK), Japan. So far 767 plants species have been recorded and about 400 are identified as medicinal plants. Significant advances have been achieved and ***A Guide to the Forests of Natma Taung – Natma Taung National Park, Myanmar*** is one of the outcomes from the cooperative program.

This guide book provides the travelers with information on Natma Taung such as natural sceneries, forests, orchids, medicinal plants, and customs and traditions of local communities in the area.

The Chin Hills comprise a range of high mountains extending from international border along with India to the East along the Chindwin River. The Chin Hills contain large areas of hill and montane evergreen forest ecosystems. Natmataung National Park was proposed in 1997 and Kyauk Pan Taung Wildlife Sanctuary in 2003 to protect the biodiversity of Chin Hills.

The Bago Yoma occupies the southern part of the central basin of Myanmar between Ayeyarwaddy and Sittaung Rivers and extending 435 km from north to south till to a ridge near Yangon City. It is known as home of Teak (*Tectona grandis*).

The Rakhine Yoma rises in the Bay of Bengal, between the international border with Bangladesh and the Ayeyarwady Delta. The mountains of the Rakhine Yoma support a large, contiguous block of semi-evergreen, evergreen and mixed deciduous forests. This Range also includes a large stretch of coastline, with extensive areas of inter-tidal mudflats and mangrove, most notably Kaladan Estuary. Rakhine Forest Turtle (*Heosemys depressa*) and Burmese Roofed Turtle -*Batagur* (*Kachuga) trivittata* are of endemic species.

Box 3: Turtle conservation program in Myanmar

Wildlife Conservation Society (Myanmar Program)

The Burmese Roofed Turtle - *Batagur* (*Kachuga) trivittata* is a critically endangered endemic river turtle rediscovered in 2002 by the Forest Department and Wildlife Conservation Society (WCS). The wild population of this turtle is highly vulnerable to extinction. Chronic, long-term collection of eggs from freshly laid nests decimated the population, and current threats include drowning in fishing nets, illegal fishing practices (dynamite) and collection for food markets. Efforts to save this rare turtle have focused on studying and protecting the remnant wild population on the Upper Chindwin River and establishing a captive breeding population at the Yadanabon Zoo in Mandalay. River surveys to locate new nesting individuals and populations, coupled with interviews with local villagers and fishermen, have helped pinpoint riverbanks that are consistently used for nesting.

Once nests are identified, they are guarded or moved eggs from the nests to safer areas for incubation. As a result, a total of 163 hatchings have been taken to the Yadanabon Zoo for further scientific study since 2006. The captive program is making significant progress, and the new breeding and management facility opened in December 2006 is running effectively.

The Tanintharyi comprises the Sundaic sub-region, an extremely large block of natural habitat. The Sundaic sub-region includes the largest area of lowland and wet evergreen forests remaining in the Indo-Myanmar Hotspot. This corridor also includes a significant portion of coastline, a large number of offshore islands and significant areas of key wetland habitats including mangrove and inter-tidal mudflat. Also this area supports rich lowland evergreen forest communities, including such species as Malay Tapir (*Tapirus indicus*), Plain-pouched Hornbill (*Aceros subruficollis*) and Gurney's Pitta (*Pitta gurneyi*) which are endemic to Tanintharyi Division. Camera trap survey with WCS in 2000 confirmed presence of tiger in this area.

Box 4: Cooperative project between the Forest Department and the Kochi Prefectural Makino Botanical Garden, Japan (2005-2007)

Forest Department has been conducting Collaborative research on the medicinal plants of Myanmar together with the Kochi Prefectural Makino Botanical Garden from 2005 to 2007.

The main objectives are to make floristic inventory of the plants of Myanmar, to do research on the medicinal usefulness of plants and to make economic botanical studies of Myanmar plants. Surveys focused on the collection and identification of useful medicinal plants including orchids from localities in Natma Taung National Park in Chin State, Alaungdaw Kathapa National Park, Hukaung Valley Wildlife Sanctuary and Popa Mountain Park.

Roscoea australis, endemic to Myanmar

Totally 4,436 herbarium specimens and 485 samples for chemical studies were collected by botanical expeditions and one set of herbarium specimens was left in local Forest Department (FD) office in each site. All specimens collected during the expeditions were deposited at the Herbarium of the FD Office in Natma Taung National Park and Makino Botanical Garden Herbarium.

As the result of this research, the Flowering Plants of Mt.Popa, Central Myanmar (2006) has been published. *Gmelina tomentosa* Fletcher (Verbenaceae), *Silene khasiana* Rohrb (Coryophyllaceae) are recorded as new for the flora of Myanmar. *Begonia hayamiana* Nb. Tanaka could be recorded as a new species of *Begonia* in Northern Myanmar. *Gardenia obtusifolia* (Rubiaceae), *Melia toosendan* (Meliaceae), *Hesperethusa caenulata* (Rutaceae), *Tephrosia candida* (Leguminosae) and *Annona spp*.(Annonaceae) are determined for chemical components. Anti-cancer activities (lung, large intestine and pharyngeal cancer) were detected from these plants.

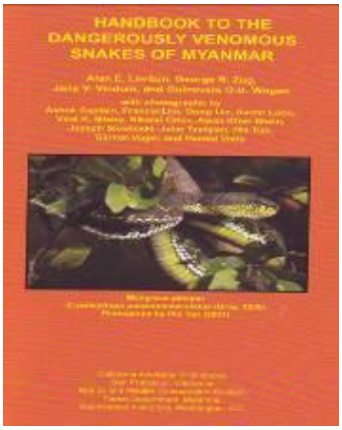
1.3.2. Trend

Out of 43 protected areas established, 34 represent mountain biodiversity. In order to rehabilitate the Bago Yoma, the Forest Department has been carrying out Bago Yoma Greening Project (2004- 05 to 2008- 09) as a special project. During the project, the major activities are being implemented as conservation and protection of natural forests, enrichment planting, natural regeneration and establishment of plantations. Myanmar has been a member country to International Center for Integrated Mountain Development (ICIMOD) since early 1990s. Biodiversity studies such as regional collaboration in conservation of the Hkakaborazi Mountain Ecosystem and study on technical approach to model management for Pidaung Wildlife Sanctuary were undertaken jointly by the Forest Department and ICIMOD. An experiment on slope land agriculture technique is also conducted in Northern Shan State, which was financed by ICIMOD. Capacity building, education, training and awareness raising programs are taken with emphasis on the sustainable development of mountainous areas in close cooperation with ICIMOD. In early 2007, a training program on 'the Application of Geo-Informatics for Conservation and Management' was conducted by the Mountain Environment and Natural Resources Information Systems Division of ICIMOD in collaboration with the Forest Department with the object to help

address issues and problems related to the management and use of natural resources in these mountain regions.

Box 5: Handbook to the dangerously venomous snakes of Myanmar

Rich herpeto-fauna of Myanmar is being surveyed from 1999 to up to now with the technical and financial assistance of California Academy of Science (CAS) and Smithsonian Institution (SI). So far 378 species were recorded and 58 species are found to be new to the texa. Handbook to the Dangerously Venomous Snakes of Myanmar was published in 2008.



1.3.3. Threats

In Myanmar, mountain ecosystems are vulnerable to climate change, forest fire, soil erosion, landslides and rapid loss of habitat and genetic diversity. Agricultural expansion, hunting for wildlife trade, over-exploitation of forest products and livestock grazing are also major threats. Being a developing country, poverty, unemployment, poor health and sanitation also prevail among mountain dwellers and in turn threats to mountain biodiversity.

1.4. Forest Biodiversity

1.4.1 Status

The forest resource assessment (FRA – 2005) conducted by the Food and Agriculture Organization (FAO) in cooperation with the Forest Department indicated that Myanmar is still endowed with a forest covered area of about 50% of the country's total land area of 676,577 km^2.

Table 9. Forest cover status in 2008

Sr. No.	Forest Category	Area (km^2)	% of Total Land Area
1	Forests	322,218 .6	47.62
2	Other wooded land	108,339 .5	16.01
3	Other land	226,989 .0	33.55
4	Inland water bodies	19,029 .9	2.82
	Total	**676,577.0**	**100.00**

Source: *Forest Department,2008*

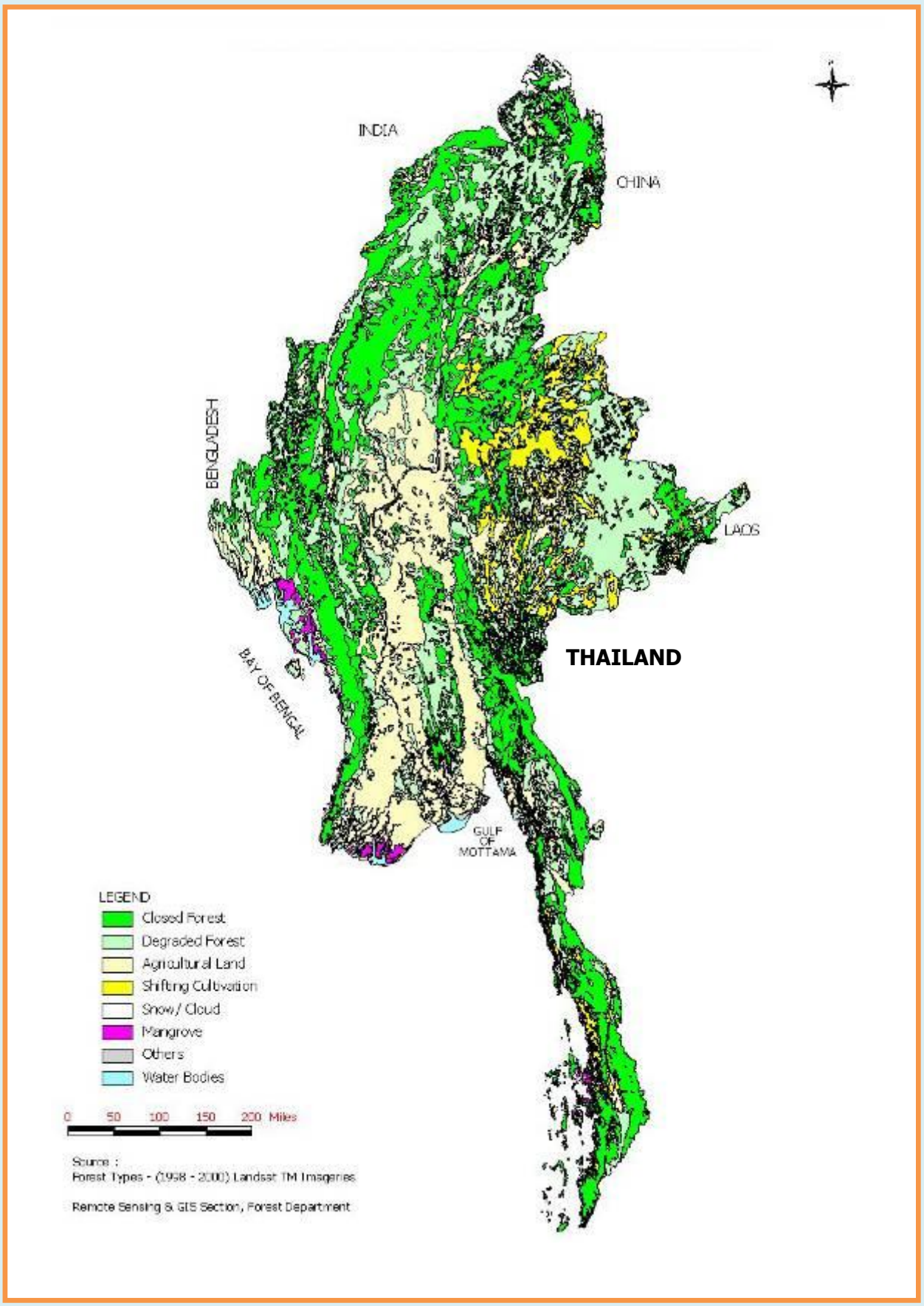


Figure 2. Forest cover status in Myanmar

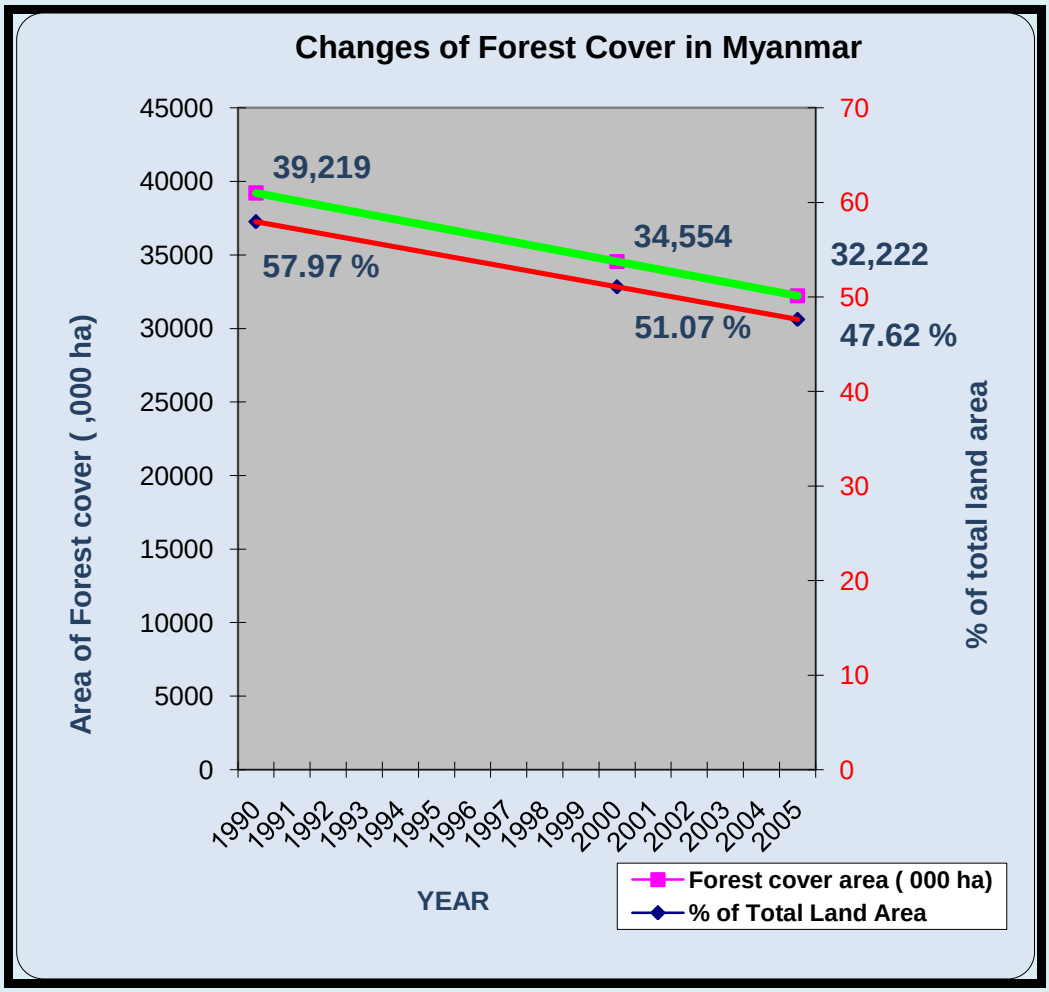
Source: Forest Department

Table 10. Major forest types in Myanmar

Sr. No.	Forest Types
1	Tidal Forest, Beach and Dune Forest, Swamp Forest
2	Tropical Evergreen Forest
3	Mixed Deciduous Forest
4	Dry Forest
5	Deciduous Dipterocarp Forest
6	Hill and Evergreen Forest
7	Fallow Land

Source: *Forest Department*

The forest cover is decreasing due to human pressure and forest cover changes between 1990 and 2005 are given in Figure 3.



Source: *Forest Resource Assessment,2005*

Figure 3. Forest cover changes of Myanmar

Box 6: Land-use changes of Bago Yoma

Bago Yoma, bearing a large proportion of gregarious teak stands and hardwood associates, is referred to as typical example in management of forest in Myanmar. Connected with fertile valleys on its both foothills which support very productive agriculture and high population which result in the change of forest cover over the time. The results analyzed using 5 TM imagery of 1995-97 and 2007 Landsat 7 ETM images are shown in following table and images.

Land-use	**Area(hectares)**		
Classes	**ISDP 1995-97**	**FD 2007**	**Net + -**
Close Forest	428,663	384,629	-44,035
Open Forest	889,907	1,086,259	196,352
Water	36,114	87,933	51,820
Agri+Non Forest+ Other Wooded Land +Bamboo	3,642,348	3,438,210	-204,137
	4,997,031	4,997,031	

N.B; Ground truthing trips have revealed that not only closed forest area have decreased, but the quality of forests have declined considerably. Only the FAO definition of closed forests (over 40% crown density with minimum 0.5 hectare, tree height over 5 meter) make these two data comparable. Also bamboo area of 1995-97 are true bamboo breaks, whereas bamboo area of 2007 are of stunted clamps almost no value except holding soil. Also it includes bamboo areas of villages and such area as Nay Pyi Taw.

Also to make two classifications comparable the non-forest classes are combined which include, agriculture area, other wooded land area, bare lands, orchards and villages, sand etc. Emphasis is given to decrease in closed forest, increase of open forest areas and significant increase in irrigation systems in the forest areas.

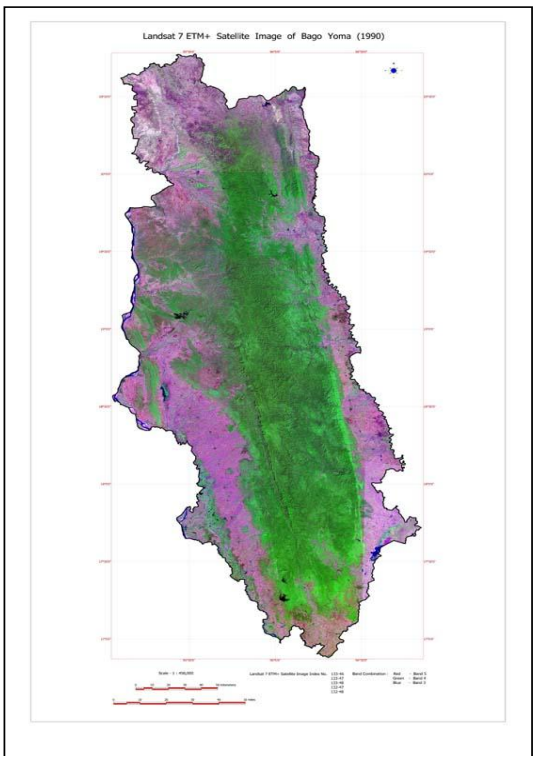


Figure 1. 1990 Landsat 5 TM image of Study area

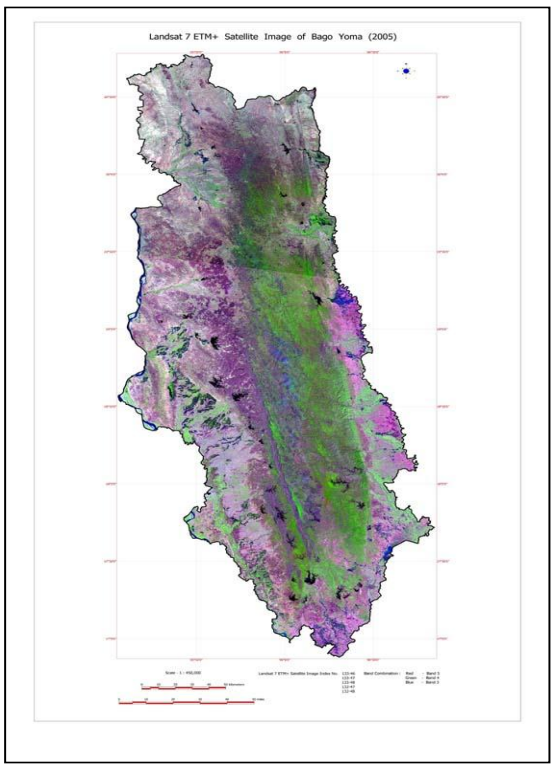


Figure 2. 2005 Lansdat 7 ETM image of study area

Figure 1 and 2 clearly show the decrease of closed forest areas as well as significant increase of water reservoirs for the whole region.

Table 11. Permanent Forest Estates (PFE) in Myanmar

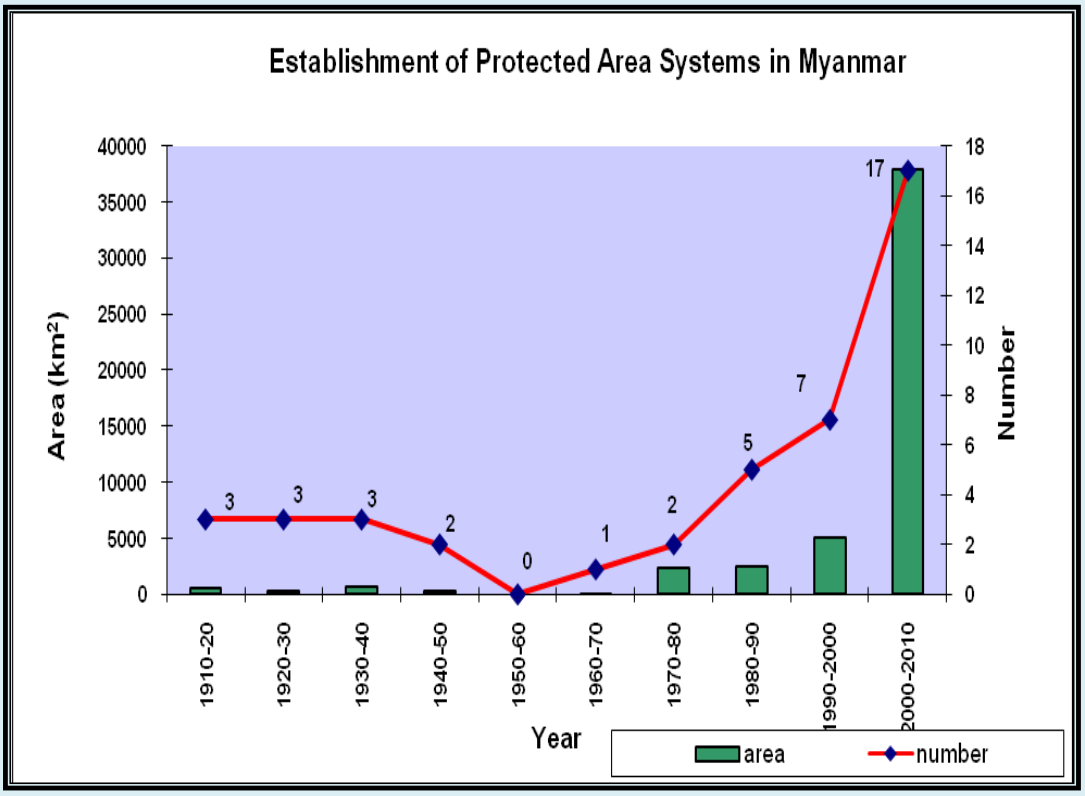
Category	Area (km^2)	% of land area
Permanent Forest Estates	**206,615**	**30.53**
1. Reserved Forests	121,911	18.02
2. Protected Public Forests	35,248	5.21
3. Protected Area Systems	49,456	7.30

Source: *Forest Department,2008*

Note; Protected Area Systems described represent both 3.93% of notified and 3.37% of proposed.

1.4.2 Trends

Although rich in biodiversity in the region, loss of biodiversity due primarily to the socio-economic pressure is unavoidable in a developing country like Myanmar. The general trend of wild animal population is appeared to be decreasing compared with their relative abundance over the past 20 or 30 years. Due to habitat destruction, their population is not large enough to reproduce a viable population. The down-ward trend is apparent with large mammals such as tiger and elephant because of reduction of their sex ratio and home range by human activities etc. There can be decrease of wildlife where there is easy access to people and heavily populated areas. But, Myanmar is trying to conserve the habitats of wildlife species through establishment of protected areas. Therefore, there is an up-ward trend of wildlife in protected areas in general. The trend of protected areas is given in Figure 4



Source: *Forest Department*, 2008

Figure 4. Establishment of protected area systems in Myanmar

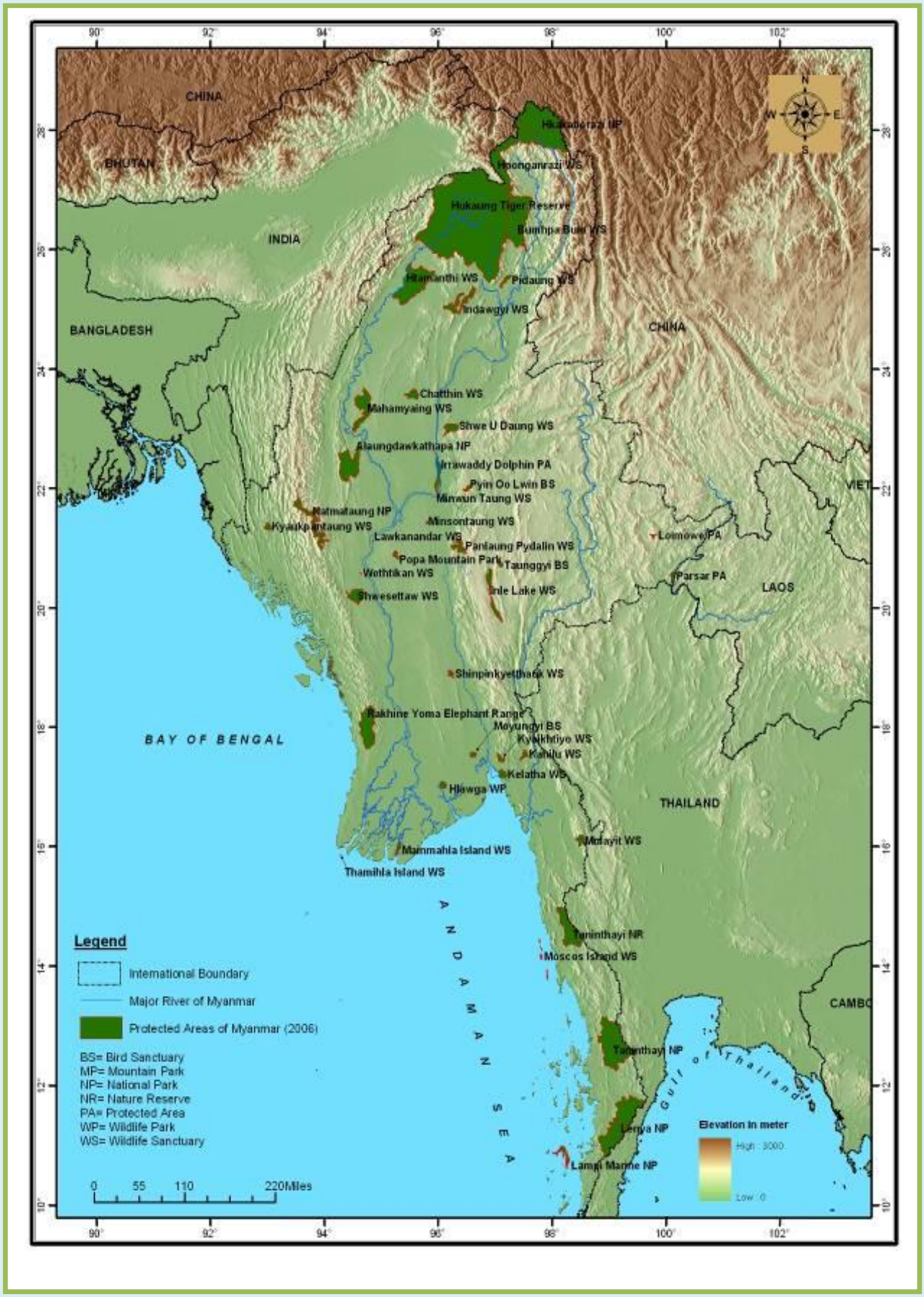


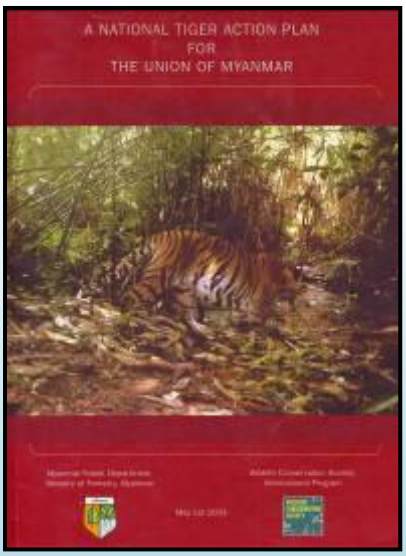
Figure 5. Protected areas systems in Myanmar *Source: WCS (Myanmar Program)*

1.4.3. Threats

Hunting poses a direct threat to wildlife. Forest depletion and degradation are major threats to biodiversity. Encroachment into forests is another threat to wildlife. Forest fires become more severe these days killing wildlife. Market for wildlife and their parts is growing in the neighboring countries and wildlife trade to meet the market demands is growing, and in turn it gives a direct threat. Alien species which are introduced intentionally or unintentionally may become Invasive Alien Species and they can escape into the native landscape and threaten the survival of native flora and fauna. Climate change is likely to cause increased dryness as well as wetness and thereby, affects the survival of flora and fauna. Genetically modified organisms are threat to biodiversity because of the risk associated with them.

Box 7: National Tiger Action Plan for the Union of Myanmar

In the past tigers lived across Myanmar with good forest areas. Due to habitat loss and poaching their number dwindled over the time. It was estimated between 600-1000 tigers in 1991 and 250-300 in 1998. Forest Department conducted a tiger survey in 17 tiger potential sites in 2001, out of them 4 were confirmed their presence in the far north and south of Myanmar. Consequently a National Tiger Action Plan was prepared and Tiger Protection Units including Wildlife Police are patrolling to step up tiger conservation in Myanmar with the support of Wildlife Conservation Society (WCS). As follow up of the tiger action plan Hukaung Valley Wildlife Sanctuary was established in 2004 with the support of WCS. It is 6,371km^2 large and composed arrays of forest types with plains flooded in the rainy season. A management plan that will fulfill the needs of the villagers has been drafted to implement the conservation of tiger, its preys and habitat.



1.5. Dry and Sub-humid Land Biodiversity

1.5.1. Status

In Myanmar, dry forest ecosystem generally dominates the arid and semi-arid region of central part of Myanmar where temperature is very high, rainfall is scarce and the soils are generally deteriorating. The Central Dry Zone area comprises of deciduous dipterocarp forests, dry mixed deciduous forests, thorn forests and flanking habitats of riverine forests.

Isolated remnants of deciduous dipterocarp forests, locally known as *indaing* forests, which is dominated by *Dipterocarpus tuberculatus* species, generally extend the surrounding areas of Chatthin Wildlife Sanctuary and Shwesattaw Wildlife Sanctuary. This type of forest ecosystem is characterized by a low, open canopy, a grassy under storey and low tree species richness. This type of ecosystem supports several wildlife species endemic to Myanmar, notably Burmese Star Tortoise (*Geochelone platynota*), White-throated Babbler (*Turdoides gularis*), Hooded Treepie *(Crypsirina cucullata*) and Burmese Bushlark (*Mirafra microptera*). Moreover, it also supports the largest known wild population of Eld's Deer (*Cervus eldii thamin*) which is endemic to this

ecosystem. According to the survey carried out in April 2008, nearly 1,910 numbers of Eld's Deer are recorded in Chatthin and Shwesettaw Wildlife Sanctuaries.

The second dry mixed deciduous forests dominate extensively on hills to the north and west of Central Dry Zone, especially within Alaungdaw Kathapa National Park and Maharmyaing Wildlife Sanctuary. Dominant species are Teak (*Tectona grandis*), Pyinkado (*Xylia dolabriformis*), Taukkyan (*Terminalia tomentosa*), Panga (*Terminalia chebula*), Ingyin (*Pentacme siamensis*) and Thitya (*Shorea oblongifolia*). Several globally threatened species including Hoolock Gibbon (*Bunipithecus hoolock*), Leaf Monkey species (*Trachypithecus* spp.), Asian Elephant and Banteng (*Bos javanicus*) (all Endangered) generally inhabit in these areas.

Box 8: Managing wild populations: The development of a management plan for wild elephants in Myanmar

(Forest Department &National Zoological Park, Smithsonian Institution)

In 2001, scientists from the Smithsonian's National Zoo started work with the Forest Department. The project, titled Managing Two Critical Elephant Ranges in Myanmar, focused on the conservation and management of elephant populations in Alaungdaw Kathapa National Park (AKNP) and Htamanthi Wildlife Sanctuary (HWS) in Myanmar. These parks lie within the country's once-extensive elephant range.

Project staff monitored elephant populations throughout the two areas, conducted attitude surveys of 69 villages in the surrounding areas, and assessed community needs. Radio-tracking of a female elephant, collared with a satellite-GPS transmitter, generated information on habitat use in AKNP over an 18-month period. Its main goal is to re-establish viable populations of wild elephants at AKNP and HWS and make AKNP and HWS models for managing wild elephants in Myanmar and other range countries in South-East Asia.

Results from the elephant surveys indicate populations are declining, and are highly vulnerable to local extinction. The primary threats to elephants are organized poaching for ivory and meat and live capture for domestic use. Secondary threats to elephants are indirect and include disturbance and modifications to habitat. These threats result from extraction of forest products, road development, mining, and activities such as poison fishing, which is also often carried out by non-locals for commercial purposes.

Another type is *Thorn* forest, known as *Than-dahat* forest, which dominates the core area of central dry zone. Dominant species are Cutch-sha (*Acacia catechu*), Tanaung (*A. leucophloea*), Zi (*Zizyphus jujuba*), Than (*Terminalia oliveri*) and Dahat (*Tectona hamiltoniana*). Minzontaung Wildlife Sanctuary is a well rehabilitated area of such characteristics. This Sanctuary supports several species endemic to Myanmar, including White-throated Babbler and Hooded Treepie. Most significantly, this site supports a significant population of Burmese Star Tortoise (*Geochelone platynota*) which is listed as critically endangered.

1.5.2. Trend

Since the dry land ecosystems can be found in the central dry zone of Myanmar, the Ministry of Forestry formed the Dry Zone Greening Department (DZGD) in July 1997 with the objective of greening the Central Dry Zone. In the past, the Agricultural and Rural Development Corporation (ARDC) with the seconded personnel of the Forest Department was entrusted with reforestation and afforestation of the whole of the Dry Zone in 1953-54. Thereafter, since 1st October 1963, the Forest Department took over the responsibility of reforestation works. In 1994, Special Region Nine District Greening Project for the area in the Dry Zone of Central Myanmar was adopted in order to be more successful and effective in implementation greening activities. In 1997, the Dry Zone Greening Department was formed to conduct more intensive implementation of greening activities in the Dry Zone areas of the Central Myanmar. The main activities implementing by this Department include;

- Establishment of forest plantations for arresting the desert-like formation and local supply,
- Protection and rehabilitation of remaining natural forests,
- Introduction and promotion of the utilization of wood fuel substitute, and
- Management and development of water resources.

To implement these four main tasks, a comprehensive 30-year master plan was laid down which was divided into six phases each lasting five years. Beside these main tasks, the Dry Zone Greening Department is undertaking special programmes such as greening of Shwe Bon Taung, located in Chauk Township of Magway Division, and Bago Yoma Greening Project. In case of International Cooperation, the Dry Zone Greening Department has been conducting the Project for afforestation in the Dry Zone of central Myanmar with the financial assistance from Japan (JICA).

Table 12. Location and area extent of Dry Zone

Sr. No.	Division	Number of Districts	Number of Townships	Area (ha)
1	Sagaing	3	17	2,142,582
2	Mandalay	5	16	2,380,014
3	Magway	5	24	4,201,587
	Total	**13**	**57**	**8,724,183**

Source: Dry Zone Greening Department, 2008

Table 13. Land use status in Dry Zone

Sr.No.	Category	Area(ha)	% of Total Land
1	Closed Forest	1,720,192	19.70
2	Degraded Forest	734,861	8.40
3	Forest affected by shifting cultivation	1,134,834	13.00
4	Agriculture	4,841,114	55.50
5	Water	122,289	1.40
6	Others	170,892	2.00
	Total	**8,724,183**	**100.00**

Source: Dry Zone Greening Department, 2008

1.5.3 Threats

Due to severe climatic conditions, extreme high temperature and very scarce rainfall, managing the Dry Zone ecosystem is a challenging task. With the development of trades and cottage industry growing with the steady increase in population, the demand for forest products is markedly increasing, particularly firewood. Over-utilization of forest products lead to deterioration of the dry forests. Accordingly, the impacts on the environment like soil deterioration, reducing water retention capacity of soils, loss of biodiversity and climate change are of additional problems.

1.6. Agriculture Biodiversity

The agriculture sector that includes agriculture, livestock and fishery sub-sectors is considered as the most important sector in the country. This sub-section outlines the agriculture and livestock sectors.

1.6.1. Agriculture

1.6.1.1. Status

The economy of Myanmar is largely based on the agriculture sector with 37 % of its GDP and 13.3% of its total export earnings, employing 61.2% of the total labor force. With 18 million ha of total arable land and 57.5 millions of people with 1.75 % population growth, the agriculture sector will play a very significant role in the future. The country's population to be fed by 2010 is projected at 60 millions. Therefore, its first and foremost objective is to develop and promote other economic sectors based on agriculture. For the development of agriculture sector, increasing productivity and improvement of product quality are two principal objectives. In order to meet these principal objectives, three strategies are being laid out as:

- expansion of respective crop growing areas,
- increasing respective cropping intensity, and
- increasing respective crop yield per unit of land area.

The major approaches to superimpose the three strategies are

- development of crop varieties with improved adaptability to newly claimed land
- varieties with shorter duration and resource use efficiency for multiple cropping systems,
- varieties with good quality and higher yield potential, combining with resistance to biotic and abiotic stresses in a respective growing environment, and
- improved cultural practices for each ecosystem.

Therefore, an overall approach to meeting two principle objectives is the development of cultural practices and sustainable production system with special emphasis on genetic improvement of respective crop species.

Since Myanmar is the home of many tropical crop species, genetic diversity is immense. However, the rate of adoption of the modern varieties (MV) and technology is never ceased in Myanmar to produce more food to feed its over 57 millions of people in 2008 and beyond. Therefore, further replacement of MV over traditional varieties and landraces is essential and destruction of the habitat of wild species and related genera by rapid urbanization can be expected in very near future. In order to prevent the permanent loss of genetic diversity for many tropical crop species, research activities on plant genetic resources management, conservation and utilization become critical issues for the agriculture sector in Myanmar.

Diverse crop species and unmeasured under-utilized crop species are grown under different agro-ecological zones such as coastal, delta, mountainous and dry areas in Myanmar with the following objectives:

- Rescuing endangered wild related species of crops and crop landraces which are essential for developing new cultivars with desirable traits,
- Characterizing genetic diversity for efficient and sustainable utilization of crop genetic resources,
- Establishing In-situ conservation system, field gene bank, etc., and maintaining and developing existing Ex-situ conservation system, and
- Developing agro-environmental techniques in parallel with certain crop species for increasing productivity in order to reduce poverty.

Some crop species such as rice, mango, banana, etc. are genetically diverse and are grown all over the country, but under-utilized crop species are grown by minor tribes of different ethnic groups for local and traditional uses. Still, wild related species of crops such as species of wild rice and wild *Vigna* occur in natural habitats.

Thus, crop landraces and traditional varieties are grown and maintained as home garden and on-farm conservation. Most multi-crop species and their wild relatives are collected and maintained as *Ex-situ* conservation in Myanmar Seed Bank. 14,328 samples of multi-crops and their wild races have been collected and 9,905 accessions are stored in the Seed Bank. Since cryopreservation is not available in the seed bank, vegetative propagated crop species are also maintained as field gene bank.

1.6.1.2. Plant Genetic Resources (PGR) management in Myanmar

1.6.1.2.1.Background

Myanmar recognizes the value of PGR resources even before modern agriculture technology was introduced. Myanmar literatures, proverbs, and motto mentioned the value of PGR. There are many evidences such as establishment of orchard gardens, collection of vegetables and medicinal plants, especially in Buddhist monastic culture. There is said to be the introduction of citrus germplasm by the Christian missions in the northern Myanmar as early as 1980's.

PGR management in Myanmar is undertaken by the Department of Agricultural Research (DAR), Yezin. PGR collection started long before the seed bank was established: more than 3,000 accessions of local rice varieties were collected and maintained by rice division of DAR, similarly, oil seed, food legume, maize and other cereals, fiber and horticulture crops by respective crop divisions. In-situ conservation of Mango and medicinal plants was initiated in 1980s. However, systematic PGR management began after the establishment of the Seed Bank in 1987 with the grant aid of Japanese International Co-operation Agency (JICA). Technical co-operation between Myanmar and Japan for PGR management was launched in June 1997 with the following objectives.

- To establish the system of PGR management
- To upgrade the knowledge and technologies of PGR management for local scientists
- To exchange PGR and information

The overall objective of the Seed Bank is to improve sustainable agriculture production and productivity through better use of plant genetic resources in Myanmar. PGR management system of Myanmar adopted the following activities:

Sr. No.	Activities
1	Exploration
2	Collection
3	Multiplication
4	Evaluation
5	Classification
6	Rejuvenation
7	Characterization
8	Conservation
9	Data Management
10	Utilization

1.6.1.2.2. Organizational set-up

PGR management activities undertaken by the Seed Bank were originally composed of the following sections.

- Exploration and Collection Section
- Multiplication, Evaluation, and Characterization Section
- Conservation Section
- Data Management Section

However, for better use of plant genetic resources and to assist breeding programs of all major crops, pre-breeding activities are thought to be necessary. Therefore, pre-breeding unit is

currently initiated to conduct preliminary evaluation of available germplasm pool for all the economically and agronomically important characters and germplasm enhancement for major crops in collaboration with respective crop division.

1.6.1.2.3. Manpower of the seed bank

Currently, research activities of the Seed Bank are implemented by 29 staff members. In order to promote PGR management and research activities at national level, number of staff members with suitable qualification need to be increased. Therefore, training for PGR management at national and international level (degree or non-degree training) is essential at present and in future.

Activities	*Manpower*
Exploration and collection	3
Multiplication, characterization, evaluation and pre-breeding	12
Conservation	5
Data management	2
Administrative matters	7
Total	**29**

Source: Department of Agricultural Research (DAR)

1.6.1.2.4. PGR Conservation Priorities

The seed bank conserves crop species in line with national economic policies. Prioritizations are as follows:

Sr. No.	Priorities
1	Rice
2	Oil seed crops
3	Food legumes
4	Crop species at immediate danger of extinction
5	Wild and weedy relatives of important crop species

Source: Department of Agricultural Research (DAR)

1.6.1.2.5. Exploration, collection, and introduction activities

From 1998-2002, during technical co-operation between Myanmar and Japan 22 missions have been completed and total of 2,434 accessions have been collected. At present, a total of 14,328 accessions have been collected.

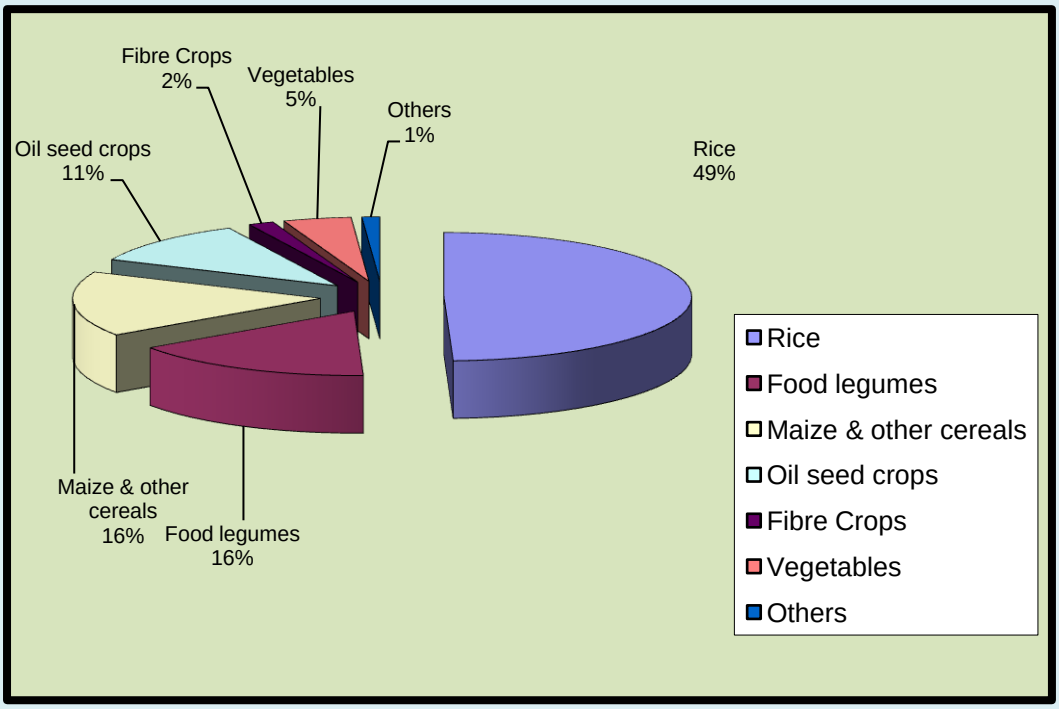
Table 14. Exploration and collection missions conducted from 1998 to 2002

Year	No. of mission	No. of State/Divisions visited	No. of accessions collected
1998 – 1999	4	7	182
1999 – 2000	7	7	628
2000 – 2001	7	5	597
2001 - 2002	8	12	1,027
	22		**2,434**

Source: Department of Agricultural Research (DAR)

1.6.1.2.6. Multiplication, characterization, and evaluation activities (MCE)

During technical co-operation, original crop descriptors were revised to design for efficient characterization with Myanmar technical standard. A total of 23 crop descriptors have been prepared for characterization. Preparation of descriptors for other crop species is also underway. Multiplication section undertakes rejuvenation, preliminary seed increase, observation, characterization, and evaluation for morphological characters. However, evaluation for specific traits such as biotic and abiotic stresses will be carried out separately by newly recruited pre-breeding section. All MCE activities are carried out in DAR and its satellite farms. From 1997 to 2008, total of 13,044 PGR accessions have been multiplied, characterized and evaluated.



Source: DAR

Figure 6. Exploration and Collection Accessions from 1990 to 2008

During the technical co-operation with JICA, the Seed Bank introduced bio-chemical characterization and evaluation such as analysis of rice seed storage protein by Sodium Dodicyl Sulphate Polyacrylemide Gel Electrophoresis (SDS-PAGE) method, determination of rice grain Amylose content, Iodine test, and Alkali test. To date, 4,135 accessions have been evaluated for various bio-chemical characters.

Table 15. No. of rice germplasm evaluated for bio-chemical traits

Biochemical test	No. of accession
SDS-PAGE	635
Amylose content	500
Iodine	1,000
Phenol test	1,000
Alkali test	1,000
Total	4,135

Source: DAR

Table 16. No. of crop accession evaluated for biotic and abiotic stresses

Crop	Biotic and Abiotic Stress	No. of Accession
Rice	Bacterial blight resistance	652
Rice	BPH	580
Rice	Desiccation tolerance	106
Rice	Photo insensitivity	1,045
Green gram	High input vs. low input	160
Black gram	Photo insensitivity	99

Source: DAR

1.6.1.2.7. Conservation

The objective of conservation section is to preserve PGR safely without losing their viability, genetic integrity and original spectrum of variability. There are two types of preservation methods in the seed bank, namely short-term and medium-term. For short term preservation, active collections are stored in polyethylene bottles at 5-10°C with 30 to 40% RH and the storage capacity of 21,600 accessions whereas for medium-term, base collections are stored at -5°C with 30 to 40% RH in aluminum foil with vacuum and the storage capacity of 20,000 accessions. All the routine activities for cold storage are maintained. To date 10,066 accessions are preserved in short-term storage and 9,863 accessions are preserved in medium-term storage. Of all PGR under cold storage in the seed bank, rice shares 62.35% of total crop germplasm accessions.

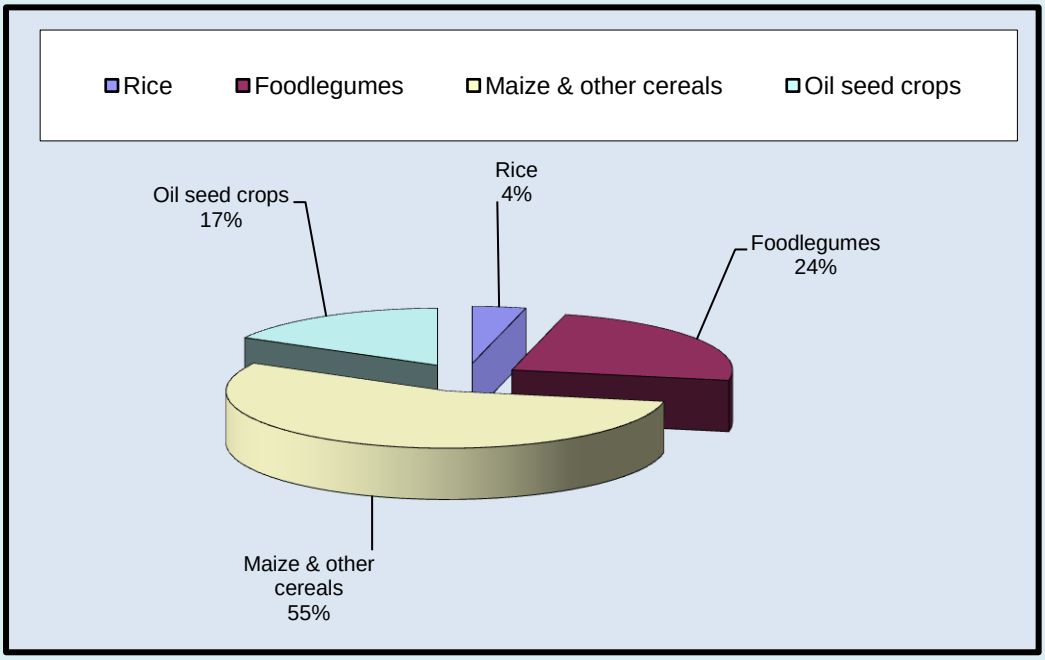


Figure 7: Germplasm accessions in active collection *Source: DAR*

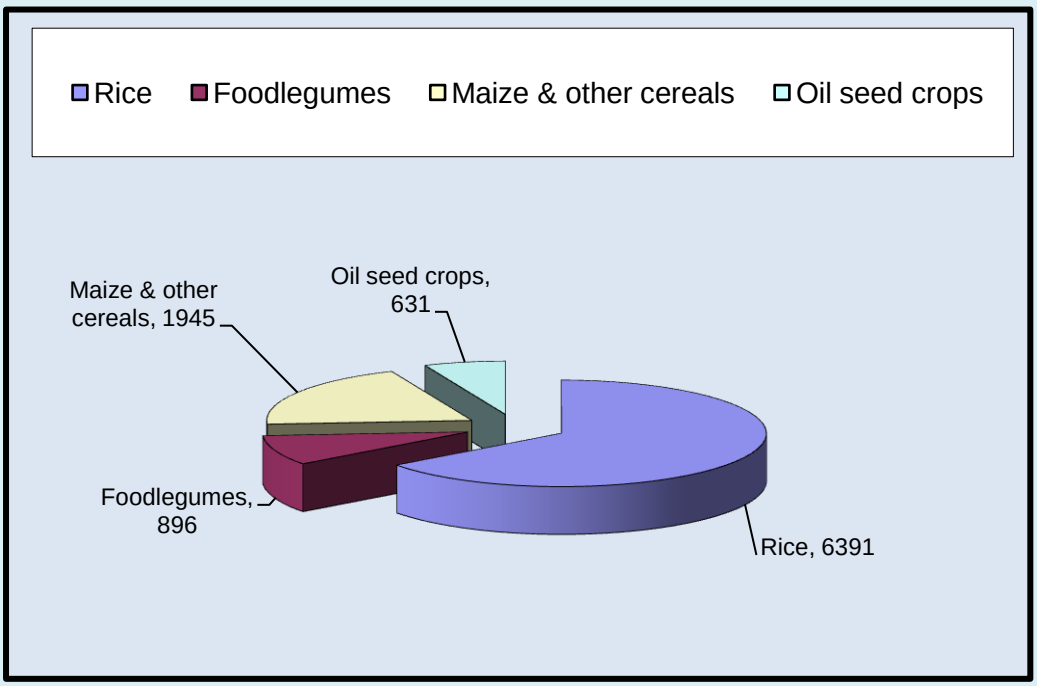
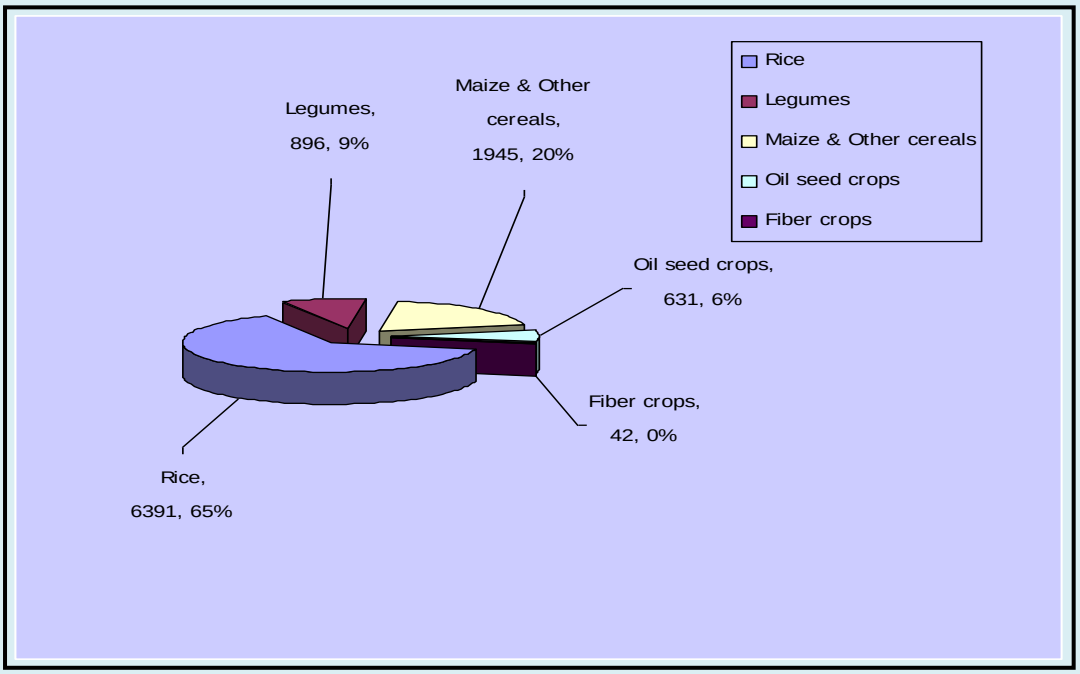


Figure 8: Germplasm accession in base collection *Source: DAR*

1.6.1.2.8. Germplasm distribution

Crop germplasm conserved in the seed bank of DAR are supplied upon request. Seed supply for other government agencies within Myanmar is done after filling the official request form. For international request, seeds are supplied with Standard Material Transfer Agreement (SMTA). So far, 1,505 crop germplasm accessions have been distributed within Myanmar and 6,733 crop germplasm accessions have been supplied to IRRI, NIAS (JAPAN), Kyushuu University of Japan, and ICRISAT. More international germplasm exchange may be expected to broaden genetic diversity of crop species and for friendship among the partner countries.



Source: DAR

Figure 9. Current status of Germplasm under medium-term storage in Myanmar seed bank

1.6.1.2.9. Documentation and data management

During TCP with JICA, data management forms and formats have been unified. Database construction has also been completed. Catalogues 2001 of Germplasm Accessions have been published during the project period. At present, Catalogue on Rice Germplasm Accessions is prioritized for publication.

1.6.1.2.10. Pre-breeding activities

During technical co-operation (TC) with JICA, only four sections are originally composed: Exploration and Collection, Multiplication, Characterization and Evaluation (MCE), Conservation, and Data Management. However, for better use of PGR and linking the crop breeding program of the DAR, pre-breeding activities should be proposed. Pre-breeding activities of the Seed Bank are to be on;

- critical evaluation of crop germplasm for specific traits such as Bacterial Blight (BB), resistance Brown Plant Hopper (BPH) resistance, grain quality, drought resistance, photo-insensitivity, input responsiveness and efficiency, and novel plant types,
- development and supply of diverse crop germplasm for long term breeding goals of crop breeding programs of the DAR, and
- establishment of National Network for Germplasm Evaluation. All the pre-breeding activities are being carried out in collaboration with respective crop divisions of DAR.

At present, a total of 36 segregating populations is under evaluation for BB resistance. Since Myanmar has been the center of diversity for rice, causal organism of BB: *Xanthomonas oryzae* (Xo) may also have great diversity. Hence, to access the durable resistance among rice germplasm, Xo strain collection is being carried out in collaboration with National Institute of Agro-biological Sciences (NIAS), Japan and Plant Pathology Division, DAR. In addition,

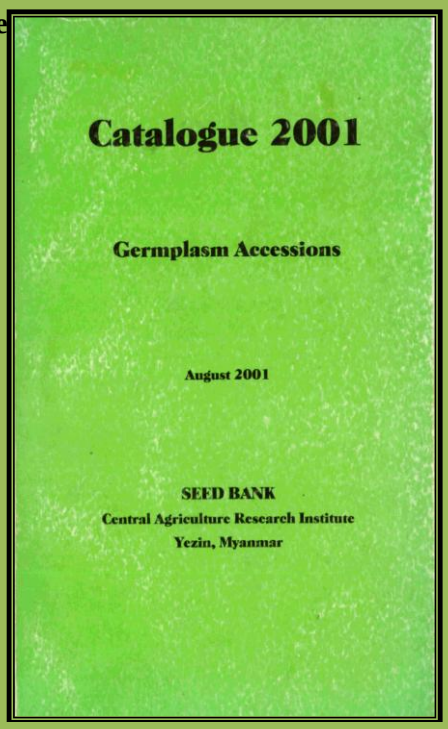
methods of screening for drought resistance, desiccation tolerance, and anaerobic germination of rice are under development. Similarly, green gram and black gram germplasm are being evaluated for multiple stress responses.

Box 9 : Catalogue 2001 of Germplasm Accessions

A total of 7,558 accessions of 21 different crops and wild relatives were conserved in Department of Agricultural Research (DAR), Seed Bank (7,466 as active collection and 7,360 as base collection) at the end of August.

Summary of germplasm accessions under the storage

Plant	Accessions
***Arachis hypogaea* L.**	326
***Cajanus cajan* (L.) Millsp.**	4
***Cicer arietinum* L.**	321
***Glycine max* (L.) Merrill.**	2
***Guizotia abyssinica* (L.f.) Cass.**	1
***Helianthus annuus* L.**	1
***Oryza latifolia* Desv.**	1
***Oryza nivara* Sharma et Shastry**	18
***Oryza officinalis* Wall. ex Presl**	22
***Oryza rufipogon* Griff.**	28
***Oryza sativa* L.**	4,934
***Oryza spp.* (PHP: Possible hybrid population of wild rice)**	23
***Pennisetum americanum* (L.)**	14
***Phaseolus lunatus* L.**	2
***Sesamum indicum* L.**	5
***Sorghum bicolor (L.)* Moench**	140
***Triticum aestivum* L.**	1,411
***Vigna mungo* (L.) Hepper**	99
***Vigna radiata* (L,) R. Wilczek**	102
***Vigna unguiculata* (L.) Walp.**	72
***Zea mays* L.**	32
Total	**7,558**



One of the main objectives of the seed bank is to ensure their effective utilization in breeding programs so as to contribute to agricultural development in Myanmar. These germplasm accessions conserved in the storage must be useful for researchers, workers, and the persons concerned in present and future crop improvement program in Myanmar. Therefore, we publish "Catalogue 2001 Germplasm Accessions".

These germplasm accessions can be distributed to domestic users with by request. Seed Bank is also willing to exchange germplasm accessions with foreign and international institutions under the mutual understanding based on the spirit of Convention of Biological Diversity.

1.6.1.3. Trends

Genetic of crop species in Myanmar is eroding due mainly to the introduction of improved varieties including exotic ones in the place of local varieties. Deforestation, population pressure, urbanization, etc., also lead to lessen genetic diversities of crops and their wild relatives.

Before the seed bank was established, the crop species were conserved by growing in the field every year, which costs a lot of resources including time and land area. Moreover, the loss of varieties occurred as a result of weather, diseases, hybridization, etc. After establishment of the seed bank, the seeds of crop species can be conserved without growing in the field annually, but their viability is limited to some years. With cryopreservation, the seeds can be conserved and stored without limited time.

1.6.1.4. Threats

Crop landraces and/or local varieties are endangered due to the replacement of high-yielding varieties of field crops, hybrid seeds of vegetable crops and market value of fruit trees. Wild relatives of rice and other wild species are also threatened by urbanization, deforestation and growing population pressure. Socio-economic issues and unsustainable agricultural practices are threats to agriculture biodiversity.

1.6.2. Livestock

1.6.2.1. Status

The current status regarding the use and development of breeds, varieties of farm animals, and summary of the history of farm animal diversity in Myanmar are given in this sub-section. Since 1949, the Government has been making efforts to promote livestock sector. At present, under the auspicious of the Ministry of Livestock and Fisheries, research and development programs relating to livestock and poultry farming, development of draught and dairy program, artificial insemination(AI), cross breeding program and animal husbandry and veterinary services have been undertaken by the respective departments and institutions in collaboration with the international organizations.

Table 17. Livestock population (2006-07)

Livestock	Population (Million)
Cattle	12.63
Buffaloes	2.84
Sheep/goat	2.85
Pig	6.95
Chicken	10.14
Duck	10.10
Turkey and Geese	1.09
Quail	0.30

Source: Livestock Breeding and Veterinary Department

Table 18. Other livestock species

Year	Livestock	Population	Remark
1981-82	Elephant	11,985	Wild and Captives
2004-05	Mythun	34,218	
1993-94	Horses	120,164	
1993-94	Donkey	978	
1993-94	Mule	8,637	

Source: Livestock Breeding and Veterinary Department

1.6.2.2. Trends

Due to growing human population, urbanization and industrialization demand for meat, egg and milk has been increasing. Also owing to the market-oriented economy, border trade of livestock has become greater than ever before. With the remarkable contribution of the private sector livestock population for the period between 1990 and 2005 shows up-ward trend as shown in Table 19.

Table 19. Livestock product in Myanmar (Number in Thousands)

Sr. No.	Particular	Unit	1990-91	2000-2001	2005-2006
1	**Meat**				
	(1)Beef	Metric Ton	47.16	72.25	76.49
	(2)Mutton	Metric Ton	6.65	11.67	12.69
	(3)Park	Metric Ton	38.53	123.49	194.21
	(4)Fowl meat	Metric Ton	67.81	21.44	323.92
	(5)Duck Meat	Metric Ton	10.73	29.41	36.51
	(6)Turkey,Gees,Muskovy Duck and Barrock	Metric Ton	1.48	2.21	2.48
2	**Eggs**				
	(1)Fowl egg	Number	727.75	249.97	379.66
	(2)Duck egg	Number	97.37	343.71	421.94
3	**Milk**	Metric Ton	518.54	542.02	577.13

Source: Livestock Breeding and Veterinary Department

Table 20. Breeds of domestic animals

Sr. No	Species	Name of species	Local Name	State and Division
1	Cattle	*Bos indicus*	Pya Sein, Shwe Ni, Shan Nwa, Katonwa, Kyauk Phyu	Mandalay, Magwe, Sagaing,Shan, Kayin, Rakhine
2	Mythun	*Bos frontalis*	Nwa Nauk	Chin
3	Buffalo	*Bubals bubals*	Myanmar Kywe, Shan Kywe	Ayeyarwaddy, Sagaing, Shan
4	Horse	*Equus caballus*	Myanmar Myin, Shan Myin	Magwe, Mandalay, Sagaing, Shan
5	Ass	*Equus asinus*	Myanmar Mye	Shan
6	Pig	*Sus domesticus*	Bo cake, Chin wet, Badoung, Akhar, Wet taung	Magwe, Mandalay, Sagaing, Shan
7	Sheep	*Ovis aries*	Myanmar Thoe, Karla Thoe	Magwe, Mandalay, Sagaing

8	Goat	*Capra hircus*	Seik Ni / Jade Ni,/ Nyaung Oo/Htain San / Hkway Seik	Magwe, 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 Muskovy	*Cairina Maschata*	Mandarli	Wide spread
13	Goose	*Anser cygnoides*	Ngan	Wide spread
14	Quail	*Coturnix spp*	Ngown	Wide spread

Source: Livestock Breeding and Veterinary Department

Table 21. List of imported exotic breed (Cattle)

Sr. No	Name of Breed	Imported Year	Country	Remark
1	Red Sindhi	1958	Pakistan	
2	Tarry	1958	Pakistan	
3	Friesian 67 Jersey 62 Pregnant Heifer 129 heads	1978, June	New Zealand	World bank Loan
4	Friesian 75 Pregnant Heifer 2 young Bulls	1978	Australia	UNDP

Source: Livestock, Feedstuff and Milk products Enterprise

Table 22. List of imported exotic breed (Pig)

Sr. No	Name of Breed	Imported Year	Country	Remark
1	Large Black (Bo cake)	British colonial time	USA	
2	Yorkshire (LW) Landrace Berkshire (180 gilt + 20 Boar) (Pyinmabin Pig Farm)	1978, July	Australia	World Bank Loan
3	Yorkshire (Improved L.W) (Grng Grong) 9 70 gilt = pyinmabin Pig Farm)	1978, August	Australia	UNDCP
4	Duroc , Yorkshire Landdrace, Berkshire 35o heads of pigs	1975	Japan	JICA project
5	Yorkshire (89 heads) Daik- Oo, Bago Division	1985	Australia	Food Industry Coperation (FIC)
6	Yorkshire and Landrace 14 Bores + 6 Boars 20 young Boar	1995 Feb:	Australia	
7	Yorkshire + Duroc + Landrace Gp 3 boars + 15 gilt (Pyinmabin Farm) CP Company has improved	1999 D.Y.L Breed	thailand	

Source: Livestock, Feedstuff and Milk products Enterprise

Table 23. List of imported exotic breed (Poultry)

Sr. No	Year	Name of Breed	Stock	Country
		I. Chicken		
1	1980-81	Sunny	Layer Grand Parent Stock	Israel
2	"	Hubbard Golden Comet (pullet)	Layer Grand Parent Stock	Belgium
3	"	Star Cross 288	Layer Parent Stock	Canada
4	"	Star Cross 566	Layer Grand Parent Stock	Canada
5	"	Arbor Acres	Broiler Grand Parent Stock	USA
6	"	Hubbard	Broiler Grand Parent Stock	Belgium
7	"	Starbro	Broiler Grand Parent Stock	Canada
8	1981-82	Star Cross 288	Layer Grand Parent Stock	Canada
9	"	Star Cross 566	Layer Grand Parent Stock	Canada
10	"	Arbor Acres	Broiler Grand Parent Stock	USA
11	1982-83	Sunny	Layer Grand Parent Stock	Israel
12	"	Star Cross 566	Layer Grand Parent Stock	Canada
13	"	Hubbard	Broiler Grand Parent Stock	Belgium
14	1983-84	Nera Sex Link	Layer Grand Parent Stock	USA
15	1983-84	Arbor Acres	Broiler Grand Parent Stock	USA
16	1984-85	Black Beauty	Layer Grand Parent Stock	USA
17	"	Cornish Gane Bird	Broiler Parent Stock	Canada
18	1988-89	Starbro	Broiler Grand Parent Stock	Canada
19	"	White Plymouth Rock	True Line	Canada
20	"	White Cornish	True Line	Canada
21	"	Rhode Island Red (RIR)	True Line	Canada
22	"	Barred Plymouth Rock	True Line	Canada
23	1992-93	Tegel Brown	Broiler Parent Stock	Australia
24	1993-94	Tegel Brown	Broiler Parent Stock	Australia
25	"	Tegel Brown	Layer Parent Stock	Australia
		II. Duck		
1	1990-91 & 1991-92	Cherry Valley	Broiler Parent Stock	UK

Source: Livestock, Feedstuff and Milk products Enterprise

Table 24. Livestock population trend in Myanmar

(1990-2005, in millions)

Year	Buffalo	Cattle	Sheep and Goat	Pig	Fowl	Duck
1990-91	2.1	9.3	1.3	2.2	2.4	3.2
1991-92	2.1	9.4	1.4	2.4	23.4	3.6
1992-93	2.1	9.5	1.5	2.5	24.7	4.4
1993-94	2.1	9.6	1.4	2.5	25.2	4.2
1994.95	2.1	9.7	1.4	2.6	25.4	4.2
1995-95	2.2	9.9	1.5	2.9	28.0	5.0
1996-97	2.3	10.1	1.5	3.2	31.3	5.4

1997-98	2.3	10.3	1.6	3.3	33.0	5.6
1998-99	2.3	10.4	1.6	3.5	36.1	5.8
1999-2000	2.3	10.7	1.7	3.7	39.5	6.1
2000-2001	2.4	10.9	1.8	3.9	43.5	6.4
2001-2002	2.5	11.2	1.8	4.1	48.2	6.8
2002-2003	2.6	11.6	2.0	4.5	57.1	7.2
2003-2004	2.6	11.7	2.1	4.8	63.0	7.6
2004-2005	2.6	11.9	3.0	5.2	71.3	8.3
2005-2006	2.7	12.1	2.3	5.6	81.5	9.1

Source: Livestock Breeding and Veterinary Department

1.6.2.3. Threats

Epidemic diseases (e.g bird flu), various disasters (e.g droughts, floods, etc.,), reduction of pasture land, increased cropping land, urbanization and industrialization are threats to the livestock genetic diversity.

1.7. Inland water biodiversity

1.7.1. Status

Myanmar is rich with diverse inland water ecosystems from creeks, streams to rivers that provide numerous aquatic lives. Fauna of fresh water fish, waterfowl of residence and migratory and aquatic plants are associated with inland water biodiversity. Inland water biodiversity is a vital resource to the people in the country for their agriculture, protein need, food, transport as well as cultural and spiritual integrity. Although the Ministry of Forestry has been the focal in the conservation and management of inland water biodiversity, such allied Ministries of Agriculture and Irrigation, Home Affairs, Transport and Electrical Power (2) as well as stakeholders of NGOs and local communities contribute synergies and collaboration in the conservation of this biodiversity.

Table 25. Wetland regions in Myanmar

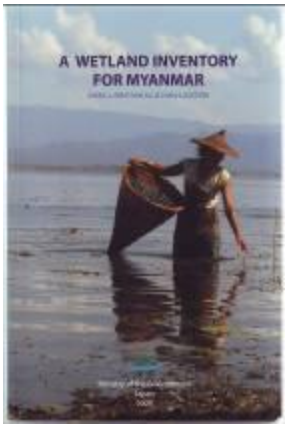
Sr. No.	Wetland Region	No. of Wetland Sites
1	Ayeyarwaddy/ Chindwin River Basin	85
2	Thanlwin (Salween) River Basin	6
3	Sittaung River Basin	5
4	Mekong River Basin	-
5	Rakhine Coastal Region	3
6	Thaninthayi Coastal Region	-
	Total	99

Source; Wetland Inventory, 2004

Myanmar is also endowed with the freshwater fish diversity in the river, lake and stream and natural water systems. There are over 350 fresh water fish species recorded in the previous survey and checklist of the DOF. The abundance of the riverine system is varied depending on the

season. The most abundant order of the species are Osteoglossiformes, Clupeiformes, Cypriniformes, Siluriformes Perciformes and Tetraodontiformes.

Box 10 : A wetland inventory for Myanmar



Three wetland surveys were conducted by the Forest Department and Wild Bird Society of Japan from 2001 to 2003 in the central Dry Zone along the Ayeyarwaddy River, in Shan State in the east and Kachin State in the north. About 100 wetland sites were surveyed and documented.

Inle Wetland Site

Table 26. Globally threatened wetland bird species in Myanmar

Sr.No.	Common name	Scientific name	IUCN Category	Resident/ Migratory
1	Pink-headed Duck	*Rhodonessa caryophyllacea*	CR	Resident
2	White-shouldered Ibis	*Pseudibis davisoni*	CR	Resident
3	White-bellied Heron	*Ardea insignis*	EN	Resident
4	White-winged Duck	*Cairina scutulata*	EN	Resident
5	Great Adjutant	*Leptoptilos dubius*	EN	Resident
6	Spotted Greenshank	*Tringa guttifer*	EN	Migrant
7	Spoon-billed sandpiper	*Eurynorhynchus pygmaeus*	EN	Migrant
8	Spot-billed Pelican	*Pelecanus philippensis*	VU	Resident
9	Lesser Adjutant	*Leptoptilos javanicus*	VU	Resident
10	Baikal Teal	*Anas formosa*	VU	Migrant
11	Bear's Pochard	*Aythya baeri*	VU	Migrant
12	Greater Spotted Eagle	*Aquila clanga*	VU	Migrant
13	Sarus Crane	*Grus antigone*	VU	Resident
14	Masked Finfoot	*Heliopais personata*	VU	Resident
15	Wood Snipe	*Gallinago nemoricola*	VU	Migrant
16	Indian Skimmer	*Rhychops alhicollis*	VU	Resident

Source: Wetland Inventory, 2004

1.7.2. Trend

Decline of inland water biodiversity is common due to increased demand on fresh water resources as well as drainage of wetland for agriculture and urbanization. Forest degradation, soil erosion, increased navigation, illegal fishing and water pollution are primary causes for decline of inland water biodiversity.

Box 11: Conserving freshwater and coastal cetaceans in Myanmar

Brian Smith, Wildlife Conservation Society

Irrawaddy Dolphins *Orcaella brevirostris* in the Ayeyarwady River are in immediate danger of extinction. This freshwater dolphin population is isolated from the nearest other members of the species in the Bay of Bengal by more than 1,000 km of river length, and was recently classified as Critically Endangered, according to IUCN criteria. Surveys conducted by the Wildlife Conservation Society (WCS) and Department of Fisheries between 2002 and 2004 revealed that the total population numbers 59 to 72 individuals, and that its downstream range has declined by almost 60%. Documented threats include incidental killing in gillnets and during illegal electric fishing operations, and excessive sedimentation and mercury and noise pollution caused by large gold mining dredges and shoreline blasting operations.

In many areas of the world, dolphins are viewed as competitors to humans. However, Irrawaddy Dolphins in the Ayeyarwady River are revered by local people, and they provide direct economic benefits via their role in a cooperative fishery with cast-net fishermen. The fishermen summon the dolphins by tapping the sides of their boat with a conical wooden pin called a *labai kway*. If the dolphins "agree" to help the fishermen, one animal slaps the water surface with its tail flukes. One or two lead dolphins then swim in smaller and smaller semi-circles, corralling the fish toward the shore, while the other animals remained outside to guard against escapees. With a wave of their half-submerged flukes, the dolphins then deliver a concentrated mass of fish to the fishermen and "signal" them to cast their net. Using this technique, the fishermen can catch as much fish in a single net cast as they normally do during a whole day of fishing without the dolphins. The dolphins benefit from the activity by preying on fish whose movements are confused by the sinking net and those that are momentarily stuck on the mud bottom after the net is pulled up. Opportunities to improve the conservation prospects of dolphins in the Ayeyarwady River are excellent due the important role these animals play in the culture and economy of local people.

Initial efforts have also been made by WCS and Department of Fisheries to assess marine populations of cetaceans in Myanmar. From 23 February to 6 March 2005, the two organizations conducted a vessel-based line-transect survey for cetaceans along almost 1,100km of track line in the coastal waters of the Mergui (Meik) Archipelago. A total of 34 sightings were made of seven species: Indo-Pacific Bottlenose Dolphin *Tursiops aduncus*; Indo-Pacific Humpback Dolphin *Sousa chinensis*; Dwarf Spinner Dolphin *Stenella longirostris roseiventris*; Pantropical Spotted Dolphin *S. attenuata*; Finless Porpoise *Neophocaena phocaenoides*;Irrawaddy Dolphin; and Bryde's Whale (small form) *Balaenoptera edeni*. These preliminary results indicate that the Mergui Archipelago supports relatively high cetacean diversity and abundance in the region. Sighting rates were much higher than those reported for coastal waters of the Andaman Sea in Thailand. Current efforts include investigating incidental catches in gillnet fisheries and incorporating cetaceans as an integral component of conservation planning for the archipelago.

Source: Myanmar - Investment Opportunities in Biodiversity, 2005

Box 12: Water birds survey in the Hukaung Valley, northern Myanmar

During December 2005 and January 2006, the Forest Department conducted water birds survey together with the WCS (Myanmar Program) in the Hukaung Valley. It is a very important site for water birds in Myanmar. The Forest Department has notified an area of 6,371 km^2 in the valley as the Hukaung Valley Wildlife Sanctuary in 2004 and proposed the extended area of 15,431 km^2 to be a world largest tiger conservation area. The most important water birds species identified in this valley are as follows:

Sr. No.	Water birds	Status
1	White-bellied Heron (*Ardea insignis*)	Globally Endangered occurs only in the northern Myanmar and north-east India, world population estimate is 250-1000 birds only.
2	White-winged Wood Duck (*Cairina scutulata*)	Globally Endangered
3	Lesser Fish-eagle (*Ichthyophaga humilis*)	Globally Near-Threatened, very rare bird in South-East Asia
4	Green Peafowl (*Pavo muticus*)	Globally Vulnerable, nearly extinct in Laos, Vietnam, China, Thailand and good numbers remain only in parts of Cambodia, Java and Myanmar
5	Black-necked Stork (*Ephippiorhynchus asiaticus*)	Globally Near-Threatened, very rare bird in South-East Asia, now extinct in Thailand and Malaysia, with only 2-6 birds remaining in Laos and Vietnam, perhaps a few dozen in Cambodia, healthy population in Myanmar
6	Great Thick-knee (*Esacus recurvirostris*)	Not listed as globally threatened or near threatened because it is believed that good populations remain in much of India,
7	Lesser Adjutant (*Leptoptilos javanicus*)	Globally Vulnerable, a large population in the Hukaung Valley of Myanmar
8	Ferruginous Pochard (*Aythya nyroca*)	Globally Near-Threatened,
9	Dater (*Anhinga melanogaster*)	Globally Near-Threatened, large numbers in Myanmar
10	Black Stork (*Ciconia nigra*)	Not listed as Globally Threatened or Near-Threatened, population has declined in East Asian, large numbers in the Hukaung Valley

White-bellied Heron

Black-necked Stock

1.7.3 Threats

According to the surveys, the following threats were identified.

Sr. No.	Threats
1	Introduction of exotic species
2	Over fishing
3	Siltation
4	Desiccation
5	Drainage/reclamation
6	Stalinization
7	Hunting/trapping/poisoning of birds
8	Destructive/illegal fishing
9	Eutrophication
10	Over-harvesting of trees
11	Pollution
12	Panning (gold)
13	Over-harvesting of total eggs
14	Deforestation in catchments
15	Erosion
16	Over-grazing
17	Illegal settlement

Box 13: Estuarine crocodile (*Crocodylus porosus)* conservation

The estuarine crocodile (*Crocodylus porosus)* was formerly abundant in coastal regions of Myanmar, but is now known principally from the lower Ayeyarwaddy Delta. The survey jointly collaborated by the Forest Department and WCS (Myanmar Program) had been conducted during January 1999 to assess quantitatively the status of crocodile populations in protected areas of the lower delta. Spotlight counts were conducted along 275.4 km of waterways. Sixty-one crocodiles (50 juveniles, 4 sub-adults, 2 adults and 5 eye-shines) were observed in the Meinmahla Kyun Wildlife Sanctuary (MKWS), and the total population was estimated to be less than 100. The Kadônkani and Pyindaye Reserved Forests (RF) apparently no longer support viable populations.

Although crocodiles remain critically endangered in the region, a comparison with survey data from 1980 suggests localized recovery is occurring in MKWS. Population declines are attributed to a combination of commercial skin hunting, habitat loss, drowning in fishing nets and over-collection of living animals to supply crocodile farms. A programme of law enforcement, habitat protection and head-starting juveniles is necessary to ensure the continued survival of estuarine crocodiles in the Ayeyarwaddy Delta.

***Crocodylus porosus*, endangered species**

1.8. Coastal and Marine Biodiversity

1.8.1. Status

Myanmar is endowed with rich natural resources including huge lands and freshwater resources and enormous under exploited marine resources, valuable forest resources, and extensive but largely un-surveyed marine resources. The fishery sector plays an important role in contributing to the social and economic status of Myanmar. The fishery resources would act as a critical part in the production of food and improvement of the income generation for the fishing communities.

With a long coastline of nearly 3,000 kilometers, the total swamp area along the coastal is about 0.5 million hectares that perform the essential function of spawning grounds, nursery areas and feeding grounds for the aquatic organism of near shore and brackish water fauna. The continental shelf over spreads 228,751 km^2 and Exclusive Economic Zone-EEZ is 486,000 sq kilometers. According to the survey results of the marine fishery, it was noted about 1.0 million metric ton of pelagic fish and 0.75 million of demersal fish are existing as biomass in Myanmar marine fishery water. Out of total biomass, 0.5 million ton of pelagic fish and 0.55 million ton of demersal fish together 1.05 million metric ton is marked as annual maximum sustainable yield (MSY).

Table 27. List of exported aquarium fish species

Sr.No	Scientific Name	Common Name
1.	*Datnioides microlepis*	Tiger fish
2.	*Danio fergradi*	-
3.	*Danio kerri*	Hikari danio
4.	*Danio kyathit*	Kyathit barb
5.	*Danio choprae*	Glowlight danio
6.	*Danio malabaricus*	-
7.	*Danio pantheri*	New glowlight
8.	*Danio aequipinnatus*	Giant danio
9.	*Danio dangila*	-
10.	*Danio albolineatus*	Pearl danio
11.	*Danio aquapinna*	-
12.	*Danio frankei*	-
13.	*Danio maetaengensis*	-
14.	*Danio nigrofasciatus*	Spotted danio
15.	*Danio shanensis*	Danio rosea
16.	*Danio spp:*	Danio shan
17.	*Botia berdmorei*	Berdmorei loach
18.	*Botia histrionica*	Golden botia
19.	*Botia kubotai*	Angelicus
20.	*Botia rostrata*	Golden botia
21.	*Puntius gelius*	Pigmy barb
22.	*Puntius oligolipis*	Checker barb
23.	*Puntius spp:*	Red-lip barb
24.	*Puntius spp:*	Odessa barb
25.	*Puntius spp:*	Lipstock barb
26.	*Puntius stoliczkanus*	Stoliczka barb
27.	*Puntius puntio*	-

28.	*Parasphaerichthys ocellatus*	Chocolate gourami
29.	*Parasphaerichthys lineatus*	Mini chocolate gourami
30.	*Badis ruber*	Red badis
31.	*Badis pyema*	Selender badis
32.	*Badis corycaeus*	-
33.	*Badis kyar*	Myanmar badio kyar
34.	*Mystus leucophasis*	Upside down catfish
35.	*Channa punctata*	Green snakehead
36.	*Channa harcourtbutteri*	Inlay channa
37.	*Oryzias melastigma*	Rice fish
38.	*Oreichthys cosuatis*	Orange hi-fined barb
39.	*Chaca burmensis*	Myanmar flathead catfish
40	*Dario hysginon*	Badis dario
41	*Mastacembelus zebrinus*	Zebra eel
42	*Mastacembelus armatus*	Spiny eel
43	*Glyptothorax dorsalis*	-
44.	*Hornloptera bilineata*	-
45.	*Gagata cenia*	-
46	*Schistura balteata*	Sumo loach
47.	*Sawbwa resplenden*	Myanmar rummynose
48.	*Microrasbora nana*	Tiny microrasbora
49.	*Akysis parashadi*	Hill stream catfish
50.	*Yunanilus brevis*	-
51.	*Intecypris auropurpureus*	False barilius
52.	*Microrasbora erythromicron*	Emerald dwarf rasbora
53.	*Danionella translucida*	Crystal rasbora
54.	*Brachygobiu xanthozonuss*	Bumble bee goby
55.	*Esomus caudiocelatus*	Flying barb
56.	*Microrasbora rubescens*	Pink microrasbora
57.	*Barilius bakeri*	Blue dotter hill trout
58.	*Brachydanio nigrofasciatus*	Spotted danio
59.	*Parambasis lala*	Glass fish
60.	*Tetrodon cutcutia*	Puffer
61.	*Garra flavatra*	Rainbow garra
62.	*Acanthocobitis urophthalmus*	Loach
63.	*Bastasio blythil*	Catfish
64.	*Amblyceps mangois*	Olary
65.	*Brachygobius xanthozonus*	Ba Bee
66.	*Erethistes hara*	Mini cat
67.	*Inlecypris auropurpureus*	-
68.	*Microrasbora erythromicron*	Ehthovent danul rasbora
69.	*Parambasis pelucinala*	-
70.	*Trichopsis vittata*	Chpoen gourami
71.	*Nandus marmoratus*	Non dus

Source: DOF

1.8.1.1. Species diversity

There are over 800 marine fish species diversity in Myanmar water recorded in 1979-80 with the research vessel "Dr. Fridtjof Nenson" that conducted survey in Myanmar waters. As a result, of 1 million metric ton of pelagic fishes and 0.8 million metric ton of demersal fishes were existing as biomass in Myanmar water. The diversity of species of mostly common family is listed in the Table 28.

Table 28. List of mostly common family of fish species in Myanmar

Sr. No.	Family	Common name
1	Arridae	sea catfishes
2	Carrangidae	caranx, trevally, sead
3	Clupeidae	Hilsa shad, sardine
4	Lutjanidae	snapper
5	Mullidae	goat fishes
6	Muraensociadae	pike conger
7	Nemipteridae	threadfin breams
8	Polynemidae	Indian threadfin
9	Pomadasyidae	sea grant
10	Sciaenidae	croaker
11	Scomberidae	mackerels
12	Serranidae	groupers
13	Stromatidae	pomfrets
14	Synodontidae	lizard fish
15	Trichiuridae	hairtails

Source; DOF

(i) Sea Grasses

Sea grasses play a lesser known but nonetheless important ecological role. The grasses, which most often grow in relatively shallow waters, from 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. Myanmar has 9 species of sea-grass. Most of these sea-grass species are found in Rakhine and Tanintharyi coastal areas. But sea-grass is totally absent in Ayeyarwaddy Delta and Gulf of Mottama coastal regions due to turbid water by enormous sediment discharge of two big rivers Ayeyarwaddy and Than Lwin.

Threats to sea grass meadows include the use of push nets and trawls for fishing, wastewater discharges from shrimp farms, urban and industrial pollution, and salinity variations caused by irrigation and land clearing.

(ii) Shark

Many shark fisheries in Myanmar are small scale, which utilize wooden boats with engine not more than 25 horse power. Most of the shark landings are coming from incidental catch. In Myanmar, elasmobranches fishing has been banned since 2004.

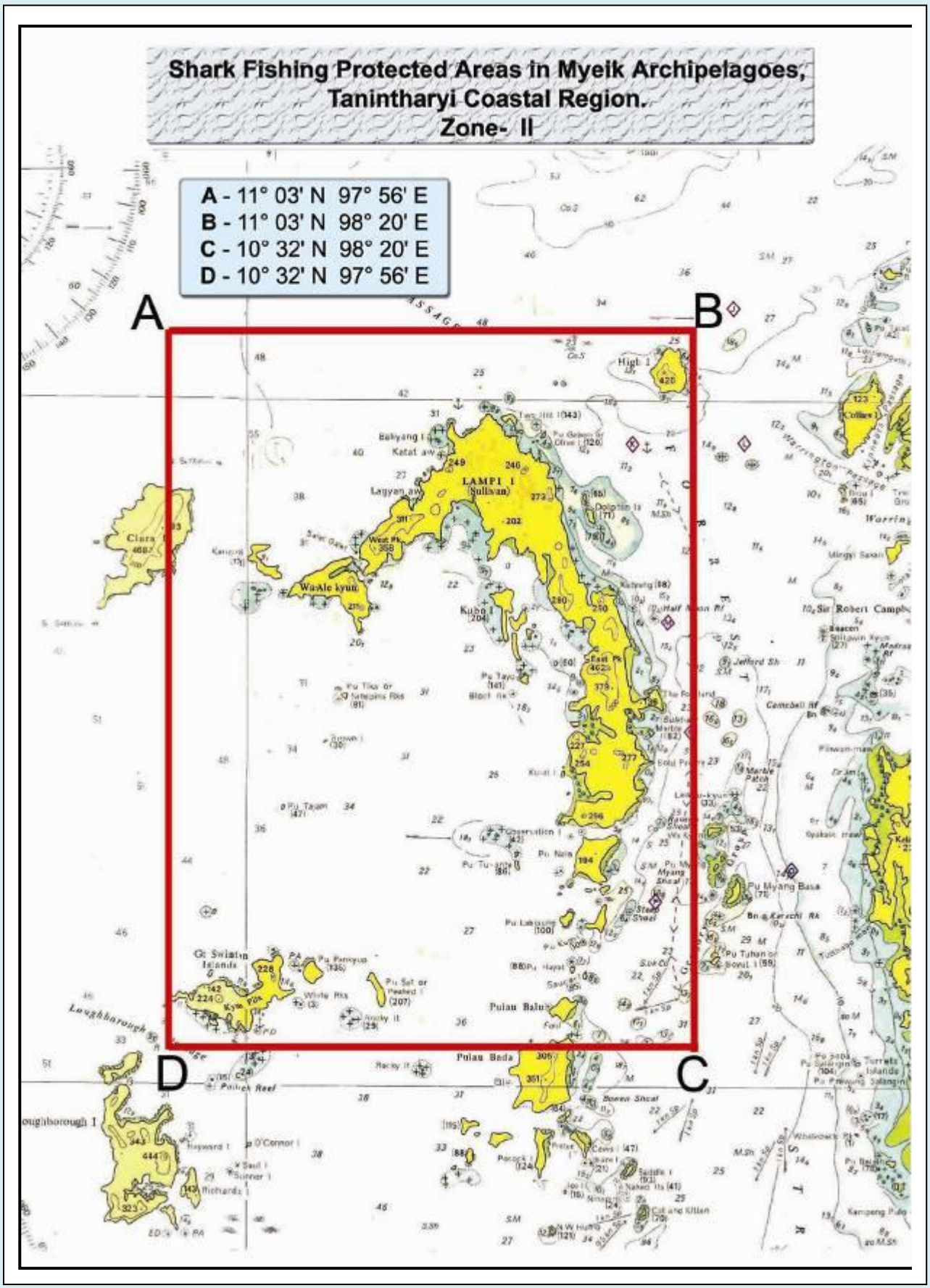


Figure 10. Location map of Lampi marine national park *Source: DOF*

As non-target species, detailed information on shark catch, effort, and fishing grounds are still lacking in Myanmar's Fisheries Yearbook. Such information is a prerequisite for any fishery management decisions.

Sharks are used worldwide for their meat, skins, fins, cartilage, jaws and livers. There is increasing concern that heavy, largely unregulated trade in shark species is contributing to a decline in global shark stocks. Efforts by the IUCN/SSC Shark Specialist Group and relevant national and international authorities to gauge the current level of threat are hindered by a lack of data, including data on trade in shark products, and its effects on individual's species.

In order to study which species of shark are utilized in Myanmar, the quantity harvested, the area being fished, and the methods and gear employed, the special project on shark fisheries has being implemented since January 2004.

(iii) Dugong

The Dugong is listed as vulnerable to extinction in the International Union for the Conservation of Nature, World Conservation Union's Red Data Book of Threatened Species (IUCN 2000). The Dugong is listed on the Convention on the Conservation of Migratory Species of Wild Animal (Bonn Convention) and on Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES).

Dugong populations seem to be abundant with certain population sizes in Myanmar, especially in the Rakhine State. From the southern part Gwa to the north ward in Kyaukpyu, Manaung and its vicinities where there are dense sea grass bed have the reports of existing Dugoung. However, the reports avails were relevant to the death catches incidentally by the fishers' nets. Actually that dugong was less interested as food in the locals but sometimes prefers as peculiar recipes after death caught. According to the reports there were seven death catches of dugong in the Rakhine State during 1994 to 2004. There may be several habitats for the dugong in the southern coastal in Myanmar since the unconfirmed reports from the local have availed frequently. Thus it is needed to extend more conservation in the areas where it has not been touched yet.

The conservation on aquatic wild life has been undertaking by the Department of Fisheries (DOF) as it is the most competent authority in fisheries related activities apart from the rendering of fish food securities, livelihoods and research and development in sustainable manners. Eventhough there are limited experiences and activities in general conservation, the close monitoring and information gathering has been emphasized on the shark, dolphin marine turtles and dugong. There are laws relating to the fisheries activities have the provisions for the conservation of rare and endangered species in the country.

Currently, the most advanced activities undertaking by the DOF is the management and monitoring of Marine Turtles as the collaborated projects with SEAFDEC and IOSEA. Also, the conservation of Ayayarwaddy Dolphin is advancing its program with WCS. However, there are less activities undertaken on the effective conservation on Dugong due to less capacity and for effective field survey.

Table 29. Shark species currently known in Myanmar waters

Family	Scientific name	English name	Myanmar name
1. HEMISCYLLIDAE	1. *Chioscyillium griseum*	Gray bambooshark	Nga-Mann-Ain-Myaung
	2. Chioscyillium punctatum	Brownbanded 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*	Hooktooth 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*	Whitecheek 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*	Spottail shark	Thae-Nga-Mann
	12. *Galeocerdo cuvier*	Tiger shark	
	13. *Glyphis gangetis*	Ganges shark	Loon-Nga-Mann
	14. *Loxodon macrorhinus*	Sliteye shark	
	15. *Rhizoprionodon acutus*	Milk shark	
	16. *R. oligolinx*	Gray sharpnose shark	
	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: DOF

Box 14 : Studying limestone-karst-dependent bats in Myanmar

Paul J. J. Bates, Harrison Institute, and Daw Tin Nwe, Yangon University

In June 2000, the Harrison Institute and Yangon University signed a Memorandum of Understanding to promote collaborative biodiversity studies and help increase scientific capacity within Myanmar. In 2002, the two organizations were awarded a Darwin Initiative grant, funded by the UK Government, to undertake a programme of bat studies. The first phase was completed in March 2005.

The purpose of the programme was to ensure that Myanmar fulfilled its potential in conserving its rich bat fauna, including globally threatened species. The principal objectives were to describe and map the distribution of karst-dependent bat taxa and establish, within Yangon University, a centre of expertise in bat research and conservation. Over the three years, project outputs included: seven field surveys; training eight Myanmar students to PhD level; hosting an international bat workshop at Yangon University; participating in six international conferences; facilitating Mandalay University to develop a second centre of bat expertise; and writing eight scientific papers. Four of these papers have been published with the remainder in preparation or submitted.

The programme added greatly to the knowledge of Myanmar's bat fauna. Nine species previously not recorded from the country were collected, including one, Kachin Woolly Bat *Kerivoula kachinensis*, new to science. A number of sites, habitats and species were identified as priorities for conservation. A study of echolocation by cave-dwelling bats has been used to help develop an identification system based on acoustic signals. This has the potential to become a useful tool for future biodiversity assessments both within Myanmar and elsewhere in South-East Asia. Data have been gathered on the diet, morphology and taxonomy of bats and on their relationship with man.

So what of the future? The programme established that Myanmar can play a significant role in bat conservation, including for species that are globally threatened. Funds have been secured for several follow-up activities:

- a study of the Endangered Kitti's Hog-nosed Bat *Craseonycteris thonglongyai*;
- an analysis of the social and economic role of the free-tailed bat *Tadarida plicata* in the guano industry; and
- development of a regional network of bat taxonomists in South-East Asia.

Perhaps the greatest limitation remains on how to translate research results into active conservation in the field. Currently, in Myanmar, most bats are not immediately threatened with extinction. Nevertheless, it is clear that increased economic activity, for example the extraction of limestone for the cement industry, may be a particular threat in the future. There is also a threat from rapid deforestation in many areas. In addition, increasing human activity is a problem at some roosting sites. This activity includes the hunting of bats for sport and food, and the disturbance of bats by pilgrims and tourists visiting the caves. At some stage, difficult compromises will need to be made between the aspirations of man and the needs of wildlife, if the conservation of bats and the other rich but fragile biodiversity associated with Myanmar's limestone karst is to be achieved.

Source: Myanmar - Investment Opportunities in Biodiversity, 2005

(iv) Marine Turtle

Five of the world's seven marine turtle species, the Hawksbill (*Eretmochelys imbricata*), Green (*Chelonia mydas*), Loggerhead (*Caretta caretta*), Olive Ridely (*Lepidochelys aolivace*), and Leatherback (*Dermochelys coriacea*) are found in waters of Myanmar. All five are known to feed and/or nest along the coastal regions of Rakhine, Ayeyarwady and Tanintharyi. All five face

the threat of extinction. Threats from human are numerous, include capture for consumption, harvesting for the crafting of ornamental items, egg collection, accidental capture by fishing operations (by-catch), destruction of nesting sites, and pollution. The population of marine turtles in this region has declined sharply and the number of females returning to the nesting sites has fallen. The exact population of marine turtles nesting each along Myanmar's coast is unknown. Nesting of turtles is observed around Andaman Sea, Gulf of Mottama, Thameehla Island and Bay of Bengal.

Since 1963, the DOF has taken up a project to propagate and conserve marine turtles on Thameehla Island (Diamond Island) in Ngaputaw Township, Ayeyarwaddy Division. Then in 1986-87, the project was fully revived and hatchery was established.

Although Myanmar had started marine turtle conservation since 1986 the momentum of the activity was not accelerated. Myanmar became a member of Southeast Asian Fisheries Development Center (SEAFDEC) in 1999. As a member, Myanmar was able to participate in trainings and workshops related to conservation and enhancement of turtle conducted by SEAFDEC. Generally marine turtle conservation activities are conducted in collaboration and with the assistance of SEAFDEC.

Since September 2001, the turtle conservation activities have been enhanced as the collaboration with international agencies and organizations are extended. The Memorandum of Understanding on *"Conservation and Management of the Marine Turtle and their Habitats of Indian Ocean and South-East Asia (IOSEA)"* was signed between DOF Myanmar and IOSEA.

Currently DOF has sighted 35 nesting sites in areas along the coastal region. Among them, six are closely conserved through monitoring and surveillance of turtles landing sites, clutches and magnitude of hatchling enable to return to the sea.

Table 30. Distribution of marine turtles in Myanmar

Location	Leatherback *Dermochelys coriacea*	Loggerhead *Caretta caretta*	Green *Chelonia mydas*	Hawksbill *Eretmochelys mbricate*	Olive Ridley *Lepidochelys olivacea*
Ayeyarwady Division	✓		✓	✓	✓
Rakhine State		✓	✓	✓	✓
Mon State			✓		✓
Tanintharyi Division	✓		✓	✓	
Yangon Division(Coco Island)	✓		✓	✓	✓

Source: DOF

Table 31. Marine turtle nesting areas in Myanmar

Area	Activities	Establishment
Rakhine State		
1.Marn Aung Island	No	-
2.Ye Kyun Island	No	-
3. Inbari Kyun Island	No	-
4. Tin Pann Kyun Island	In-situ/ Hatchling,Releasing/ Tagging/Tissue Sampling	-
5. Nantar Kyun Island	No	-
Ayeyarwaddy Division		
1.Thameehla Island	Hatchery/Hatchling Releasing / Tagging	1986
2.Khone Gyi Beach	In-situ/ Hatchling Releasing/ Tagging	2001
3. Wargone Beach	In-situ/ Hatchling Releasing/ Tagging	2001
4. Kyauk Ka Lat Beach	No	-
5.Thet Ke Thaung Beach (Maydarai)	In-situ/ Hatchling Releasing/ Tagging	2001
6. ZeeChai Beach	No	-
7. Pyin Ka Yai Beach	No	-
8. Kadongalay Island	In-situ/ Hatchling Releasing/ Tagging under DOF	1997/1998
9. Gayetgyi Island	In-situ/ Hatchling Releasing/ Tagging under DOF	1997/1998
10.Nhet U Thaung Beach	In-situ/ Hatchling Releasing/ Tagging	2001
11. Ma Sein Yone Beach	In-situ/ Hatchling Releasing/ Tagging	2001
12. Htaung Gyi Tan Beach	In-situ/ Hatchling Releasing/ Tagging under DOF	2002
13.Ashaet Phya Beach	In-situ/ Hatchling Releasing/ Tagging	2002
14. Mingalar Thaung Tan Beach	In-situ/ Hatchling Releasing/ Tagging	2001
15. Nga Mann Thaung Beach	In-situ/ Hatchling Releasing/ Tagging	2002
16. Kai Thaung Beach	No	-
17.Amatt Gyi Beach(Kwin Bauk Vuillage)	In-situ/ Hatchling Releasing/ Tagging under DOF	1989
19. Pyin Salu Beach	No	-
Mon state	No	
1. Bilu Kyun Island	No	
2. Han Kan Beach	No	
3.War Kyun Island		-
4. Zee Phyu Thaung Beach	No	-
5. Byu-Byeik Beach	No	-
		-
Taninthayi Division		
1. Pyin Gyi Island	No	
2. Ba War Beach	No	
3. Kan Thaung Beach	No	
4. Pidakuk Beach	No	-

5. Piketaelay Beach	No	-
6. Daminseik Beach	No	-
7. Maungmakan Bok Island	No	-
8. Loung Lon Bok Island	In-situ/ Hatchling releasing/Tagging under DOF	-
		-
9. Shinmaw Beach	No	-
10. Pa Nyit Beach	No	2006
11.Lampi Island	National Marine Park	-
12. Mali Island	No	-
13. Donn Kyun Island	No	-
14. Pyin Sabu Island	No	-
Yangon Division		-
1. Coco Island	Hatchery/ Hatchling releasing /Tagging /Tissue Sampling together undertaken by Navy and DOF	-
		-

Source: DOF

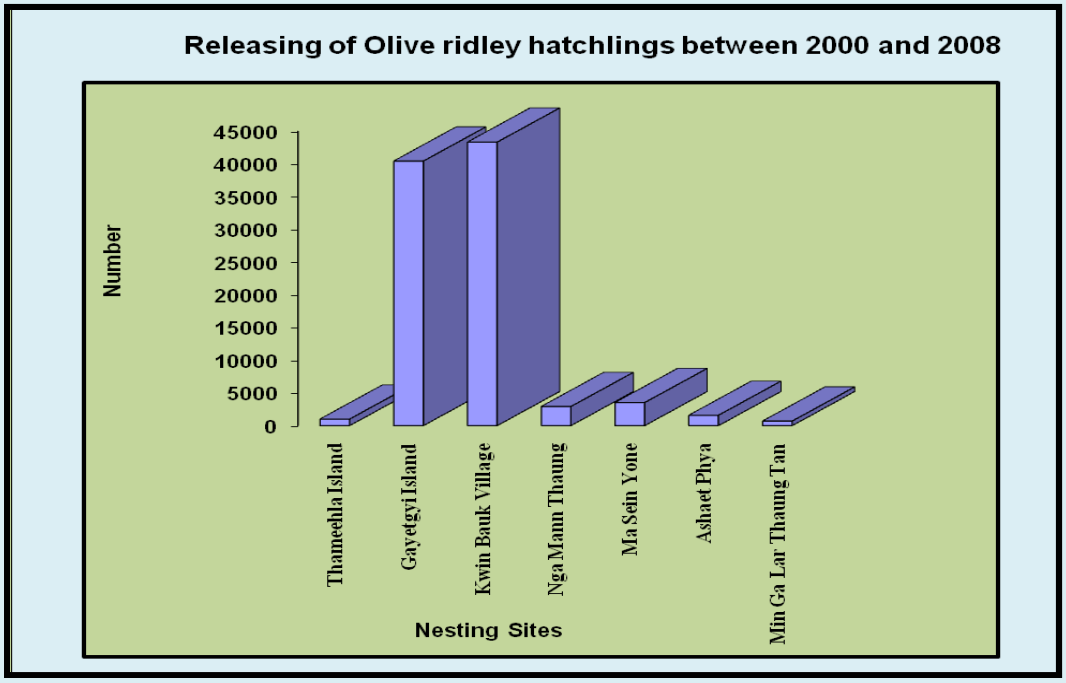


Figure 11. Release of Olive ridley hatchlings between 2000 and 2008 *Source: DOF*

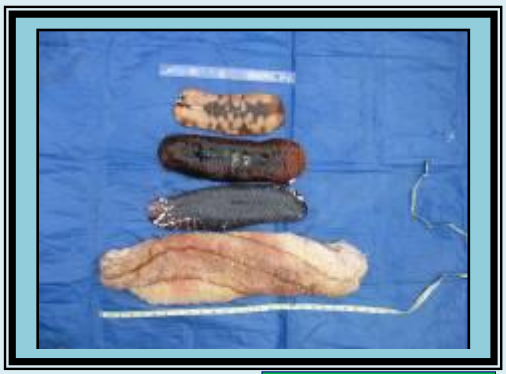
(v) Sea Cucumber

The sea cucumber species systematically identified from Myanmar waters are given in Table 32.

Table 32. Sea cucumber species in Myanmar

Sr. No.	Scientific Name	Common Name
1.	***Actinopyga miliaris***	Black fish
2.	***Actinopyga lecanora***	Stone fish
3	***Thelenota ananas***	Prickly red fish
4	***Thelenota anax***	Amber fish
5	***Stichopus variegates***	Curry fish
6	***Stichopus chloronotus***	Green fish
7	***Holothuria nobilis***	Black Teat fish
8	***Holothuria atra***	Lolly fish
9	***Holothuria fuscogilva***	White Teat fish
10	***Bohadschia argus***	Leopard / Tiger fish

Source: DOF



Sea Cucumber

1.8.2. Trend

The following conservation measures were conducted by DOF.

Sr. No.	Measures	Activities
1	Sea turtle conservation	Tagging programmes, information collecting program, sea turtle conservation training collaboration with IOSEA
2	Shark protection measure	Notify the shark protection area, issue the order that not allowed to catch, issue the permit for the license for the traders
3	Pomfret protection measure	Permitting the seasonal closed
4	Ayeyarwaddy Dolphin conservation measure	Conducting the survey collaborating with Wildlife Conservation Society(WCS)in 2002, Whale and Dugong Conservation Society(WDCS) in 2003-04
5	Collaborative survey programme	Collaboration with SEAFDEC in 2004 Collaboration with BIMSTEC in 2007

Source: DOF

1.8.3. Threats

Coastal and marine biodiversity have been impacted by the following threats.

Sr. No.	*Threats*
1	Illegal fishing 1.1 Dynamic fishing 1.2 Electric fishing
2	Siltation
3	Gold panning

CHAPTER II

CURRENT STATUS OF NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

2.1. Development of NBSAP

Within the Bali Strategic Plan for Capacity Building and Technical Support, a Memorandum of Understanding (MOU) between the National Commission for Environmental Affairs (NCEA) of Myanmar and United Nations Environment Programme- Regional Office for Asia and the Pacific (UNEP-ROAP) was signed in January 2006 for initiating the development of NBSAP.

An inception workshop was held by the Ministry of Forestry in collaboration with UNEP-ROAP for developing NBSAP in Yangon, Myanmar on 7-8 June 2006. Altogether 149 participants from 44 organizations including government agencies, universities, international NGOs, local NGOs and private sector attended the workshop and presented thirteen papers. Salient points highlighted in the workshop were as follows:

- Process for NBSAP
- Status of biodiversity conservation in Myanmar
- Genetic resources management in Myanmar
- Preliminary stocktaking, data available and major threats with regard to birds, fisheries, livestock and veterinary
- The research being carried out by the university in marine science and marine ecosystems

2.1.1. Institutional structure of NBSAP development

During the inception workshop, an institutional structure consisting three levels was proposed.

National Steering Committee is a high level committee which has to ensure that the NBSAP gets fully integrated in Government Policy across sectors. It consists of high level officials from relevant Ministries.

Project Management Team is responsible for providing methodological guidance, provision of technical expertise, meeting deadlines, editing and production of reports, and supervision of the Working Groups.

Thematic Working Groups is categorized into three groups:

Working Group 1- Natural Resource Use: Sustainable forestry, Agriculture and Biotechnology, Fisheries, Hunting, Plant Use

Working Group 2- Conservation & Ecology: Protected Areas, Species and Habitats, Research and Monitoring, Data Management

Working Group 3- Social, Political and Economic: Sustainable Development Economic, Law, Institutions, MEA, Pubic Awareness, Environmental Education.

2.1.2. Follow-up activities after inception workshop

The first coordination meeting of working groups was held on 14 August 2006 in Yangon. The necessary data and information was collected by using questionnaires from the Department of Fisheries, Marine Science Department and Zoology Department from the related Universities, Myanmar Bird and Nature Society, Wildlife Conservation Society and Academy of Forestry Science.

2.1.3. Further requirements of taking actions for bringing about NBSAP

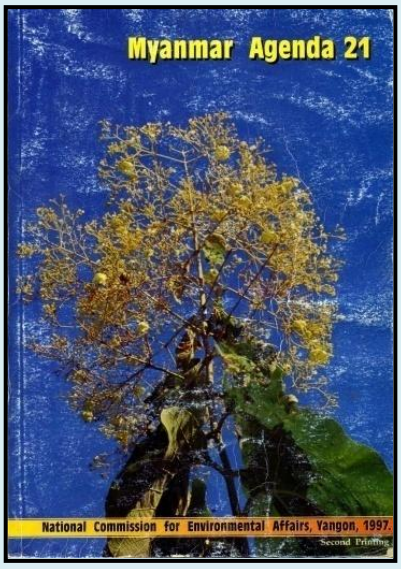
Forest Department conducted an inception workshop as the first step towards the development of the NBSAP. As the follow up of this, the proposal was submitted to Global Environmental Facility in order to provide financial support so as to carry out enabling activities of NBSAP. Now, there has been discussing between Forest Department and GEF to sign a project cooperation agreement. Furthermore, the Ministry of Forestry has forward to the higher authorities for approval to sign the project cooperation agreement to develop NBSAP for Myanmar. At the moment, Forest Department has been preparing to form respective committees and teams in order to proceed with the development of the NBSAP and some documents have been sent to GEF.

2.2. Other Related Strategies and Plans towards Biodiversity Conservation

Although development of NBSAP is in the process, Myanmar has committed to biodiversity conservation in various scales from different sectors.

2.2.1. Myanmar Agenda 21

The formulation of Myanmar Agenda 21 is an important step in the process of achieving sustainable development in the country. It is intended to serve as a framework for integrating environmental consideration in the national development plans as well as the sectoral and regional development programmes in the future. This document is the expression of the political commitment of the Government to sustainable development.



Myanmar National Environment Policy was promulgated on 5 December 1994. The policy calls for integration of environmental considerations into the development process. It forms the basis for developing environmental strategies, environmental program and plans.

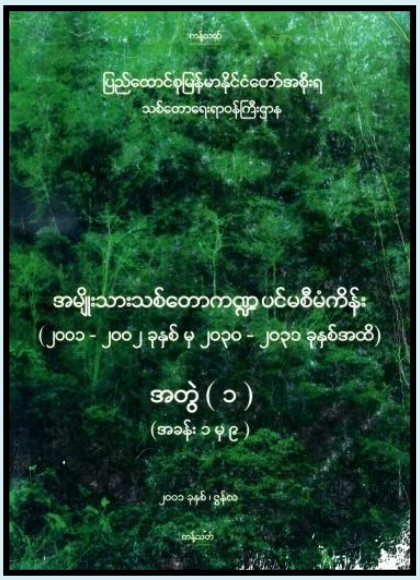
Environmental Impact Assessment (EIA) is an important mechanism for the integration of environment and development. Although Myanmar has yet to follow the EIA procedures, most of the foreign donors-funded large scale projects carry out EIA before project implementation and necessary measures are taken to mitigate adverse environmental impacts.

Myanmar Agenda 21 stresses Biodiversity Conservation in a separate chapter. It stated two programme areas: protected area planning and management, and biodiversity conservation.

The implementation of Myanmar Agenda 21 will require financial support and political commitment. It is unrealistic to assume that all programmes and activities in Myanmar Agenda 21 can be implemented through national budgetary support only. Enhanced official development assistance from donors will be absolutely vital to the promotion of practical measures and activities to implement Myanmar Agenda 21.

2.2.2. 30-year National Forest Master Plan (NFMP)

Forest resources have played an important role not only in socio-economic development but also in ecosystem management and biodiversity conservation in Myanmar. Therefore, Ministry of Forestry has formulated a National Forest Master Plan covering a time span of 30 years from 2001-2002 to 2030-2031.



The NFMP was worked out comprehensively into two volumes and the strategic areas are (a) management of natural forests, (b) establishment of forest plantation, (c) establishment of community forests, (d) growing trees in homestead and non-forested areas, and (e) promotion of wood-based industry value-added forest products. At the end of the planned period (2030-31), the permanent forest estate (PFE) will remain 40 percent of the country area.

Major achievement in Forest Conservation has been being able to update old working plans into Forest Management Plans. In practice, each forest district known as forest management unit has to prepare working plan for every ten years and, forest management activities are conducted according to the plan. However, working plans for some forest districts had been out-dated for two to four decades due to various reasons. Meanwhile, a change in constitution of forest districts from forest range-based to civil administrative boundary-based suggested revising of working plans essentially. Therefore, in 1996-97, new Forest Management Plans instead of old working plans had been formulated inconformity with the current situation in almost every aspect for each reconstituted forest districts. Until now, altogether 66 forest districts have the forest management plans further revised in due course of 10 years-plan period by 2006-07.

2.2.3 Dry Zone Greening Action Plan

The central part of Myanmar is well known as the Central Dry Zone due to its harsh climate of low rainfall and extreme temperature. In effect, the Central Dry Zone is featured by dry land ecosystem wherein forests are of dry types and low productivity. Compounded with indiscriminate exploitation of forest products and even irreversible land use changes for increasing population, forests in the dry zone had been deteriorated with a rapid pace and so did the environment and ecosystem. In consequences, the social and economic situation in the region has been problematic.

Realizing the root cause of socio-economic problems, reforestation and afforestation programs, the “Agricultural and Rural Development Corporation (ARDC)” in 1950s and the

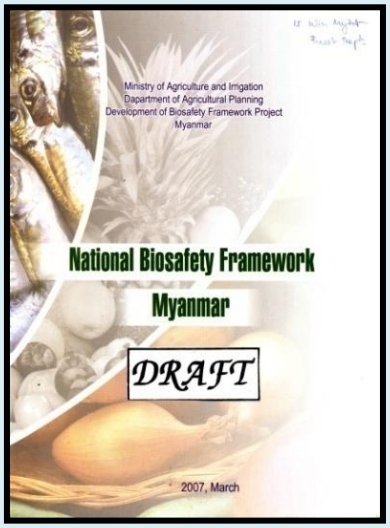
"Special Region Nine District Green Project" in 1974, had been initiated by the Forest Department. In view of boosting up implementation activities, the Ministry of Forestry formed a new Department the "Dry Zone Greening Department (DZGD)" and the area to be undertaken has also been stretched out encompassing three divisions; Sagaing, Mandalay and Magway, in 1997. The Department laid down following four strategic activities;

- Establishment of forest plantations
- Conservation of remaining natural forests
- Introducing and promotion of wood-fuel substitutions
- Water resources management

Then, a comprehensive 30-year master plan comprised of five-year intermediate ones has been formulated and activities are being carried out accordingly. A total of 14,164 ha of forest plantations using appropriate native and exotic tree species have been established annually in degraded forests. The degraded natural forests and the remnants have been conserved at annual target rate of 4,047 thousands of ha through natural regeneration and enrichment planting. Promotion of utilization of wood-fuel substitutions has also been achieved through distribution of efficient stoves and awareness and extension services. As for water resources management, various ways and means such as construction of tube wells, reservoirs and siltation dams, irrigation from rivers and streams, and 170 small ponds per annum has resulted in a relief for the people from scarcity of water. The tremendous achievement over a decade since emergence of the DZGD has been witnessed with considerable overall changes of greening effects in some mountain ranges and the environment.

2.2.4. National Biosafety Framework (NBF)

Myanmar became one of the signatory countries of the Cartagena Protocol on Biosafety which was opened for members' signatory on 29 January, 2000, and has become full fledged member country in 2008 after ratification to the protocol. From May 2004 to November 2006, with the assistance of GEF and UNEP, a project of "Development of National Biosafety Framework Project, Myanmar" was conducted. The objective of the project is to support biotechnology development while guarding the national biodiversity in sustainable way as well as ensuring human health.



The project was steered by a National Coordinating Committee (NCC) which consists of 17 members of high ranking officials from all Ministries and Government institutions. A surveyor team consists of experts from various subjects related to biotechnology development conducted a survey on "the current status of biotechnology and biosafety in Myanmar". A series of multi-stakeholder consultation workshops, seminars was held for preparation of the framework. Nine regional workshops were conducted for regional input of stakeholders into formulation of regulatory regime and to improve public awareness.

The key components of a National Biosafety Framework

including policy, regulatory regime, mechanism to handle notifications or request for authorization is important to ensure the safe transfer, a system for "follow up" such as enforcement and monitoring for environmental effects; and, mechanisms for public awareness, education and participation. At the completion of the project a draft on “National Biosafety Framework” and a draft on “Law on Biosafety” were produced in Myanmar and English versions both, and submission to higher authority has been under way.

Biotechnology in itself is not much advanced in Myanmar but import of Genetically Modified Organism (GMO) is a possibility because of Myanmar's geographical location and the rapid development of GMOs in the neighboring countries.

2.2.4.1. System to handle applications request for authorization

The guiding principles in developing biosafety administrative system are; (1) to support the safe application of sustainable modern biotechnology for Myanmar agricultural productivity, food security and health improvement, (2) to ensure an adequate level of biosafety in transfer, handling and use in development, production, distribution and release of GMO and GM products by conducting scientifically based risk assessment and evaluation on a case-by-case basis, (3) to recognize the importance of transparency, people participation, and public awareness, and (4) to be efficient one door policy in line with available related mechanisms.

The National Competent Authorities (NCAs) are the highest decision making authorities comprising of various ministries such as Ministry of Forestry, Ministry of Livestock Breeding and Fisheries, Ministry of Agriculture and Irrigation, Ministry of Science and Technology, Ministry of Commerce, Ministry of Health, Ministry of Education and other related ministries dependent upon the type of GMO or GM products concerned. NCEA will serve as the focal point of Cartagena Protocol in matters related with the CBD secretariat.

The National Biosafety Committee (NBC) is the advisory body to the NCAs for decision making, and a body responsible to carry out evaluation of risk assessments, giving public information, receiving inputs from public, and give inputs to governments on the national biosafety policies. NBC consists of high ranking government officials of related institutions.

2.2.4.2. Monitoring and Enforcement of GMOs

After the release of GMO, monitoring will be done by technical teams such as extension service workers, seed supervisor, pesticide supervisor and veterinarian assigned to slaughter house periodically under related National Competent Authorities. Moreover, NBC will collect information through various channels and organizations including NGO such as Union Solidarity Development Association and Myanmar Women's Affairs Federation. In cooperation with NBC, related ministries shall establish impact monitoring and risk management. In case of monitoring, NBC will also serve as interface between NGOs or public and NCAs. In the event of harm to the environment or toxicity/allergenicity for food or feed, relevant National Authority will be reported. At the same time, communities, consumers and NGOs are asked to monitor and report to NBC if the release of GMO cause harm to environment and health. NCAs will consider withdrawing the release permit and inform the decision to NBC.

Public awareness and participation in biosafety as a part of environmental education should be developed in relation to respective sectors, especially with the environmental policy as the sector responsible for the implementation of international biosafety and biodiversity related issue.

In the short term, the activities identified as necessary to be accomplished are;

- Developing a program on public education and awareness in biosafety and ensuring its inter-linkage to other related programs;
- For the long run, scientists, teachers and other possible trainers such as Village Extension Manager (VEM) in public education and communications in order to enhance their capacity to educate the public on biosafety issues;
- Ensuring information sharing on risk assessment and risk management for GMOs; and
- Developing regional cooperation especially within ASEAN countries regarding GMOs, as well as cooperating with international organization.

2.2.5. National plant variety protection system

To protect the genetic resources from being unlawful exploitation is the sovereign right of the Union of Myanmar. So, Myanmar Seed Law has been drafted to develop appropriate system for protecting new plant variety. After extensive testing of candidate varieties under the prevailing conditions, varietal testing results along with salient characteristics are needed to submit National Seed Committee (NSC) for variety release. There is no private sector for seed production and exchange of crop varieties. For germplasm exchange with other Institutions, Standard Material Transfer Agreement (SMTA) is used at present.

Crop Varietal Improvement Program has several methods in plant breeding. Indigenous Selection, Introduction from Consultative Group on International Agricultural Research (CGIAR) countries, Privates, Non-Governmental Organization (NGOs), Hybridization and Selection and Mutation are commonly practiced. Plant breeding is long and expensive. However, plant varieties can be easily and quickly reproduced by others without permission. So breeders need protection to recover investment.

Myanmar became aware of Intellectual Property Right (IPR). So, it is needed to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society. Now, human resources development program is emphasized by attending seminars, workshops, and trainings, held in advanced countries with the support of Association of South East Asian Nations (ASEAN) plus three.

CHAPTER III

SECTORAL AND CROSS-SECTORAL INTEGRATION OR MAINSTREAMING OF BIODIVERSITY CONSERVATION

3.1 Introduction

Myanmar is committed to promote the conservation and sustainable use of biodiversity in activities in all sectors of society and the country is also committed to the more effective implementation of these objectives so as to significantly reduce the rate of loss of biodiversity by 2010 national level. Being a signatory country to CBD, some government and non-government organizations are getting involved in biodiversity conservation through their work implementation.

Pertaining to the environmental conservation in Myanmar, there are two main organizations formed in 1990 and 2004, and they are NCEA (National Commission for Environmental Affairs) and Environment Conservation Committee. The former act as focal point for international environmental conventions/protocols and the latter focuses on internal environmental protection.

3.2. Some measures on biodiversity conservation

All bio-diversity related government agencies and NGOs have been making efforts to conserve biodiversity in Myanmar.

3.2.1. Mainstreaming biodiversity into agricultural sector

Myanmar is an agro-based country and the Ministry of Agriculture and Irrigation plays an important role in food supply to the country while conserving biodiversity. Myanmar people had recognized the value of plant genetic resource (PGR) even before modern agricultural technology was introduced to the country. Collecting and conserving PGR is the main task of the Ministry's research centre Department of Agricultural Research (DAR) and more than 3,000 accessions of local rice varieties had been collected and conserved by the rice division long before seed bank was established. Likewise, other crop divisions maintained germplasm of oilseeds, food legumes, maize and other cereals, fibre and horticulture crops. In-situ conservation of mango and medicinal plants had begun in the 1980s.

To prevent the landraces from genetic erosion as well as for the crop research in the future, crop germplasm collection was conducted in cooperation with international agencies. In 1966, 1,426 strains of local rice varieties and nine kinds of wild rice were collected under joint plans for mutual benefit of Myanmar and the IRRI from the Philippines. Since 1973, rice germplasm collection was again launched in cooperation with the IRRI. The collected varieties were conserved by growing in the field every year, which cost money, time and land area. To protect the loss of varieties occurred as results of weather, diseases, hybridization, etc, seed bank was established in cooperation with JICA in 1990.

3.2.2. Agricultural legislations

To protect environment and biodiversity, the Ministry of Agriculture and Irrigation (MOAI) has enacted the following laws and some are in draft stage.

Table 33. Some agricultural legislations related to biodiversity conservation

Title	Scope	Responsible agency	Status
Pesticide Law	Covers the use of pesticides	MOAI	Enacted in 1990
Plant Pest Quarantine Law	To prevent quarantine pests from entering Myanmar	MOAI	Enacted in 1993
Fertilizer Law	To manage the use of fertilizers	MOAI	Enacted in 2002
The Seed Law	To maintain quality and the use of seeds	MOAI	Being drafted
Law on Biosafety	To manage GMOs	MOAI	Being drafted

Enactment of the above-mentioned laws also raises awareness on biodiversity conservation among the people of Myanmar.

Uncontrolled use of pesticides may cause serious environmental impacts on human, animals, agriculture, fisheries and so on. Under the Pesticide Law (1990), a National Pesticide Registration Board (NRB) serves as the advisory body for pesticide registration and issues import permit on recommendation of the technical committee.

The main objectives the Plant Pest Quarantine Law (1993) are:

- To quarantine plants entering Myanmar,
- To suppress the spread of quarantine pests,
- To carry out, if necessary, disinfections treatment of plant or plant products to be explored, and
- To issue phytosanitary certificate.

The Fertilizer Law (2002) covers organic and inorganic fertilizers as well as Bio-fertilizers with beneficial organisms such as bacteria or fungus.

Currently the seed law is still under the process for promulgation. However, before enacting the law, "National Seed Committee" (NSC) was formed and is an authority for matters on import and export of seeds. Thus, committee or technical subcommittee of NSC could play an important role for managing biosafety even before National Bio-safety Framework or law is enacted.

In addition to conserving biodiversity through enactment of relevant laws, the Ministry is also encouraging farmers to conserve soil and promote organic farming throughout the country.

3. 2. 3 Some measures to protect agricultural biodiversity

Central dry zone of Myanmar is very arid with extreme climatic conditions due to very low rainfall (with an annual rainfall of less than 600 mm) and poor water retention of soil. As a result of these factors, there is a very hot weather with an intense rainfall in a short period and long periods of drought thereby causing soil erosion, decrease in soil fertility, and reduction in crop yields and crop failure. Thus, Land Use Division of Myanmar Agriculture Service launched the activities such as construction of check dams and hedge row terracing for soil conservation and

soil fertility improvement, extension education for water harvesting, and formation of income generation groups for on-farm, off-farm and non-farm activities to relieve pressure on land and environment in cooperation with UNDP/FAO.

Moreover, the Department of Agricultural Research has established research stations at different ecological zones for the in-situ and on-farm conservation of local plant genetic diversity.

Soil biodiversity is enhanced by organic farming practices, bringing beneficial effects such as recovery and rehabilitation of degraded soils, improved soil structure and water infiltration. Well-managed organic agriculture leads to more favorable conditions at all environmental levels.

Sustainable agricultural practices are given as priority for farmers. Sustainable agriculture promotes agricultural biodiversity, which is crucial for food security and rural livelihood.

Rice and cereal crops are the largest genetic resources and other genetic resources such as a variety of peas, beans, cotton, tubers, fruit plant species and vegetable plants are of important sources of food. Various agricultural crops under the category of cereals, oilseeds, pulses, industrial crops, kitchen crops and fruits and vegetables are annually cultivated and conserved in the entire nation. An array of research activities on rice, peas and beans, physic nut, job's tears, and other field crops has been conducted by the agricultural research department for conservation of plant genetic diversity.

Myanmar recognizes the value of PGR for the present as well as for the future as they are very important to attain food security and sustainable agricultural production in Myanmar. From 1998 to 2002, 22 missions were completed, 2,434 accessions collected, and 12 States and Divisions (86% of states and divisions) visited.

A total of 23 crops descriptors were prepared by 2002. These species are rice, maize, wheat, buckwheat, finger millet, pearl millet, common & little millet, sorghum, chickpea, cowpea, lima-bean, black-gram, green-gram, pigeon-pea, soybean, lentil, groundnut, sunflower, sesame, sunflower, jute, cotton and yam. From 1997 to 2002, a total of 1,414 PGR accessions have been multiplied, characterized and evaluated. To date, 10,108 accessions are preserved in short-term storage while 9,905 accessions are in medium- to long-term storage.

3. 2.4. Mainstreaming of biodiversity in educational sector

The role of educational sector to integrate with biodiversity is fundamentally important as it deals mainly with conservation of biodiversity by future generation through education. The majority of young people in every country involve with literacy and further educational processes, knowledge about the living things contain in their school lessons as animal and plant science. Since the primary levels, school children have to learn about the science subject pertaining to plants and animals and they have come to learn how plants and animals live, reproduce and their role for the benefit of mankind.

Beside, nowadays, they are to learn what the consequences of disturbed ecosystem are. Syllabuses and curriculums of basic and higher education also contain studies about the environment, about the diversity among the plants and animals as well as among the microorganisms. Therefore, biodiversity conservation in education sector is done through teaching, doing research activities and conduction of EIA.

BOX 15. Conservation of plant genetic resources

1. Study on genetic diversity of 165 accessions of Paw San Hmwe or Myanmar traditional aromatic pearl rice.
2. Study on genetic diversity of 278 accessions of glutinous rice conserved in Myanmar Seed Bank.
3. Study on Photoperiodic sensitivity among 6,000 rice accessions.
4. Study on heading performance of Myanmar traditional rice germplasm under two locations, Hmawbi (Yangon) and Yezin (Nay Pyi Taw).
5. Collection of rice and multi-crop genetic resources in collaboration with students from Yezin Agricultural University (YAU).
6. Study on effect of old seedling age on Myanmar local rice germplasm.
7. Identifying weed competitive ability among Myanmar local rice germplasm.
8. Evaluation on Nitrogen use efficiency among Myanmar rice germplasm.
9. Evaluation on Bacterial Blight Resistance among Myanmar rice germplasm.
10. Conservation of vegetative propagated field crops in field gene bank.
11. Exploration and collection of Yam (*Dioscorea* spp.) and Elephant Food Yam (*Amorphophalus* spp.) in Myanmar.
12. Exploration and collection of landraces of *Solanaceae* in Myanmar.
13. Diversity of cucumber (*Cucumis sativus*) Landraces in Myanmar.
14. Collection and conservation of local varieties of bottle gourd (*Lagenaria vulgaris*)
15. Study on Duplicate Accessions Conserved in Myanmar Seed Bank.

The following programs are being conducted within the department and with the other organizations from the country and abroad.

- Lectures, seminars and workshops focused on biodiversity conservation/ environmental impact assessment
- Lectures on Environmental Study, Conservation and Management give ideas to improve the biodiversity conservation and to avoid/minimize adverse impact on biodiversity
- Seminars and workshops are conducted based on the actual data and analyses from the field surveys to make decisions to avoid/minimize adverse impact on biodiversity

Researches conducted are mostly focused on biodiversity and its conservation directly or indirectly. Records on the species diversity of invertebrate animal in an area are essential since the existence of these animals is the indicator of the habitat of that region. (eg. Presence of dragon flies and fire flies in clean water habitat, absence of tadpoles in contaminated water.)

EIA surveys include monitoring of the impacts of human and natural disasters on the affected regions or areas which usually suffer from ecosystem imbalance and its consequences.

BOX. 16. EIA Conduction

Projects for the conduction of **EIA** by researchers from the Yangon University are as follows;

- Monywa copper mine
- gold mine project
- TOTAL gas pipeline project
- Yeywa Hydropower project
- Discharge of industrial wastes into ponds, lakes and rivers etc.

Besides, Yangon University enthusiastically participated in execution of **EIA** in initial stage of establishment of Htamanthi Hydro-power project. Environmental Impact Assessment on Flora of Htamanthi Hydro-power and Multipurpose Dam was conducted by the scientists of Botany Department in cooperation with other organization and Ministries in the 2006. The assessment proves that type of forest in the Htamanthi area is semi-evergreen type. In the study area 516 species belonging 97 families were identified and the species density was calculated. Among them 8 species were included in the IUCN Red list of Threatened Species and mitigation for these species was suggested.

Some research titles and outcomes concerning with biodiversity conservation and sustainable utilization by Department of Botany are;

- Phytosociological study for conservation and restoration of mangrove vegetation in the Ayeyarwady Delta.
- A Phytosociological Study of Vegetation on Kelatha Mountain, Belin Township, Mon state.
- Geobotanical study on Plant community and accumulation of trace elements in plants and soils with special reference to Khwe Aik Taung, Heho, Southern Shan State
- Geo-botanical study on the associated plant species and relationship of plants and rocks and mineralization in Taung Ni Taung area Kyauk Pa Daung township, Mandalay Division
- Diversity of plant species in the Letpadaung hills and their socioeconomic status in some villages located in the vicinities

3.2.5. Integration of biodiversity in forestry sector

The Forest Department under the Ministry of Forestry is responsible for biodiversity conservation in general, and Nature and Wildlife Conservation Division under the Forest Department is responsible for the establishment of protected areas network and wildlife management of the country in particular. Biological resources conservation has been taken into Myanmar tradition since early days as prohibition of hunting in religious sites, establishment of sanctuaries for some animal species were in existence in the country. Until now, it is one of the national priorities in the country as protection of the entire environment including biodiversity is identified as an important imperative in Myanmar forestry legislations. Laws covering the control of trade and protection of wildlife had been enacted and amendments made from time to time. In 1879, "The Elephant Preservation Act" was promulgated and amended in 1883. In 1881, Burma Forest Act was promulgated and amended in 1902. Wild animals and their parts were declared as forest produce. Specific legislation to protect wildlife was enacted in 1912 under, "The Wild Birds and Animals protection Act 1912." The department is also implementing its conservation work based on the 30-year forestry master plan to ensure sustainable forest management.

The forestry and wildlife conservation legislations currently in use are presented in the table below.

Table 34. Forestry Laws relating to biodiversity conservation

Title	Scope	Responsible agency	Status
Forest Law	Ditto	Ditto	Enacted in 1992
Forest Policy	Ditto	Ditto	Enacted in 1995
Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law	To protect wildlife	Ditto	Enacted in 1994

The new wildlife legislation as against the old has assumed the modern approaches in biodiversity conservation.

The objectives of the 1994 law are;

- to implement the policy concerning the protection of wildlife and wild plants
- to implement the policy concerning the conservation of protected areas
- to conserve wild plants, wildlife, nature and migratory birds in accord with the standards set by the international Conventions acceded by the Government
- to protect and conserve endangered wildlife species and wild plants their habitats,
- to contribute research on natural sciences, and
- to protect wildlife and wild plants by establishing zoological gardens and botanical gardens.

The Law has greatly widened the scope of protection for wildlife including birds and mammals. The 1994 wildlife legislation declares complete protection for 39 mammals, 50 birds and 9 reptile species, normal protection for12 mammals, 43 birds and 6 reptiles species; and seasonally protected species including 2 mammals and 13 birds. For conservation of biodiversity, mangrove ecosystems and fragile mountain ecosystem about 1 marine national park, 36 wildlife sanctuaries and 6 national parks areas have been established in Myanmar.

Therefore the law stipulates to establish scientific reserves, national parks, marine parks, nature reserve, wildlife sanctuaries, national heritage sites, etc. so that to conserve wildlife, wild plants in perpetuity.

3.2.6. Mainstreaming of biodiversity in trade sector

The Ministry of Commerce has prohibited exportation of ivory, drought cattle of buffaloes, cows, elephants, horses and rare animals and their products by the notification of 10/99 since 1999. This helps reduce the loss of elephant and drought cattle population as ivory and animal products trade within the country and neighboring countries has great negative impact on the said animal population. Institute of Global Environmental Strategies (IGES) reports (2008) that illegal wildlife trade within the country and neighboring countries is threatening the biodiversity existence in Myanmar.

3.2.7. Mainstreaming biodiversity into health sector

Ministry of health is conserving traditional medicinal plants in 9 herbal gardens covering 120 hectares in different regions of the country. The traditional medicine is based on medicinal plants and it is included in learning session for medical students. The government of Myanmar has already established the Department of Traditional Medicine and the gardens are managed by the Department. As of 2008, a total of 1,524 species of medicinal and useful plants has been recorded and of those 908 species are medicinal plants. The medicinal plants are of great importance for treating six major diseases of diabetes, hypertension, tuberculosis, malaria, diarrhea and dysentery.

3.2.8. Mainstreaming biodiversity into mining sector

Ministry of Mine has enacted the following legislations so as to prevent loss of biodiversity in the mine-areas.

The Myanmar gemstone law (1995) provides to prevent deforestation and water or soil pollution due to mining activities.

The Myanmar Pearl Law (1995) prevents extinction of oysters in Myanmar coastal areas.

3.2.9. Mainstreaming of biodiversity in livestock breeding and fishery sectors

Ministry of livestock breeding and fishery has enacted the following legislations so as to prevent loss of biodiversity in these sectors.

The Animal Health and Development Law (1993) has objectives for the health and development of animals. It contains provisions for preventing of dangers to animal feeds, infectious diseases and cruelty to animal.

The Law Relating to the Fishing Rights of Foreign Fishing Vessels (1989) provides for sustainable development of fisheries sector. It prohibits fishing of foreign fishing vessels without permit, keeping on board the fishing vessel, explosive substances, poisons, chemicals and other

substances not permitted for use in fishing, carrying out fishing by those means, fishing in the fishing grounds or using fishing implements or fishing in the periods not permitted in the license.

The Myanmar Marine Fisheries Law (1990) is a major law for conservation of marine environment and sustainable development of marine fisheries in Myanmar. It prohibits keeping on board the fishing vessel, explosive substances, poisons, chemicals and other dangerous substances not permitted for use in fishing, disposing of living aquatic creatures or any material into fisheries waters to cause pollution or to harass fishes and other marine organisms, collecting any marine products without license.

The objectives of Freshwater Fisheries Law (1991) are to further develop the fisheries, to prevent the extinction of fish, safeguard and prevent the destruction of freshwater fisheries waters, to obtain duties and fees payable to the State and to manage the fisheries.

The Territorial Sea and Maritime Zone Law (1997) empowers the State with the authorities and powers for protection and conservation of marine environment, and for control of marine pollution etc. in the territorial sea, continental shelf and exclusive economic zone.

3.2.10. Mainstreaming biodiversity into science and technology sector

The Ministry of Science and Technology has been implementing an integrated team-work-research on bio-fertilizer and bio-pesticide development. The ministry's special team is trying to exploit and conserve microbial diversity which is important for scientific, industrial and social development. The research team is also focusing on research studies dealing with the isolation, identification and utilization of environmentally important micro-organisms for process such as waste water treatment, bio-degradation of pesticide residues and preparation of bio-degradable plastics. These research activities will help reduce the loss of biodiversity as it protects the environment to an extent.

3.2.11. Mainstreaming biodiversity into sustainable development as shown in Myanmar Agenda 21

As a follow-up to UNCED, the Government of the Union of Myanmar adopted the following policy on 5 December 1994 with the aim to establish sound environment policies in the utilization of water, land, forests, mineral, marine resources and other natural resource in order to conserve the environment and prevent its degradation.

Regarding with biodiversity integration in Myanmar sustainable development, the policy states as, "The objective of Myanmar's environment 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 life of all its citizens. 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 ".

Myanmar Agenda 21 was adopted in 1997. The purpose of Myanmar Agenda 21 is to mobilize and focus national efforts to achieve sustainable development. The policy strategies and actions on social, economic and environmental dimensions are clearly depicted in the agenda. There are seven measures mentioned in the agenda to ensure environmental conservation in the country. The first deals with sustainable land use, the second related to fresh water resource

management, the third concerned with rational development and utilization of mineral resources, the fourth connected to SFM (Sustainable Forest Management), the fifth for biodiversity conservation, the sixth is to manage costal and marine ecosystems systematically and the final measure for Conservation of Myanmar's rich cultural heritage. For biodiversity conservation, the measure states as follows;

"Conservation of the rich biodiversity of the country through strengthening and expansion of protected areas and improved management".

Biodiversity conservation is therefore integrated into the sustainable development activities of Myanmar.

3.3. Integration of biodiversity for sustainable development as shown in Myanmar National Sustainable Development Strategy (NSDS)

Myanmar has drafted a National Sustainable Development Strategy (NSDS) in 2006 in line with the UN's mandate of Article 162 of WSSD, Johannesburg, 2002 which notes that "**States should take immediate steps' to make progress in the formulation and elaboration of national strategies for sustainable development and begin their implementation by 2005**".

NSDS will uplift the quality of life of Myanmar citizens; in other words, to alleviate poverty. Three pillars: environment, economics and social aspects are identified in Myanmar NSDS. The environmental perspective of Myanmar's NSDS comprises eleven areas. Of those, biodiversity conservation is one of the areas:

BOX. 17. Environmental perspectives of Myanmar NSDS

a. sustainable forest resources management;
b. biological diversity conservation;
c. sustainable freshwater resources management;
d. environmental quality management and enhancement;
e. integrated management of land resources;
f. sustainable management of coastal, marine and island ecosystems;
g. sustainable tourism development;
h. sustainable development and utilization of mineral resources;
i. sustainable agriculture, livestock and fisheries development;
j. sustainable energy production and consumption; and
k. sustainable industry, transport and communication development.

Strategy for biodiversity conservation as shown in Myanmar NSDS is as that Ministry of Forestry acts as lead institution and relevant departments and agencies are as collaboration institutions.

Myanmar NSDS noted that the country has a high potential for establishing an effective and integrated protected area system before forested areas largely fragmented, and lose their ability to provide adequate ecosystem services. It urges to increase protected areas system from present 7.3 % to 10 % without delay in year 2010 at the latest. There are 9 proposed protected areas with 22,843 km^2 covering 3.36% of the total country's area. Moeyingyi Weltand Wildlife Sanctuary has been listed as one of the wetlands of international importance in ASEAN countries (ASEAN SOE 2005).

3.4. Myanmar commitment to MEA (Multilateral Environmental Agreement)

Myanmar has signed some international 32 environmental agreements and some regional agreements until at the end of 2008. Of those, 7 international agreements and some regional agreements are more related to biodiversity conservation and they are listed in the table below.

Table 35. Myanmar's commitment to some biodiversity related agreements/conventions

Sr. No.	Name of environmental related agreement/ convention/ protocol	Status
1	Plant Protection Agreement for the South East Asia and the Pacific Region	1959(R)
2	United Nations Framework Convention on Climate Change	1994(R)
3	Convention on Biodiversity	1994(R)
4	Convention on Conservation of World's Cultural Heritage	1994(A)
5	International Tropical Timber Agreement (ITTA), Geneva, 1994	1996(R)
6	United Nations Convention on the Law of the Sea	1996(R)
7	Convention on International Trade in Endangered Species of Wild Fauna and Flora	1997(A)
8	United Nations Convention to Combat Desertification	1997(A)
9	ASEAN Agreement on the Conservation of Nature and Natural Resources, 1985	1997(S)
10	ASEAN Agreement on Trans-boundary Haze and Pollution	2003(R)
11	ASEAN Declaration on Heritage Parks and Reserves	2003(S)
12	Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971 as amended in 1982 and 1987	2004(A)
13	International Treaty on Plant Genetic Resources for Food and Agriculture, 2001	2004(R)
14	Agreement on the Establishment of the ASEAN Centre for Biodiversity	2005(S)
15	Cartagena Protocol on Biosafety	2008(R)

S = Sign
R= Ratify
A= Access/Accept/Adhere

Being a member to those conventions, protocol and working with those organizations also reflect that biodiversity conservation is one of the national priorities in Myanmar.

Besides, Myanmar is cooperating with some international organizations for biodiversity conservation and some of those organizations are Asian Elephant Specialists Group (AESG), Global Tiger Forum (GTF), Washington Park Zoo, Whale and dolphin conservation society in UK, and with some different governmental organizations.

3.5. Rural development scheme for income generation and upgrade livelihood

Border area & national race development program initiated in 1989 and developmental areas cover transport, communication, education, health, electricity supply and agriculture & livestock raising. Integrated rural development in the third 5-year plan (2001-06) increases rural income through other sources will help reduce the loss of biodiversity across the country. A total of 28 developmental zones has been set up throughout Myanmar and developmental activities are being carried out. This is true particularly in border areas where biodiversity is rich and diverse.

CHAPTER IV

CONCLUSION; PROGRESS TOWARDS 2010 TARGETS AND IMPLEMENTATION OF STRATEGIC PLAN

4.1 Progress Towards the 2010 Target

Myanmar has been implementing the strategic plans in order to achieving 2010 targets and measuring indicators not only in line with the CBD guidelines but also according to the resources available and national requirements.

Since the first goal of *Promote the conservation of the biological diversity of ecosystems, habitats and biomes* has been accomplished with the target "*To establish a network of protected areas covering 5% of the total area of the country by the year 2010",* about 3.93% of the country area had been notified as Protected Areas as well as about 3.73% had been proposed for further establishments. For the second goal, *Promote the conservation of species diversity*, 53 mammals, 106 birds and 15 reptile species were protected by the Protection of wildlife and wild plants and Conservation of Natural Areas Law (1994) where these species are categorized into three groups depending on their conservation importance. Moreover, establishment of 43 protected areas as well as 3 zoological gardens, 1 botanical garden and a national herbal park also promote In-situ and Ex-situ conservation of wildlife species.

Box 18. Conservation of herbal plants

Over 70% of the population lives in rural areas in Myanmar, and they rely on traditional medicines of which many are developed from herbs. One of the National Health Policies is to reinforce the services and research activities of indigenous medicine to international level and to involve in community health care activities. As an in-situ conservation of plant genetic resources including herbs relevant laws, regulations are in place and permanent forest estates to ensure their conservation are legally formed. In addition, mainstreaming of Ex-situ conservation of useful plants to the relevant sectors has also been taking place in the agriculture and health. The National Herbal Park, 81 ha in area, was established in Nay Pyi Taw in 2008. Over 2000 herbal and medicinal plants are being grown in the park.

In order to achieve the Goal 3 of *Promote the conservation of genetic resources*, a Seed Bank was established by the Department of Agricultural Research to conduct plant genetic resource management where 14328 accessions have been collected at the end of 2008. Also, *to promote sustainable use and consumption*, Thirty Year Master Plans had been outlined in each Ministry with relevant sector of biodiversity; for example, Thirty Year Forestry Master Plan has provisions for Sustainable Forest Management and Timber Certification with relevant criteria and indicators. However, certain indicators such as trends in illegal logging and fishing have not been assessed yet and also EIA has been conducted only for the development projects which are considered to be very important.

For the field of *Reduce pressures from habitat loss, land use change and degradation, and unsustainable water use*, a National Sustainable Development Strategy (NSDS) has been drafted. But assessments on the rate of loss of degradation of natural habitats are still poor. In the field of *Control threats from invasive alien species*, surveys on major potential alien invasive species have been conducted, but preparation of management plan for IAS control is in its infant stage. In order to *address challenges to biodiversity form climate change, and pollution*, Ministry of Forestry prepared a draft action plans and forwarded to UNCCD to control desertification and reduce pollution and its impact on biodiversity.

Box 19. The Zoological Gardens (Nay Pyi Taw)

In order to promote conservation of wild animals of rare species as well as for public education and recreation the Ministry of Forestry constructed a modern Zoological Garden in 2008 at the new capital of Nay Pyi Taw. It is about 225 hectare large and arrays of animal exhibits are arranged as close as to the nature of the wild animals displayed. The zoo provides the visitors with the opportunity to see the wild animals not only from Myanmar but also those of very rare ones such as white tiger, kangaroo, penguins etc. from the overseas countries. Totally, 900 animals including 90 mammals, 14 reptiles and 70 bird species are displayed. The Zoological Gardens (Nay Pyi Taw) has the potential to carry out international cooperation in the areas of ex-situ conservation, curation, research and animal exchange.

For the goal of *Maintain goods and services and support livelihoods,* Myanmar Forest Policy controls the use of Non-wood Forest Products except for local consumption and also harvesting of timber is regulated by the National Codes of Forest Harvesting and Timber Certification. However there has been no nationally defined progress for the targets and indicators originating from the protection and use of biodiversity in the field of *Protect traditional knowledge, innovations and practices.* This situation is similar in the sphere of the *fair and equitable sharing of benefits of genetic resources and Provision of adequate resources.*

4.2 Progress towards the Goals and Objectives of the Strategic Plan of the Convention

In Myanmar, there is no defined plan for achieving the strategic goals and objectives of CBD. Preparation of NBSAP is still under way. Since an inception workshop for developing NBSAP was held in 2006, Ministry of Forestry is organizing to implement a project for preparation of NBSAP from 2008, November to 2010, supported by UNEP with financial assistance from UNDP Global Environment Facility (GEF). Myanmar is not able to carry out biodiversity conservation within the framework of CBD strategic plans as the National Strategic Plans is yet to be prepared for implementation due to several constraints and lack of capacity. However, Myanmar has prescribed her own sector wise targets and goals in the thirty year master plans as well as in Myanmar Agenda 21. Cross-sector coordination has been taking place to finalize National Sustainable Development Strategy (NSDS) and similarly National Biodiversity Strategy and Action Plan development is in progress of which both process will contribute to the biodiversity conservation in Myanmar in accordance with the convention's objectives.

A project of "Development of National Biosafety Framework Project, Myanmar" was conducted From May 2004 to November 2006, with the assistance of GEF and UNEP with the object to support biotechnology development while guarding the national biodiversity in sustainable way as well as ensuring human health. At the completion of the project a draft on "National Biosafety Framework" and a draft on "Law on Biosafety" were produced in Myanmar and English versions both, and have been submitted to higher authority for approval.

Box 20. Environment Conservation Committee

In order to promote sustainable development of the country, maintaining environment has become crucial importance. Envisaging this fact, Environment Conservation Committee was formed in Myanmar since November, 2004. The Committee is organized with the minister, Ministry of Forestry as Chairman, the Minister of Ministry of Mines as Vice Chairman, Deputy Ministers from related seven Ministries as members and Director General of Forest Department and Department of Mines are secretary and Joint Secretary respectively.

Soon after its set up, the Committee developed strategies and prepared an action plan to implement environmental conservation activities in the entire country. In implementing the action plan, the Committee Member Deputy Ministers who are also leaders of special task forces meet the concerned authorities in States and Divisions and coordinate among various stakeholders carrying out environment conservation efforts. In doing so, the special task force leaders, the Deputy Ministers, observe and gather particular environmental issues in their responsible areas and advise measures to be taken by the environment conservation groups concerned. Progressive reports on environment conservation by States and Division are forwarded by the Deputy Ministers to the Chairman of the Environment Committee. All the reports are discussed at the Quarterly Meeting. The Committee adopted the Environment Conservation Program in the States and Divisions which focused on the following areas;

- to carry out public education and awareness program on environment conservation;
- to eradicate shifting cultivation;
- to conserve the coastal and delta mangrove forests;
- to supervise systematic disposal of wastes from the industries;
- to monitor the environmental impacts in mining areas;
- to do efforts to promote air quality in Yangon and Mandalay Cities;
- to organize local peoples' participation in greening Dry Zone;
- to preserve snow-capped mountains in collaboration with all stake-holders;
- to prevent forest fire in border areas so as to control haze pollution in the region and
- to promote Cities from each states and divisions to achieve ASEAN Environmentally Sustainable City Award.

The Environment Conservation Committee has been monitoring the implementation of environment conservation activities by its members in the country and is giving necessary advices to achieve success.

Box 21. People participation in Biodiversity Conservation; Case Study; Popa Mountain Park

People participation plays a crucial role in biodiversity conservation and sustainable development of the country. As people participation is one of the six policy imperatives highlighted in the Myanmar Forest Policy, the Forest Department is implementing the conservation activities through the participation of the local community. An example of this was observed in the Popa Mountain Park, one of the protected areas and famous tourism site in the country, which was established in 1989.

The Forest Department introduced the agroforestry for the villagers to abandon the age-old practice of growing banana alone which severely causes soil deterioration as well as loss of biodiversity. Owing to hard efforts of Forest Department, many local people living around the park are getting aware of much benefits derived from this agroforestry and stated growing high cash yielding fruit trees such as mango, cashew nut, jackfruit, sunflower, custard apple and guava etc. knowing that it makes sustainable income-generation for their livelihoods.

4.3 Conclusion

The overall assessment on the data and activities presented in this report indicates that biodiversity conservation activities in Myanmar have been improved to some extent, after acceding to the Convention on Biodiversity and integration in the international legal dimension. It is clear that establishments of Permanent Forest Estates including Protected Areas in Myanmar have been increased after joining the Convention. Also Myanmar is conducting various wildlife conservation and management programmes in order to improve conservation and sustainable use of biodiversity such as preparation of National Tiger Action Plan, jointly conducted with Wildlife Conservation Society (WCS) in 2002. Like other developing countries, anthropogenic activities leading to habitat degradation and loss of biodiversity are inevitable. For the fair and equitable sharing of benefits arising out of the utilization of the genetic resources, certain activities including project on Community Based Natural Resource Management in some protected areas are able to be initiated.

Regarding the implementation of activities outlined by the Convention, Myanmar has successfully implemented most of the actions in the various fields of biodiversity conservation. Examples of some successful actions taken are as follows;

- About 30 % of the country area has been established as Permanent Forest Estates (PFE).
- The National Bio-safety Framework and National Sustainable Development Strategy are being drafted.
- Myanmar Agenda 21 has been formulated.
- The development of NBSAP has been initiated.

Although some actions are on progress, there are gaps in the field of the fair and equitable sharing of benefits arising out of the utilization of natural resources. Moreover, monitoring and evaluation activities are needed to be strengthened for most of the projects conducted to achieve the objectives of the convention.

From Myanmar perspectives, implementation of the CBD objectives and its 2010 targets are being carried out by all Government Agencies and stakeholders concerned. For better implementation of CBD-related activities in future, the following issues will have to be improved, promoted, strengthened and developed.

- Application of ecosystem approach
- Development of a national land-use policy
- Mainstreaming biodiversity conservation into land-use practices
- Narrowing the scientific gaps in biodiversity conservation and management
- Strengthening cross-sectoral coordination among stakeholders
- Promoting environmental awareness among the public and local authorities concerned
- Strengthening capacity building and institutional capabilities of biodiversity-related institutions
- Promoting biodiversity research database establishment and assessment periodically
- Establishing financial mechanism to ensure adequate financial supports for biodiversity conservation

As biodiversity conservation is a global concern, close cooperation and collaboration from the outside agencies are also needed. The following challenges have been encountered and they need an urgent attention.

- Outside agencies rarely provide technical and financial assistance on account of Myanmar internal affairs

- There is budget and financial constraints for biodiversity conservation
- Specialized units for biodiversity conservation plan and management at national level should be strengthened
- With a view to biodiversity conservation, the sense of ownership of local communities and stakeholders should be enhanced.
- Effective and scientific management of terrestrial and marine protected areas should be promoted to meet representative samples of ecosystems particularly to those of marine and coastal.
- It is also in need of law enforcement to check the loss of biodiversity outside protected areas, and
- Development of national biodiversity indicators is urgently needed.

For effective implementation of the convention, the following actions will be taken by biodiversity-related institutions and stakeholders.

- Incorporate issues of biodiversity conservation in the context of education for sustainable development at schools and universities.
- Build up institutional capacity of the existing biodiversity conservation programmes
- Increase level of public awareness on environmental issues and motivate local communities to participate in nature protection activity.
- Respect traditional knowledge in order to incorporate in the area of community based natural resource management.
- Improve mechanism for sustainable financial assistance for biodiversity conservation.
- Network biodiversity conservation activities among stakeholders.
- Transfer technology on biodiversity, biotechnology and biosafety, and
- Exercise access to genetic resources and benefit sharing arising out of the utilization of the genetic resources.

Appendix III – Progress towards Targets of the Global Strategy for Plant Conservation and the Programme of Work on Protected Areas

A. Progress towards Targets of the Global Strategy for Plant Conservation

Targets	Progress
Target 1: A widely accessible working list of known plant species, as a step towards a complete world flora.	A Checklist of the Trees, Shrubs, Herbs, and Climbers recorded from Myanmar had been revised form the original works by J. H. Lace, R. Rodger, H. G. Hundley, and U Chit Ko Ko in 2003 with the cooperation of Forest Department of Myanmar and Smithsonian Institution, USA. A project of Inventory on the Useful Plants in Myanmar is being conducted jointly by Forest Department and Makino Botanical Garden, Japan. Review and updated information for plant species are needed to achieve the target.
Target 2 : Development of models with protocols for plant conservation and sustainable use, based on research and practical experience	A Protection of Wildlife and Wild Plant and Conservation of Natural Areas Law was promulgated in 1994 in order to protect endangered species of wild flora and fauna and their habitats. Guidelines and regulations for Orchid farms had been formulated to ensure conservation and sustainable use of Orchids. Recently, a total of 6 private farms have been registered for commercial purpose. Regular inspections are being conducted at each farm.
Target 3 : Effective conservation of ecological regions	Ten bio-units have been recognized. Reserved forests covering some over 23% of the country's areas are being incorporated with specific management regimes which ensure to meet the goals of sustainable forest management and ecosystem services. Since these reserved forests are located throughout the country and are legally protected and scientifically managed effective conservation of ecological regions can be realized. Besides, network of protected area systems established pertaining to snow-capped mountains and high altitude wetlands in the far north to evergreen forest and deciduous complexes, dry and sub-humid land in the central part, diversity of river and fresh water bodies to deltaic and coastal complexes are permanently conserved to demonstrate Myanmar is committed to this target.
Target 4 : Protection of the most important areas for plant diversity	Northern Forest Complexes made up of four wildlife sanctuaries covering some 30,205 km^2 are considered as the most important areas for plant diversity. Since its north part connects eastern Himalayan with its west scientists believe that species found in east and west Himalaya can exist here. Presently, this region is very rich with biodiversity. For example, pristine forests ranging from tropical evergreen to alpine are found intact in large areas. Frequent sightings of such flagship specious of Asian big cats including tigers and elephants indicate biodiversity richness and ecosystem health. Large flat plains with temporary flood of fresh water are typical habitats for a number of wildlife and bird species and hunting ground for the tigers in this northern forest complex.
Target 5: Management of production lands consistent with the conservation of plant diversity.	In order to achieve reservation of 30% of total country area targeted in 30 year forestry master plan, 22.37% has been reserved as production lands consistent with the conservation of plant diversity.

Target 6: **In-situ** conservation of threatened species	38 plant species was recorded and have been assessed as globally threatened, comprising 33 species of angiosperm and five species of gymnosperm. 43 Protected Areas of notified and proposed are established for the protection and conservation of threatened species as in-situ conservation.
Target 7: **Ex-situ** collections of threatened plant species	589 tree species, 75 bamboos, 75 crotons, 270 orchids and 410 medicinal plants including the 38 globally threatened plant species are planted in the National Kandawgyi Botanical Gardens as ex-situ conservation. In addition, a National Herbal Park and local herbal nurseries are also established.
Target 8: Conservation of genetic diversity of crops and other major socio-economically valuable plant species	Systematic plant genetic resources management is being implemented at Central Agricultural Research Institute and crop varieties were collected and maintained at Seed Bank. A project of inventory on the useful plants in Myanmar is being conducted jointly organized by Forest Department and Makino Botanical Garden, Japan. Currently, Forest Department has been reviewing to amend the existing Protection of Wildlife and Natural Areas Law in order to meet the present requirement and that of CITES.
Target 9: Management plan for alien species	A focal point to Alien Species Network was nominated. A total of 60 alien species are recorded in Myanmar and management plan to control the invasion of these species is under process.
Target 10: No species of wild flora endangered by international trade	Myanmar acceded to CITES in 1997 and exercising the regulations of the convention to control international trade of endangered plant species. At regional level, Myanmar joined the implementation of ASEAN Wildlife Enforcement Network established in 2005 and consequently organized the National Wildlife Enforcement Taskforce including relevant agencies such as Forest Customs, Police Force, Department of Fisheries, etc.
Target 11: Plant-based products derived from sources that are sustainably managed	Most of all plant-based forest products are controlled by Myanmar Forest Law(1992), Community Forestry Instructions(1995) and Timber Certification with relevant criteria and indicators of International Tropical Timber Organization in order to ensure sustainable management.
Target 12: Communication, education and public awareness programmes for the importance of plant diversity	Nature and Wildlife Conservation Division, Forest Department establishes education center in each protected areas. CEPA programmes were conducted for the public visiting the parks and wildlife centuries. Park staff carry out education on biodiversity conservation at village schools. The local NGOs also collaborate with NWCD in this activity.
Target 13: Capacity building programmes	University of Forestry, Forest Research Institute, Department of Agricultural Research, University of Agriculture, Central Forestry Development and Training Center, Myanmar Forest School, etc. are giving the training programmes to the Government staff and people working in plant conservation.

Target 14: Networks of plant conservation activities	Ministry of Forestry, Ministry of Agriculture and Irrigation, local communities, stakeholders, NGOs such as Forest Resources Environment and Development Association (FREDA), Myanmar Floristic Association, INGOs such as Botanic Gardens Conservation International (BGCI), Makino Botanical Garden(MBK), Japan International Cooperation Agency(JICA) are cooperating as a network of plant conservation activities.

B. Progress towards Targets of the Programme of Work on Protected Areas

Target	Progress
Target 1: To establish a network of protected areas covering 5% of the total area of the country by the year 2010.	At the moment, about 3.93% of the total area of the country had been notified as Protected Areas and about 3.73% had been proposed to establish as Protected Areas.
Target 2: To establish and strengthen trans-boundary protected areas.	To enhance the conservation and sustainable use of biological diversity and improving international cooperation, Myanmar is trying to extend the area of Hukaung Valley wildlife sanctuary, important tiger conservation area in northern Myanmar, in order to integrate Nandapha Tiger Reserve in India representing a refuge for a trans-boundary tiger population. Myanmar Forest Department started the Northern Forest Complex project in 2003. It comprises totally four protected areas together constitute the largest contiguous block of protected areas in mainland Indochina covering an area of 30205 km^2. Being a member of ICIMOD, Myanmar has been implementing high altitude wetland conservation activities with the collaboration of China intend to protect the head waters of the Ayeyarwaddy, the major river of the country.
Target 3: To improve site-based protected area planning and management	In order to achieve one of the imperatives of Myanmar Forest Policy to enhance people participation, Forest Department is formulating effective protected area management plans by consultation with the local people and stakeholders. At present, management plans for Khakaborazi National Park and Hukaung Valley Wildlife Sanctuary had been formulated and programmes to be implemented are in process. In addition, Community Based Natural Resources Management Programmes are being introduced into protected areas management to achieve sustainable use of natural resources.
Target 4: To prevent and mitigate the negative impacts of key threats to protected areas.	To mitigate the encroachment into protected areas, buffer zone management systems are being implementing in most of the protected areas. Also, law enforcement activities such as establishing a national wildlife enforcement taskforce, setting up of Elephant Protection Unit and Tiger Protection Unit, effective patrolling activities, education and awareness programmes etc. are being conducted. Moreover, modern agricultural techniques for sustainable land-use systems have been introduced to minimize shifting cultivation in protected areas.
Target 5: To promote equity and benefit sharing.	Community Based Resources Management programmes are being introduced into protected area management systems for the equitable sharing of both cost and benefits.
Target 6: To enhance and secure involvement of indigenous and local communities and relevant stakeholders.	Myanmar Forest Law (1992) allows property rights and privileges for people living in and around the protected areas. Village-use zones are also designated based on the village consultation processes conducted in protected areas.

	Participation of local people is being encouraged by conducting public awareness and education programmes and recruiting local people as field staff in conservation activities and protected area management. Multi-stakeholders meetings are also held to enhance and secure involvement of their participation in protected area management.
Target 7: To provide an enabling policy, institutional and socio-economic environment for protected areas.	Myanmar Forest Policy (1995) was formulated mainly for safeguarding soil, water catchments, ecosystems, biodiversity and plant and animal genetic resources, scenic reserves and national heritage sites. Relevant institutions such as forestry, fisheries, irrigation, mining, local authorities etc. are cooperating for effective protected area management. Also, socio-economic surveys are conducted to be considered in the preparation of management plan.
Target 8: To build capacity for the planning, establishment and management of protected areas.	Training programmes for planning, establishment, and management of protected areas are being given at various institutions such University of Forestry, Central Forest Development Training Centre and Myanmar Forest School. In addition, field staffs are provided to participate in national, regional and international workshops, meetings, seminars and trainings for strengthening their knowledge and skills.
Target 9: To ensure financial sustainability of protected areas	The Government of the Union of Myanmar is cooperating with NGOs and INGOs such as Wildlife Conservation Society, California Academy of Science, Conservation International, JICA, MBK, FAO etc. to ensure financial assistance for establishment and maintenance of protected areas.
Target 10: To strengthen communication, education and public awareness.	Education and public awareness programmes, training, seminars, workshops for decision and policy makers, students down to high school level, governmental staff, local communities, all stakeholders are being conducted throughout the country by GOs, NGOs, private organizations for understanding and appreciation of the importance and benefits of protected areas.
Target 11: To evaluate and improve the effectiveness of protected areas management.	Based on the adopted management plan, monitoring, evaluating of protected areas management are carried out regularly in each protected areas. Three monthly reports for progress have been submitted to higher authorities and analyzed to improve and amend the existing management plan. At the moment completion report of elephant survey jointly implemented with Forest Department and WCS in Hukaung Valley Wildlife Sanctuary, and medicinal plants survey conducted by Forest Department and Makino Botanical Garden, Japan in Natmataung National Park had been submitted. Furthermore, other scientific research activities such as occupancy of tiger and prey species, herpetological survey, home-range analysis of wild elephants etc. are still conducted and submitted as interim reports.

Target 12: To assess and monitor protected area status and trends.	At national level, 34 protected areas had been notified covering about 3.93% of the area of the country and 9 are still being proposed with the coverage of 3.73%. Regionally, the ASEAN Heritage Parks Programme is designed to complement the protection of several Natural World Heritage Sites within ASEAN countries and will form an important part of ASEAN's efforts to meet the UN Millennium goals on the environment with respect to reducing biodiversity loss. A total of 27 national protected areas in the region are designated as ASEAN Heritage in 2003. Among these parks, Myanmar contributes six protected areas which occupied 22% of the total sites.

ABBREVIATIONS USED IN THE TEXT

1.	ACB	ASEAN Centre for Biodiversity
2.	AESG	Asian Elephant Specialist Group
3.	AI	Artificial Insemination
4.	AKNP	Alaungdaw Kathapa National Park
5.	ARDC	Agricultural and Rural Development Corporation
6.	ASEAN SOE	ASEAN State of Environment
7.	ASEAN	Association of South East Asian Nations
8.	BB	Bacterial Blight
9.	BIMSTEC	Bay of Bengal Initiative for Multi-sectoral Technical and Economic Cooperation
10.	BPH	Brown Plant Hopper
11.	CAS	California Academy of Science
12.	CBD	Convention on Biological Diversity
13.	CGIAR	Consultative Group on International Agricultural Research
14.	CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
15.	DAR	Department of Agricultural Research
16.	DOF	Department of Fisheries
17.	DZGD	Dry Zone Greening Department
18.	EEZ	Exclusive Economic Zone
19.	EIA	Environmental Impact Assessment
20.	FAO	Food and Agricultural Organization
21.	FD	Forest Department
22.	FIC	Food Industry Cooperation
23.	FRA	Forest Resource Assessment
24.	GEF	Global Environment Facility
25.	GMO	Genetically Modified Organism
26.	GTF	Global Tiger Forum
27.	HWS	Htamanthi Wildlife Sanctuary
28.	IAS	Invasive Alien Species
29.	ICIMOD	International Center for Integrated Mountain Development
30.	ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
31.	IGES	Institute of Global Environmental Strategies
32.	IOSEA	Indian Ocean and South-East Asia
33.	IPR	Intellectual Property Right
34.	IRRI	International Rice Research Institute
35.	ISDP	Information System Development Project for the Management of Tropical Forests
36.	IUCN	International Union for Conservation of Nature
37.	IUCN/SSC	IUCN/Species Survival Commission
38.	JICA	Japanese International Co-operation Agency
39.	MBK	Makino Botanical Garden (Japan)
40.	MCE	Multiplication, Characterization, and Evaluation activities
41.	MEA	Multi lateral Environmental Agreement
42.	MKWS	Meinmahla-Kyun Wildlife Sanctuary
43.	MOAI	Ministry of Agriculture and Irrigation
44.	MoU	Memorandum of Understanding
45.	MSY	Maximum Sustainable Yield
46.	MV	Modern Varieties

47.	NBC	National Biosafety Committee
48.	NBF	National Biodiversity Framework
49.	NBSAP	National Biodiversity Strategy and Action Plan
50.	NCA	National Competent Authorities
51.	NCC	National Coordinating Committee
52.	NCEA	National Commission for Environmental Affairs
53.	NFC	Northern Forest Complex
54.	NFMP	National Forest Master Plan
55.	NGO	Non-governmental Organization
56.	NIAS	National Institute of Agro-biological Sciences
57.	NRB	National Pesticide Registration Board
58.	NSC	National Seed Committee
59.	NSDS	National Sustainable Development Strategy
60.	PFE	Permanent Forest Estate
61.	PGR	Plant Genetic Resources
62.	SDS-PAGE	Sodium Dodicyl Sulphate Polyacrylemide Gel Electrophoresis
63.	SEAFDEC	Southeast Asian Fisheries Development Center
64.	SFM	Sustainable Forest Department
65.	SI	Smithsonian Institution
66.	SMTA	Standard Material Transfer Agreement
67.	TC	Technical co-operation
68.	TCP	Technical co-operation Program
69.	UNCCD	United Nations Convention on Combating Desertification
70.	UNCED	United Nations Commission on Economic Development
71.	UNDP	United Nations Development Programme
72.	UNEP	United Nations Environment Programme
73.	UNEP-ROAP	United Nations Environment Programme- Regional Office for Asia and the Pacific
74.	VEM	Village Extension Manager
75.	WCS	Wildlife Conservation Society
76.	WDCS	Whale and Dugong Conservation Society
77.	WPA	World Pheasant Association
78.	WSSD	World Summit on Sustainable Development
79.	YAU	Yezin Agricultural University

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ATTACHMENT 1

Preliminary list of globally threatened species in Myanmar

No.	Scientific Name	Common Name	Global Threat Status			Selection Criteria for Priority Species		
			Critically Endangered	Endangered	Vulnerable	Myanmar Supports Singatificant Population	Species-focused Action Required	Need for Additional Investment
	MAMMALS		**4**	**9**	**26**			
1	*Ailurus fulgens*	Red Panda		EN		Yes	Yes	High
2	*Bos gaurus*	Gaur			VU	Yes	No	N/A
3	*Bos javanicus*	Banteng		EN		Yes	No	N/A
4	*Bubalus bubalis*	Wild Water Buffalo		EN		Yes	Yes	High
5	*Budorcas taxicolor*	Takin			VU	Yes	Yes	High
6	*Bunipithecus hoolock*	Hoolock Gibbon		EN		Yes	Yes	Medium
7	*Callosciurus pygerythrus*	Irrawaddy Squirrel			VU	Yes	No	N/A
8	*Callosciurus quinquestriatus*	Anderson's Squirrel			VU	Yes	No	N/A
9	*Capricornis sumatraensis*	Southern Serow			VU	Yes	No	N/A
10	*Catopuma temminckii*	Asian Golden Cat			VU	Yes	Yes	High
11	*Cervus eldii*	Eld's Deer			VU	Yes	Yes	Medium
12	*Craseonycteris thonglongyai*	Kitti's Hog-nosed Bat		EN		Yes	Yes	High
13	*Cuon alpinus*	Dhole			VU	Yes	No	N/A
14	*Dicerorhinus sumatrensis*	Hairy Rhinoceros	CR			Yes	Yes	High
15	*Elephas maximus*	Asian Elephant		EN		Yes	Yes	Medium
16	*Hylopetes alboniger*	Particolored Flying Squirrel		EN		Yes	No	N/A
17	*Hystrix brachyura*	East Asian Porcupine			VU	Yes	No	N/A
18	*Lutra lutra*	Eurasian Otter			VU	Yes	No	N/A
19	*Lutrogale perspicillata*	Smooth-coated Otter			VU	Yes	No	N/A
20	*Macaca arctoides*	Bear Macaque			VU	Yes	No	N/A
21	*Macaca assamensis*	Assamese Macaque			VU	Yes	No	N/A
22	*Macaca leonina*	Northern Pig-tailed Macaque			VU	Yes	No	N/A
23	*Muntiacus crinifrons*	Black Muntjac			VU	Yes	Yes	High
24	*Mustela strigidorsa*	Stripe-backed Weasel			VU	Yes	No	N/A
25	*Naemorhedus baileyi*	Red Goral			VU	Yes	Yes	High
26	*Naemorhedus caudatus*	Long-tailed Goral			VU	Yes	No	N/A
27	*Neofelis nebulosa*	Clouded Leopard			VU	Yes	Yes	High
28	*Panthera tigris*	Tiger		EN		Yes	Yes	High
29	*Pardofelis marmorata*	Marbled Cat			VU	Yes	Yes	High
30	*Pipistrellus anthonyi*	Anthony's Pipistrelle	CR			Yes	Yes	High
31	*Pipistrellus joffrei*	Joffre's Pipistrelle	CR			Yes	Yes	High
32	*Prionailurus planiceps*	Flat-headed Cat			VU	No	N/A	N/A
33	*Prionailurus viverrinus*	Fishing Cat			VU	Yes	No	N/A
34	*Rattus sikkimensis*	Sikkim Rat			VU	Yes	No	N/A
35	*Rhinoceros sondaicus*	Lesser One-horned Rhinoceros	CR			Yes	Yes	High
36	*Tapirus indicus*	Asian Tapir			VU	Yes	Yes	High
37	*Trachypithecus pileatus*	Capped Leaf Monkey		EN		Yes	Yes	High

No.	Scientific Name	Common Name	Global Threat Status			Selection Criteria for Priority Species		
			Critically Endangered	Endangered	Vulnerable	Myanmar Supports Singatificant Population	Species-focused Action Required	Need for Additional Investment
38	*Ursus thibetanus*	Asian Black Bear			VU	Yes	Yes	High
39	*Vernaya fulva*	Vernay's Climbing Mouse			VU	Yes	No	N/A
	BIRDS		**4**	**8**	**33**			
40	*Aceros nipalensis*	Rufous-necked Hornbill			VU	Yes	No	N/A
41	*Aceros subruficollis*	Plain-pouched Hornbill			VU	Yes	No	N/A
42	*Alcedo euryzona*	Blue-banded Kingfisher			VU	Yes	No	N/A
43	*Anas formosa*	Baikal Teal			VU	No	N/A	N/A
44	*Apus acuticauda*	Dark-rumped Swift			VU	No	N/A	N/A
45	*Aquila clanga*	Greater Spotted Eagle			VU	No	N/A	N/A
46	*Aquila heliaca*	Imperial Eagle			VU	No	N/A	N/A
47	*Ardea insignis*	White-bellied Heron		EN		Yes	Yes	High
48	*Aythya baeri*	Baer's Pochard			VU	Yes	No	N/A
49	*Brachypteryx hyperythra*	Rusty-bellied Shortwing			VU	Yes	No	N/A
50	*Cairina scutulata*	White-winged Duck		EN		Yes	Yes	High
51	*Chrysomma albirostre*	Jerdon's Babbler			VU	No	N/A	N/A
52	*Ciconia boyciana*	Oriental Stork		EN		No	N/A	N/A
53	*Ciconia stormi*	Storm's Stork		EN		No	N/A	N/A
54	*Columba punicea*	Pale-capped Pigeon			VU	Yes	No	N/A
55	*Eurynorhynchus pygmeus*	Spoon-billed Sandpiper			VU	No	N/A	N/A
56	*Falco naumanni*	Lesser Kestrel			VU	No	N/A	N/A
57	*Gallinago nemoricola*	Wood Snipe			VU	No	N/A	N/A
58	*Grus antigone*	Sarus Crane			VU	Yes	Yes	Medium
59	*Gyps bengalensis*	White-rumped Vulture	CR			Yes	Yes	High
60	*Gyps tenuirostris*	Slender-billed Vulture	CR			Yes	Yes	High
61	*Haliaeetus leucoryphus*	Pallas's Fish-eagle			VU	No	N/A	N/A
62	*Heliopais personata*	Masked Finfoot			VU	Yes	Yes	High
63	*Leptoptilos dubius*	Greater Adjutant		EN		No	N/A	N/A
64	*Leptoptilos javanicus*	Lesser Adjutant			VU	Yes	Yes	High
65	*Lophophorus sclateri*	Sclater's Monal			VU	Yes	No	N/A
66	*Mergus squamatus*	Scaly-sided Merganser		EN		No	N/A	N/A
67	*Otus sagittatus*	White-fronted Scops-owl			VU	Yes	No	N/A
68	*Pavo muticus*	Green Peafowl			VU	Yes	Yes	High
69	*Pelecanus philippensis*	Spot-billed Pelican			VU	Yes	No	N/A
70	*Pitta gurneyi*	Gurney's Pitta	CR			Yes	Yes	High
71	*Pycnonotus zeylanicus*	Straw-headed Bulbul			VU	No	N/A	N/A
72	*Rhodonessa caryophyllacea*	Pink-headed Duck	CR			Yes	Yes	High
73	*Rynchops albicollis*	Indian Skimmer			VU	No	N/A	N/A
74	*Sitta formosa*	Beautiful Nuthatch			VU	Yes	No	N/A
75	*Sitta magna*	Giant Nuthatch			VU	Yes	No	N/A
76	*Sitta victoriae*	White-browed Nuthatch		EN		Yes	Yes	High

No.	Scientific Name	Common Name	Global Threat Status			Selection Criteria for Priority Species		
			Critically Endangered	Endangered	Vulnerable	Myanmar Supports Singatificant Population	Species-focused Action Required	Need for Additional Investment
77	*Spizaetus nanus*	Wallace's Hawk-eagle			VU	No	N/A	N/A
78	*Stachyris oglei*	Snowy-throated Babbler			VU	Yes	No	N/A
79	*Syrmaticus humiae*	Hume's Pheasant			VU	Yes	No	N/A
80	*Tragopan blythii*	Blyth's Tragopan			VU	Yes	No	N/A
81	*Treron capellei*	Large Green-pigeon			VU	No	N/A	N/A
82	*Tringa guttifer*	Spotted Greenshank		EN		Yes	No	N/A
83	*Turdoides longirostris*	Slender-billed Babbler			VU	No	N/A	N/A
84	*Turdus feae*	Grey-sided Thrush			VU	Yes	No	N/A
	REPTILES		**4**	**10**	**7**			
85	*Amyda cartilaginea*	Asiatic Softshell Turtle			VU	Yes	Yes	High
86	*Batagur baska*	Mangrove Terrapin	CR			Yes	Yes	High
87	*Chitra vandijki*	Burmese Frog-faced Softshell Turtle		EN*		Yes	Yes	High
88	*Crocodylus siamensis*	Siamese Crocodile	CR			Yes	Yes	High
89	*Cuora amboinensis*	Asian Box Turtle			VU	Yes	Yes	Low
90	*Geochelone platynota*	Burmese Star Tortoise	CR			Yes	Yes	High
91	*Heosemys depressa*	Arakan Forest Turtle	CR			Yes	Yes	High
92	*Heosemys grandis*	Giant Asian Pond Turtle			VU	Yes	Yes	Low
93	*Heosemys spinosa*	Spiny Turtle		EN		Yes	Yes	Medium
94	*Hieremys annandalii*	Yellow-headed Temple Turtle		EN		Yes	Yes	High
95	*Indotestudo elongata*	Elongated Tortoise		EN		Yes	Yes	Medium
96	*Kachuga trivittata*	Burmese Roofed Turtle		EN		Yes	Yes	High
97	*Manouria emys*	Asian Giant Tortoise		EN		Yes	Yes	High
98	*Manouria impressa*	Impressed Tortoise			VU	Yes	Yes	High
99	*Morenia ocellata*	Burmese Eyed Turtle			VU	Yes	Yes	High
100	*Nilssonia formosa*	Burmese Peacock Softshell		EN		Yes	Yes	High
101	*Notochelys platynota*	Malayan Flat-shelled Turtle			VU	No	N/A	N/A
102	*Pelochelys cantorii*	Asian Giant Softshell Turtle		EN		Yes	Yes	High
103	*Platysternon megacephalum*	Big-headed Turtle		EN	Yes	Yes	High	
104	*Pyxidea mouhotii*	Keeled Box Turtle		EN	Yes	Yes	Medium	
105	*Siebenrockiella crassicollis*	Black Marsh Turtle		VU	Yes	Yes	Low	
	INVERTEBRATES		**0**	**0**	**1**			
106	*Euploea andamanensis*	Andaman Crow		VU	N/A	N/A	N/A	
	PLANTS		**13**	**12**	**13**			
107	*Afzelia xylocarpa*			EN	N/A	N/A	N/A	
108	*Anisoptera costata*			EN	N/A	N/A	N/A	
109	*Anisoptera scaphula*	CR			N/A	N/A	N/A	
110	*Aquilaria malaccensis*			VU	N/A	N/A	N/A	

No.	Scientific Name	Common Name	Global Threat Status			Selection Criteria for Priority Species		
			Critically Endangered	Endangered	Vulnerable	Myanmar Supports Singatificant Population	Species-focused Action Required	Need for Additional Investment
111	*Burretiodendron esquirolii*			VU	N/A	N/A	N/A	
112	*Calocedrus macrolepis*			VU	N/A	N/A	N/A	
113	*Cephalotaxus mannii*			VU	N/A	N/A	N/A	
114	*Cleidiocarpon cavaleriei*			VU	N/A	N/A	N/A	
115	*Cleidiocarpon laurinum*			EN	N/A	N/A	N/A	
116	*Cycas siamensis*				VU	N/A	N/A	N/A
117	*Dalbergia oliveri*			EN		N/A	N/A	N/A
118	*Dipterocarpus alatus*			EN		N/A	N/A	N/A
119	*Dipterocarpus baudii*		CR			N/A	N/A	N/A
120	*Dipterocarpus costatus*			EN		N/A	N/A	N/A
121	*Dipterocarpus dyeri*		CR			N/A	N/A	N/A
122	*Dipterocarpus gracilis*		CR			N/A	N/A	N/A
123	*Dipterocarpus grandiflorus*		CR			N/A	N/A	N/A
124	*Dipterocarpus kerrii*		CR			N/A	N/A	N/A
125	*Dipterocarpus retusus*				VU	N/A	N/A	N/A
126	*Dipterocarpus turbinatus*		CR			N/A	N/A	N/A
127	*Hopea apiculata*		CR			N/A	N/A	N/A
128	*Hopea ferrea*		EN			N/A	N/A	N/A
129	*Hopea griffithii*				VU	N/A	N/A	N/A
130	*Hopea helferi*		CR			N/A	N/A	N/A
131	*Hopea odorata*				VU	N/A	N/A	N/A
132	*Hopea sangal*		CR			N/A	N/A	N/A
133	*Intsia bijuga*				VU	N/A	N/A	N/A
134	*Magnolia rostrata*				VU	N/A	N/A	N/A
135	*Parashorea stellata*		CR			N/A	N/A	N/A
136	*Picea farreri*			EN		N/A	N/A	N/A
137	*Pterocarpus indicus*				VU	N/A	N/A	N/A
138	*Shorea farinosa*		CR			N/A	N/A	N/A
139	*Shorea gratissima*			EN		N/A	N/A	N/A
140	*Shorea henryana*			EN		N/A	N/A	N/A
141	*Shorea roxburghii*			EN		N/A	N/A	N/A
142	*Taiwania cryptomerioides*				VU	N/A	N/A	N/A
143	*Vatica cinerea*			EN		N/A	N/A	N/A
144	*Vatica lanceaefolia*		CR			N/A	N/A	N/A
	Total		**25**	**39**	**80**			

Note: * = this species has recently been split from the Endangered Narrow-headed Softshell Turtle Chitra indica (McCord and Prit=chard 2002). However,there has been no re-assessment of the global threat status of Chitra sp.since this split.

ATTACHMENT 2

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							Central Myanmar Mixed Deciduous Forests	No
2	Ayeyarwady Delta: Meinhla Kyun		+	+		PA	IBA	No	No
3	Ayeyarwady River: Bagan Section		+	+			IBA	No	No
4	Ayeyarwady River: Bhamo to Shwegu Section		+				IBA	No	No
5	Ayeyarwady River: Moda Section		+				IBA	No	No
6	Ayeyarwady River: Myitkyina to Sinbo Section		+				IBA	No	No
7	Ayeyarwady River: Sinbyugyun to Minbu Section						IBA	No	No
8	Ayeyarwady 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
13	Chatthin	+	+			PA	IBA	Central Myanmar Dry Deciduous Fores	No
14	Chaungmagyi reservior		+				IBA	No	No
16	Dawna Range	+						No	No
17	Gyobin	+	+				IBA	No	No
18	Hkakaborazi	+	+	+		PA	IBA	Nothern Mountains Forest Complex	No
19	Hpa-an	+						No	No
20	Hponkanrazi	+	+		+	PA	IBA	Nothern Mountains Forest Complex	No
21	Htamanthi	+	+		+	PA	IBA	Upper Chindwin Lowlands	No
22	Htaung Pru	+						Sundaic Subregion (Tanntharyi)	No
23	Hukaung Valley	+	+		+	PA	IBA	Upper Chindwin Lowlands	No
24	Indawgyi	+	+			PA	IBA	No	No
25	Inle Lake		+	+		PA	IBA	No	No
27	Kamaing		+				IBA	No	No
29	Kawthaung District Lowlands		+				IBA	Sundaic Subregion (Tanintharyi)	No
30	Kennedy Peak		+				IBA	Chin Hills Complex	No
31	Khaunglanpu	+						Northern Mountains Forest Complex	No

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
32	Kyauk Pan Taung		+			PA	IBA	Chin Hills Complex	No
33	Kyee-ni Inn		+				IBA	No	No
34	Lampi Island		+			PA	IBA	Sundaic Subregion (Tanintharyi)	No
35	Lenya		+				IBA	Sundaic Subregion (Tanintharyi)	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
42	Momeik-Mabein	+						No	No
43	Moyingyi		+			PA	IBA	No	No
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
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 (Tanintharyi)	No
59	Panlaung-Pyadalin Cave	+				PA		No	No
60	Paunglaung Catchment Area	+						No	No
61	Pe River Valley (Mintha Ext Reserve Forest)	+						Sundaic Subregion (Tanintharyi)	No
62	Peleik Inn		+				IBA	No	No
64	Saramati Taung	+						No	No
65	Shinmataung		+				IBA	No	No

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
68	Tanai River	+	+			PA	IBA	Upper Chindwin Lowlands	No
69	Tanintharyi National Park	+	+			PA	IBA	Sundaic Subregion (Tanintharyi)	No
70	Tanintharyi Nature Reserve	+						Sundaic Subregion (Tanintharyi)	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

ATTACHMENT 3

Preliminary list of conservation corridors in Myanmar

No.	Conservation Corridor	KBAs	Area (km2)	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	Ayeyarwady Delta	Ayeyarwady Delta: Meinmahla Kyun	5,300	Mangrove Terrapin		migration/ ofshorebirds; recruitment of fish	High
2	Bago Yoma Range	Central Bago Yoma; North Zarmayi	17,800	Asian Elephant; Banteng	Asian Elephant		High
3	Central Ayeyarwady River	Ayeyarwady River: Bagan Section; Ayeyarwady River: Bhamo to Shwegu Section; Ayeyarwady River: Moda Section; Ayeyarwady River: Myitkyina to Sinbo Section; Ayeyarwady River: Sinbyugyun to Minbu Section; Ayeyarwady 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	Chatthin; Shwesettaw	15,000	Burmese Star Tortoise; White-winged Duck			High
5	Central Myanmar Mixed Deciduous Forests	Alaungdaw Kathapa; Mahamyaing	7,600	Asian Elephant; Banteng;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
10	Naga Hills	Saramati Taung	5,500	Hoolock Gibbon		altitudinal migration of birds	High
11	Nan Yu Range		20,500				High

No.	Conservation Corridor	KBAs	Area (km2)	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
12	Northern Mountains 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 Gibbon	Asian Elephant; Rufous-necked Hornbill	migration of shorebirds; recruitment of fish	High
14	Sundaic Subregion (Tanintharyi)	Central Tanintharyi Coast; Chaungmon-Wachaung; Htaung Pru; Karathuri; Kawthaung District Lowlands; Lampi Island; Lenya; Ngawun; Pachan; Pe River Valley (Mintha Ext RF); Tanintharyi National Park; Tanintharyi 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-wing Duck; Wild Water Buffalo	Asian Elephant; Tiger; White-bellied Heron; sandbar-nesting birds	altitudinal migration of birds; migration of fish	High