THE UNION OF MYANMAR

MINISTRY OF FORESTRY

NATIONAL ACTION PROGRAMME OF MYANMAR TO COMBAT DESERTIFICATION IN THE CONTEXT OF UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION (UNCCD)

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EXECUTIVE SUMMARY

Myanmar is one of the developing countries in Asia severely affected by land degradation and desert-like formation mainly resulting from inappropriate land use practices. Realizing the lead role of the United Nations Convention to Combating Desertification (UNCCD) to resolve environmental and desertification problems at a global scale, Myanmar acceded to UNCCD in January 1997.

The Union of Myanmar is a tropical country in Continental South East Asia with a total land area of 676,577 km^2. The topography is generally low in the coastal and deltaic regions, but rising to about 6,000 m in the rugged north of the country. As mountain ranges generally run in the north to south direction, the major river systems also flow from north to south. Most of Myanmar belongs to the tropical region. It is characterized by a tropical monsoon climate with three well-defined seasons, namely summer, rainy and cool seasons. Annual rainfall in the coastal and deltaic region is as high as 5,000 mm whereas it is only about 600 mm in the Dry Zone of Central Myanmar. During the summer months, i.e. March and April, the highest temperature in the Central Myanmar is above 43° C while it is about 36° C in Northern Myanmar and 29°C on Shan Plateau in the east.

Myanmar is basically an agricultural country, and hence the agricultural sector has been designated as the main pillar of the country's economy. The population is estimated at 52.43 million as of 1st of January 2003. More than 70% of the population are living in rural areas, and 65% of the total labour force are engaged in the agricultural sector. Agricultural development strategy includes the encouragement of double cropping and multi-cropping through the expansion of irrigation facilities such as construction of dams and river-water pumping stations.

In Myanmar, about 52% of the country's total area is still covered with forests, out of which about 37% are closed forests, and the remaining 15% being degraded forests. Some forested areas have been constituted as permanent forest estate (PFE) under the Myanmar Forest Law, its total area reaching as much as 25.68% of the country's surface at the end of 2003. Diverse forest ecosystems in Myanmar are homing nearly 7,000 plant species, 96 bamboo species, 36 rattan species, 481 orchid species and no less than 360 mammal species, 360 reptile species and 1,000 bird species - an outstanding biodiversity not only on regional, but also on a global scale ("hot spot").

Due to the rapid development in the agriculture and forestry sectors within the last decade, the land use pattern has distinctly changed between 1996 and 2002. During that period, the agricultural land area nearly doubled following the development activities such as construction of dams and river-water pumping stations, and also because of reclamation of inundated land, and hills and mountains. The forest cover, on the other hand, gradually decreased from 57.2% of the total land area in 1955 to 50.8% in 1989. However, during the last decade, the Forest Department (FD) and the newly constituted Dry Zone Greening Department (DZGD) effectively maintained and improved the existing natural forests and also established various types of forest plantation and hence, the forest cover increased by 1.48% in 2000. The overall deforestation rate between 1955 and 1997 was about 3,160 sq. km per year, which is equivalent to 0.5% of the total country's area. The highest deforestation rates are found in Magway Division in the Central Myanmar, Bago Division and Chin State.

Extension of agricultural land, construction of dams and reservoirs, and increase in livestock breeding area has contributed to the socioeconomic development of local people. However, much of the forest areas have been clear-felled for these other land use purposes, diminishing biodiversity and environmental stability to a considerable extent.

Similarly, in the Dry Zone of Central Myanmar, due to the constraints of agro-climatic conditions with erratic rainfall, high temperature and frequent drought, crop farming is not sustainable for living. These situations make the local people depend more on the over-exploitation of natural resources for their daily lives as well as for cottage industries. Due to the shortage of fuelwood, other but less desirable alternative fuels such as agro-residue, forest-waste and coal briquette are being used.

The 1995 Myanmar Forest Policy identifies six imperatives in accordance with the forest principles adopted at the UNCED. These are: **Protection** of soil, water, wildlife, bio-diversity and environment; **Sustainability** of forest resources; **Basic needs** of the people; **Efficiency** to harness the full economic potential of forest resource; **Participation** of the people; and **Public awareness** about the vital role of forests in socioeconomic development of the nation. The policy also includes important measures directly or indirectly related to the involvement of the public sector in implementing the forestry policy and the environmental conservation policy of the Government in accordance with international agreements relating to conservation of forests and environment, among others. Community Forestry Instructions

(CFIs) was issued in 1995 and since then CFIs has been practiced with emphasis on the participation of local community in managing forests to meet their basic needs without detriment to environmental conservation.

The Dry Zone of Central Myanmar is the most problematic region in terms of degradation of land resources because of continued deforestation and its severe climatic conditions. Realizing the status of land degradation in the region, all possible measures have been taken to prevent and check the environmental deterioration and land degradation since the 1950s. In 1954, a Dry Zone rehabilitation project was initiated by the Agriculture and Rural Development Corporation (ARDC) in collaboration with the FD to carry out tree planting activities in denuded lands. In 1994, the FD implemented a special "Greening Project" for the Nine Districts of the Arid Zone of Central Myanmar. During the project period, 7,280 ha of village supply plantations were planted on denuded lands in the vicinity of the villages for greening purposes and fuelwood supply. In 1997, a new department entitled "Dry Zone Greening Department" was instituted in order to accelerate the implementation of greening and rehabilitation activities focusing on the Dry Zone. Four main tasks of the DZGD are: to establish forest plantations on degraded and denuded land for local supply, and for greening the environs; to protect and conserve the remaining natural forests; to promote the use of fuelwood substitutes and to develop water resources.

Currently in the Dry Zone, there are 54 important dams with watershed areas of about two million hectares, of which 75% are already degraded and 50% are in a critical condition. As land degradation in watershed areas is partly linked with the poverty of local people, the FD is now taking some measures to upgrade the socioeconomic status of the local people through the practice of community forestry, agroforestry, proper grazing, use of woodfuel substitutes and improving water availability, and income generation with their full participation.

In the early 1990s, the mangrove forest area was about 385,930 ha. However, it decreased to almost half in 2002. In Myanmar, fuelwood is a vital energy source for cooking, lighting and for some cottage industry. Fuelwood consumption contributed about 84% of the total energy consumption of the country in 1990. Especially, the Ayeyawady mangrove forest has suffered from serious deforestation and environmental degradation due to over-exploitation of mangrove products, including woodfuel and charcoal, to meet the demand of Yangon City. As the population increased, rate of forest degradation also increased due to over cutting of fuelwood, posts and poles, encroachment for agricultural expansion and increased fish and

prawn ponds. Realizing the ecological and economic benefits of mangroves along the coastal areas, the FD adopted specific remedial measures to conserve and rehabilitate the mangroves. They are: natural regeneration with effective protection; regeneration improvement felling; artificial regeneration using indigenous species, formation of community-owned multipurpose plantations and village nurseries, distribution of improved cooking stocks, distribution of seeds and seedlings free of charge and provision of extension services.

The FD has launched the Nation-wide Tree Planting Programme since 1977-78 with the object of raising public awareness of greening non-forested areas. The FD has distributed various kinds of seedling increasing year after year especially in the Dry Zone. For example, 17 million seedlings distributed in 1999-2000 were equivalent to planting one seedling by three citizens. The FD is intensifying efforts to keep such a good momentum of tree planting in future.

The United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992, organized a forum for sustainable management of the world's forest resources. As a partial fulfillment of its commitment to sustainable forest management (SFM), the FD of Myanmar in coordination with its partners developed and issued the Myanmar Criteria and Indicators for SFM comprising 7 criteria and 78 indicators at the national level and 7 criteria and 73 indicators at the forest management unit level in 1999. the FD formulated the long-term National Forest Master Plan (NFMP) for 30 years (2001/02 – 2030/31) for the overall development of the forestry sector in Myanmar starting from 1998 and finalized the plan in June, 2001. Similarly, the DZGD issued the Dry Zone Integrated Plan in December 2000 for the same period to provide general guidelines on the implementation of rehabilitation activities in the Dry Zone. Both master plans are being put into action. During the last decade, the FD implemented various kinds of special projects related to biodiversity and environmental conservation in cooperation with international organizations and national as well as international NGOs.

In Myanmar, the main causes of land degradation are, *inter alia*, demographic pressure, expansion of agricultural land, over-grazing, shifting cultivation, illicit logging and excessive use of fuelwood, and installation of industrial plants and mining. Due to the nation-wide land degradation, the capacity of natural forests to contribute to the environmental quality has decreased in both tangible and intangible benefits. The number of endangered both plant and animal species increases seriously affecting biodiversity, soils become infertile, water

resources become less available, and the temperature will be heating up in the Dry Zone. There is an additional negative feedback on energy supply, caused by forest destruction in water catchment areas. The latter ones are the basis for existing and future production of electric hydropower. Without forest, there will be no water in the catchment areas, without water; there will be no hydropower. Without hydropower, the population will have to intensify the already existing over-exploitation of natural resources for energy supply, thus entering in a vicious cycle.

The following are the key issues in combating desertification considering the prevailing environmental situations in the country.

(i) Policies and policy conflicts
(ii) Information and planning
(iii) Institutional framework
(iv) Budgetary resources
(v) Adhocism in land use
(vi) Shifting cultivation
(vii) Wood processing and utilization of forest resources
(viii) Livelihood strategies of local people living near the forests

Accordingly, in short-, medium-, and long-term action programmes are proposed in order to address the above-mentioned key issues. The following inputs are, *inter alia*, essential in the smooth implementation of NAP.

(i) Political commitment and support
(ii) People's participation
(iii) Multi-disciplinary approach
(iv) Workable budget
(v) Modern and efficient technologies
(vi) Regional and international cooperation
(vii) Adequate institution building
(viii) Effective monitoring and evaluation system

DEFINITION OF TERMS

(i) According to the UNCCD, Article 1:

"Desertification" means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors including climatic variations and human activities.

"Combating desertification" includes activities which are parts of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development which are aimed at:

(i) Prevention and/or reduction of land degradation;
(ii) rehabilitation of partly degraded land: and
(iii) reclamation of desertified land.

"Drought" means the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels causing serious hydrological imbalances that adversely affect land resource production systems.

"Mitigating the effects of drought" means activities related to the prediction of drought and intended to reduce the vulnerability of society and natural systems to drought as it relates to combating desertification.

"**Land**" means the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system.

"**Land degradation**" means reduction or loss, in arid, semi-arid and dry sub-humid area, of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as:

(i) soil erosion caused by wind and/or water;
(ii) deterioration of the physical, chemical and biological or economic properties of soil; and
(iii) long-term loss of natural vegetation.

"**Arid, semi-arid and dry sub-humid areas**" means areas, other than polar and sub-polar regions in which the ratio of annual precipitation to potential evapotranspiration falls within the range from 0.05 to 0.65.

"**Affected areas**" means arid, semi-arid and/or dry sub-humid areas affected or threatened by desertification.

"**Affected countries**" means countries whose lands include in whole or in part, affected areas.

"**Regional economic integration organization**" means and organization constituted by sovereign States of a given region which has competence in respect of matters governed by this Convention and has been duly authorized, in accordance with its internal procedures, to sign, ratify, accept, approve or accede to this Convention.

"Developed country Parties" means developed country Parties and regional economic integration organizations constituted by developed countries.

(ii) The following definitions are used to discuss the status of forest cover in Myanmar.

Forest – Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 hectare. The trees should be able to reach a minimum height of 5 meters at maturity in situ.

Closed forests (Actual forest) – Formation where trees in the various storeys and the undergrowth cover more than 40 percent of the ground and do not have a continuous dense grass layer. It has the same meaning with "Actual forest" in "Forest cover of Myanmar, the 1989 appraisal, by Kyaw Tint and Tun Hla, and has been continuously used by the Forest Department for forest cover and land use changes analysis.

Open forests (Degraded forest) – Formations with discontinuous tree layer but with a coverage of at least 10 percent and less than 40 percent. Generally there is a continuous grass layer allowing grazing and spreading of fires. This can be loosely called degraded forest.

Deforestation or Forest depletion – is the complete destruction or physical transfer of the forests to other non-wood uses. It means a reduction of forest area.

Shifting cultivation – is the practice that involves clear felling of a forested area, burning and planting it with food crops for a year or two and leaving it to fallow then moving to a new plot. Usually, the fallowed areas are recultivated after a few years.

Forest fallow – refers to all complexes of woody vegetation deriving from the clearing of natural forest for shifting cultivation. It consists of a mosaic of various reconstitution phases and includes patches of uncleared forest and agriculture fields, which cannot be realistically segregated and accounted for area-wise. Forest fallow is an intermediate class between forest and non-forest land uses, and accurate separation between forest and forest fallow may not always be possible.

LIST OF ACRONYMS AND ABBREVIATIONS

AAC	Annual Allowable Cut
ALGAS	Asia Least Cost Greenhouse Gas Abatement Strategy
ARDC	Agricultural and Rural Development Cooperation
C&I	Criteria an d Indicators
CAS	California Academy of Science
CBD	Convention on Biological Diversity
CFIs	Community Forestry Instructions
CITES	Convention on International Trade and Endangered Species
DZGD	Dry Zone Greening Department
EIA	Environmental Impact Assessment
ESCAP	Economic and Social Commission for Asia Pacific
FAO	Food and Agriculture Organization
FD	Forest Department
FE	Foreign Exchange
FMU	Forest Management Unit
FRA	Forest Resource Assessment
FREDA	Forest Resource Environment Development and Conservation Association
GDP	Gross Domestic Product
INC	Intergovernmental Negotiating Committee
IPGRI	International Plant Genetic Resources Institute
ISDP	Information System Development Project
ITTO	International Tropical Timber Organization
JIFPRO	Japan International Forestry Promotion and Cooperation Agency
JOFCA	Japan Overseas Forestry Consultants Association
MTE	Myanma Timber Enterprise
MYAP	Myanmar-Yomiuri Afforestation Project
NAP	National Action Programme
NCEA	National Commission for Environmental Affairs
NFMP	National Forest Master Plan
NGO	Non-Governmental Organization
NSF	National Science Foundation
NWFPs	Non-Wood Forest Products
PACD	Plan of Action to Combat Desertification
PAS	Protected Areas System
PFE	Permanent Forest Estate
PWC	Production Working Circle
SEE	State-Owned Economic Enterprise
SFM	Sustainable Forest Management
TOE	Tons of Oil Equivalent
TPNs	Thematic Programme Networks
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNDP	Unite Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	UN Framework Convention on Climate Change

Conversion Factors

Imperial	Metric
1 inch	25.40 mm
1 ft	0.30 m
1 acre	0.40 ha
1 mile	1.61 km
1 sq. mile	2.59 sq. km
1° F	-17.22° C

NATIONAL ACTION PROGRAMME OF MYANMAR TO COMBAT DESERTIFICATION IN THE CONTEXT OF UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION (UNCCD)

Chapter 1. INTRODUCTION

1.1 Background Information

Desertification is assuming even more threatening proportions worldwide. Actually land resource from which our basic needs of food, water, fuel, clothing and shelter must be met is limited. The productivity of agriculture and forests in the world's tropical regions is dwindling. At the same time, the earth's population is growing rapidly. Recognizing alarming desertification at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro – "Earth Summit", the international community resolved to adopt an International Convention, namely "United Nations Convention to Combat Desertification", or UNCCD in short. UNCCD was adopted on 17th June 1994. Ninety days after signing of the Convention by fifty countries, the Convention became active in December 1996. One hundred and seventy seven countries are parties to the Convention to date and several more will be on board in the future.

The Convention describes its objective as "to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international co-operation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas". Desertification is the process of land degradation due to variations in climate and human impacts. It particularly affects dry lands that are already ecologically fragile. To meet the objectives of the Convention, Parties of the Convention are oriented by three principles which are: (i) Participation of all stakeholders, (ii) International cooperation and (iii) Consideration of the specific needs of affected developing countries.

The Convention is to be implemented through National Action Programs (NAPs) which are to deal with: (i) definition of preventive measures, (ii) enhancement of climatologic, meteorological and hydrological capabilities, (iii) strengthening of institutional frameworks, (iv) providing for effective population participation, and (v) providing regular reviews on implementation. The formulation of the UNCCD national action program is indeed an extremely challenging process. One of the most important considerations of the process is the involvement of the stakeholders from the very beginning. This is the trademark of this convention. This "bottom-up approach" emphasizes participatory development and highlights the role of local communities in the process. It is also an on-going process that requires constant refining.

Countries that have completed their national action programmes and have proceeded ahead have undertaken further implementation activities that include, among others, national workshops on synergistic implementation of the conventions on biodiversity, desertification and climate change at the national level and national forums on resource mobilization for the implementation of the UNCCD (roundtable meetings). These linkages between the multilateral environmental agreements are indeed imperative. It is suggested that the national

workshop be followed by an official national endorsement of the NAP upon its completion and then a roundtable meeting of donors for the NAP implementation.

The Convention is also to be implemented through Sub-regional and Regional. There are four regional annexes dealing with specific implementation issues at the regional level including Regional Implementation Annex for Asia. The Convention is implemented in this Asian region through thematic programme networks (TPNs) and four of the six planned networks are already operational, hosted by China, India, Iran and Syria. The four operational networks are on monitoring and assessment (China), agroforestry and soil conservation (India), range management and dune stabilization (Iran) and water resources management for dryland agriculture (Syria). The two remaining planned networks are the networks on capacity building for combating desertification and mitigating the effects of drought (Mongolia) and the network on local development initiatives (Pakistan).

1.2 Myanmar to UNCCD

The National Commission for Environmental Affairs (NCEA) was established in 1990 to advise the government on environmental policies; to act as a focal point and as a coordinating body for environmental affairs; and to promote environmentally sound and sustainable development in Myanmar. Then in 1994, the Ministry of Forestry launched a 3-year "Greening Project for the Nine Critical Districts" in the Dry Zone. This was later extended to 13 districts with the formation of a new department, namely the Dry Zone Greening Department in 1997.

Thus, as in most countries even before Myanmar's accession to UNCCD measures relating to combating desertification had already been taken at the local and national levels. However, Myanmar's accession to UNCCD serves as the organizational and coordination guarantee to combat desertification in an integrated and cohesive manner.

In April 1995, Economic and Social Commission for Asia Pacific (ESCAP) in co-operation with NCEA and Forest Department of Myanmar organized the regional follow up meeting on the UNCCD in Yangon. After the follow up meeting, Myanmar sent her delegations to attend negotiation conferences of CCD. The National Awareness Seminar on the Convention to Combat Desertification was held in Yangon in October 1996.

The Government of Myanmar, following the signing of two conventions, namely, "Framework convention on Climate Change" and "Convention on Biodiversity Conservation", ratified the Convention as the 58th member in 1997 and has actively participated in the activities toward its implementation in the Asian region.

Myanmar had sent her delegations to all five Conferences of Parties and as a requirement, the National Report on UNCCD implementation was also submitted to the fourth Conference of Party. At the national level, countries of the South and Southeast Asian region are now in the process of drafting their own national action programs. Myanmar has already held its national NAP workshop on 20- 21 December, 2001 in Yangon.

1.3 Concept of United Nations Convention to Combat Desertification (UNCCD)

Land degradation and desertification, which are impeding socioeconomic development and challenging environmental stability, have been occurring in many parts of the world since long time ago and accelerating with the rapid development in various sectors. Realizing the

common problems and adverse impacts of land degradation and desertification, the United Nations Conference on Desertification was held in Nairobi, Kenya, in 1977 during which the Plan of Action to Combat Desertification (PACD) was prepared and the international communities were called for urgent prevention of further land degradation and active implementation of rehabilitation activities. The UN Environment Programme (UNEP) was charged with administration of PACD and UNCCD tried to widen its concern to cover other regions of the world by circulating a questionnaire to check the desertification status of various countries. However, due to the less effective efforts of PACD and less attention on desertification, the result was unsatisfactory.

In 1992, UN Conference on Environment and Development, the Earth Summit, was held at Rio de Janeiro to initiate a second phase of international response to desertification. The Earth Summit adopted an Agenda 21 – a blueprint of action on environment and development for the 21st century. The conference reaffirmed the need for conserving and managing fragile ecosystems in order to prevent further desertification and drought and participating countries committed to fight against poverty and desertification. The Earth Summit also recommended the United Nations General Assembly to establish an Intergovernmental Negotiating Committee (INC) to prepare a legally binding international instrument to combat desertification. In response, five negotiation meetings were held in Nairobi, Geneva, New York and Paris respectively within one and a half years.

In June, 1994, the UNCCD in those countries experiencing serious drought and/or desertification particularly in Africa was opened for signature on 14-15 October 1994 in Paris and remained open until mid-October 1995 in UN Headquarters. The Convention entered into force on the 26th of December 1996 which was 90 days after ratification by 50 countries. According to "the State of the world's forests, 2003, FAO," ratified countries increased to 179 as of 1st December 2002.

The following principles constitute the conceptual framework within which the action proposals on the contribution of forestry to conservation and the prevention of desertification processes were conceived.

(i) integration of forestry in sectorial and multisectorial programmes;

(ii) broad-based rural development, with emphasis on diversification of rural economic activities and contribution to food security;

(iii) the vital role of shrubs, trees and forests in providing improved conditions for agricultural and animal production through shelterbelts, conservation of the water resource, erosion control, fuelwood, timber production, and other forest and tree products; and

(iv) direct economic benefit for the local communities from forests and forest products and by generation of employment, thus promoting rural development.

1.4 Obligations of the Country Parties under UNCCD

The major obligations, which should be fulfilled by the country parties, include among others.

(i) to give due priority to combating desertification and mitigating the effects of drought, and allocate adequate resources in accordance with their circumstances and capabilities;

(ii) to establish strategies and priorities, within the framework of sustainable development plans and/or policies, to combat desertification and mitigate the effects of drought;

(iii) to address the underlying causes of desertification and pay special attention to the socio-economic factors contributing to desertification processes;

(iv) to promote awareness and facilitate the participation of local population, particularly women and youth, with the support of non-governmental organizations, in efforts to combat desertification and mitigate the effects of drought; and

(v) to provide and enabling environment by strengthening, as appropriate, relevant existing legislation and, where they do not exist, enacting new laws and establishing long-term policies and action programmes.

1.5 Objectives and Specifications of National Action Programme (NAP) to Combat Desertification

The main objectives of the NAP to combat desertification are:

(i) to enhance the place of forestry and woody vegetation within sound land husbandry, so as to ensure that the whole system contributes effectively to the production of goods and services and to the wider aim of food security;

(ii) to enhance the benefits to the community by appropriate use of forest resources and to involve the community in their expansion, diversification, management, conservation and rehabilitation;

(iii) to create awareness among politicians and the public of the contribution of forestry to sustained use of the resource base; to minimize damage and degradation caused by desertification, salinity, droughts and torrential phenomena to food security and rural development;

(iv) to ensure that forestry is made a vital part of national plans regarding food security, conservation and prevention of desertification.

The purpose of NAP is to identify the factors contributing to desertification and practical measures necessary to combat desertification and mitigate the effects of drought.

National action programme shall specify the respective roles of government, local communities and land users and the resources available and needed. They shall, *inter alia*:

(i) incorporate long-term strategies to combat desertification and mitigate the effects of drought, emphasize implementation and be integrated with national policies for sustainable development;

(ii) allow for modification to be made in response to changing circumstances and be sufficiently flexible at the local level to cope with different socio-economic, biological and geo-physical conditions;

(iii) give particular attention to the implementation of preventive measures for lands that are not yet degraded or which are only slightly degraded;

(iv) enhance national climatological, metrological and hydrological capabilities and the means to provide for drought early warning;

(v) promote policies and strengthen institutional frameworks which develop cooperation and coordination, in a spirit of partnership, between the donor community, governments at all levels, local populations and community groups, and facilitate access by local populations to appropriate information and technology;

(vi) provide for effective participation at the local, national and regional levels of non-governmental organizations and local populations, both women and men, particularly resources users, including farmers and pastoralists and their representative organizations, in policy planning, decision-making , and implementation and review of, and progress reports on their implementation.

National action programme may include, *inter alia*, some or all of the following measures to prepare for and mitigate the effects of drought:

(i) establishment and/or strengthening, as appropriate, of early warning systems, including local and national facilities and joint systems at the subregional and regional levels, and mechanisms for assisting environmentally displaced persons;

(ii) strengthening of drought preparedness and management, including drought contingency plans at the local, national, sub-regional and regional levels, which take into consideration seasonal to interannual climate predictions;

(iii) establishment and/or strengthening, as appropriate, of food security systems, including storage and marketing facilities, particularly in rural areas;

(iv) establishment of alternative livelihood projects that could provide incomes in drought prone areas; and

(v) development of sustainable irrigation programmes for both crops and livestock.

Taking into account the circumstances and requirements specific to each affected country Party, national action programmes include, as appropriate, *inter alia*, measures in some or all of the following priority fields as they relate to combating desertification and mitigating the effects of drought in affected area and to their populations; promotion of alternative livelihoods and improvement of national economic environments with a view to strengthening programmes aimed at the eradication of poverty and at ensuring food security; demographic dynamics; sustainable management of natural resources; sustainable agricultural practices; development and efficient use of various energy sources; institutional and legal frameworks; strengthening of capabilities for assessment and systematic observation, including hydrological and meteorological services, and capacity building education and public awareness.

1.6 Regional Implementation for Asia

1.6.1 Unique conditions of the Asian region

In carrying out their obligations under the Convention, the Parties shall, as appropriate, take into consideration the following particular conditions which apply in varying degrees to the affected country Parties of the region;

(i) the high proportion of areas in their territories affected by, or vulnerable to, desertification and drought and the broad diversity of these area with regard to climate, topography, land use and socio-economic systems;

(ii) the heavy pressure on natural resources for livelihoods;

(iii) the existence of production systems, directly related to widespread poverty, leading to land degradation and to pressure on scarce water resources;

(iv) the significant impact of conditions in the world economy and social problems such as poverty, poor health and nutrition, lack of food security, migration, displaced persons and demographic dynamics;

(v) their expending, but still insufficient, capacity and institutional frameworks to deal with national desertification and drought problems and

(vi) their need for international cooperation to pursue sustainable development objectives relating to combating desertification and mitigating the effects of drought.

1.6.2 Framework for National Action Programmes

(i) National action programmes shall be an integral part of broader national policies for sustainable development of the affected country Parties of the region.

(ii) The affected country Parties shall, as appropriate, develop national action programmes pursuant to articles 9 to 11 of the Convention, paying special attention to article 10 Paragraph 2(f). As appropriate bilateral and multilateral cooperation agencies may be involved in this process at the request of the affected country Party concerned.

1.6.3 Content of National Action Programmes

In preparing and implementing national action programmes, the affected country Parties of the region, consistent with their respective circumstances and policies, may, *inter alia*, as appropriate:

(i) designate appropriate bodies responsible for the preparation, coordination and implementation of their action programmes;

(ii) involve affected populations, including local communities, in the elaboration, coordination and implementation of their action programmes through a locally driven consultative process, with the cooperation of local authorities and relevant national and non-governmental organizations;

(iii) survey the state of the environment in affected areas to assess the causes and consequences of desertification and to determine priority areas for organization;

(iv) evaluate, with the participation of affected populations, past and current programmes for combating desertification and mitigating the effects of drought, in order to design a strategy and elaborate activities in their action programmes;

(v) prepare technical and financial programmes based on the information derived from the activities in subparagraphs (i) to (iv);

(vi) develop and utilize procedures and benchmarks for evaluating implementation of their action programmes;

(vii) promote the integrated management of drainage basins, the conservation of soil resources, and the enhancement and efficient use of water resources;

(viii) strengthen and/or establish information, evaluation and follow up and early warning systems in regions prone to desertification and drought, taking account of climatological, meteorological, hydrological, biological and other relevant factors; and

(ix) formulate a spirit of partnership, where international cooperation, including financial and technical resources, is involved, appropriate arrangements supporting their action programmes.

Consistent with article 10 of the Convention, the overall strategy of national action programmes for affected areas, based on participatory mechanisms and on the integration of strategies for poverty eradication into efforts to combat desertification and mitigate the drought. Sectoral measures in the action programmes shall be ground in priority fields which take account of the broad diversity of affected areas in the region referred to in article 2(a).

1.7 Scope of the Report

The National Action Programme of Myanmar to Combat Desertification has been prepared with emphasis on forestry due to its major role playing on the development of arid lands and the improvement of the well-being of their people. With the definition of terms and list of abbreviations and acronyms, the Myanmar NAP consists of nine chapters as follows:

Chapter one is the introductory chapter containing the background information of the development of UNCCD and salient features of NAP to combat desertification, status of regional implementation for Asia and the scope of the report.

Chapter two provides general information about the natural and socioeconomic conditions of the country as a whole, including biophysical information, demographic information, land-use status, and current status of land degradation and desertification.

Chapter three highlights Forest Policy, Legislation and Strategy implemented in Myanmar to enhance socioeconomic development and to ensure ecological balance and environmental stability.

Chapter four discusses the current situation of the land degradation/desertification affected areas in priority, particularly in land-use pattern, geographic and climate condition,

population and socioeconomic situation, rate of deforestation and land degradation, available water resource, and disaster encountered.

Chapter five deals with the main causes and impacts of land degradation and desertification and also reviews the past management in order to provide essential elements required for proper planning of NAP to combat desertification in Myanmar.

Chapter six presents key issues based on the prevailing conditions of the country, which are to be tackled in advance giving priority for smooth and successful implementation of NAP.

Chapter seven proposes major action programmes which are to be effectively implemented in various sectors in the short, medium and long terms in order to prevent and reduce land degradation and desertification.

Chapter eight focuses on major essential inputs without which the NAP could not be successfully implemented even though the plan is properly prepared. Political support and people's participation are of utmost importance to practice multi-disciplinary approach to combat desertification. Similarly, workable budget as well as modern and efficient technologies must be available as preconditions to implement the formulated NAP.

Chapter nine concludes the report summarizing most essential recommendations to combat desertification.

Chapter 2. NATURAL AND SOCIOECONOMIC CONDITIONS OF MYANMAR

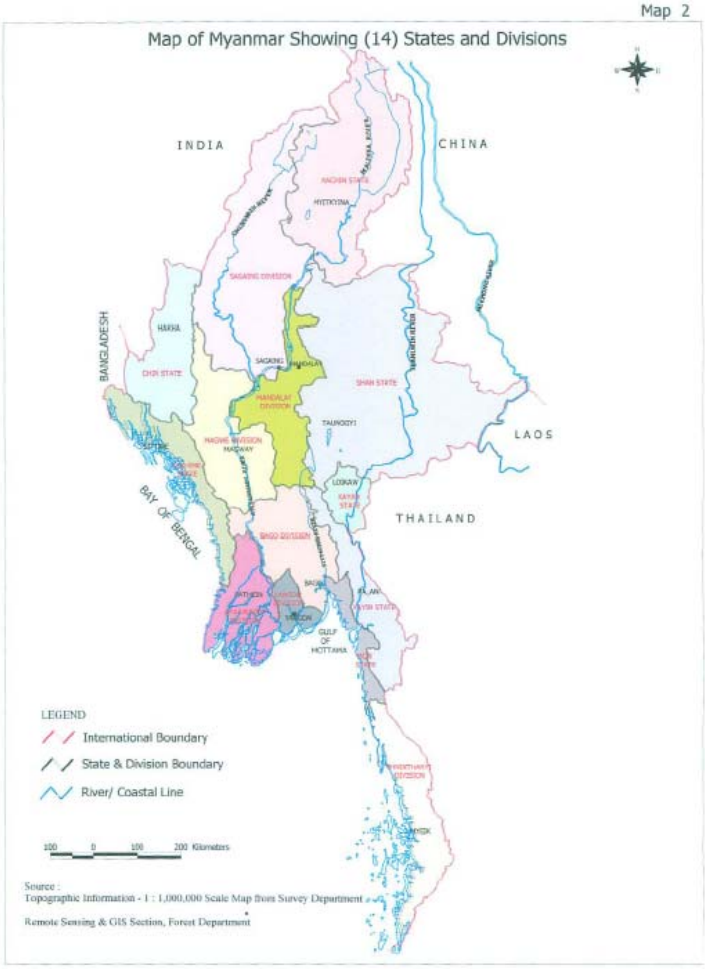
2.1 Biophysical Information

2.1.1 Location and area

The Union of Myanmar, a tropical country in Continental South East Asia, is geographically situated between latitudes 09º 32' to 28º31' North and longitudes 92º10' to 101º 11' East (See Map 1). Myanmar is bordered on the north and northeast by the People's Republic of China, on the east and southeast by the Lao People's Democratic Republic and the Kingdom of Thailand, on the south by the Andaman Sea and the Bay of Bengal and on the west by the People's Republic of Bangladesh and the Republic of India. Myanmar is administratively divided into seven states and seven divisions (See Map 2).

The country has a total land area of 676,577 km^2, stretching for 936 km^2 from east to west at the maximum width and 2,051 km from north to south. The length of contiguous frontier is 6,129 km and coastline from the mouth of the Naaf River to Kawthaung is approximately 2,229 km.

Map 2



2.1.2 Topography

The topography is generally low lying in the coastal and deltaic regions, rising to about 6,000 metres in the rugged north of the country. Topographically, the country can be roughly divided into three main parts, namely the western hills region, the central valley region, and the eastern hills region.

In the western hilly region, the western mountain ranges (*Yomas*), which serve as a wall that separates Myanmar from India, has a link with the Himalayan range in the north. The Khakabo Razi with the highest peak of about 5,881 m and Sarameti which is 3,826 m high are situated in the northern most part of the western mountain ranges. In the western portion, the Rakhine mountain ranges and Chin hills have undulating hills with altitudes over 914 m above mean sea level.

The central valley region consists of the broadest part of the Ayeyawady, Sittaung and Chindwin valleys. In this region lies the low range of the *Bago Yomas* with elevation of about 300 m and some small mountain ranges such as Zeebyu, Min-wun, Hman-kin and Gangaw. The central core of the country, which falls within the rain shadow area, is relatively flat, constituting the Central Dry Zone.

The eastern hills' region is the Shan Plateau having an average elevation of about 914 m to 1,219 m above sea-level. Unlike the plain, the plateau has high mountain ranges and the Thanlwin River flows through the Shan Plateau to the northern Taninthayi coastal strip. Some other rivers, namely Shweli, Myitnge, Zawgyi and Pan-laung have also their sources at the Shan Plateau and flow into the Ayeyawady River.

As mountain ranges in Myanmar generally run in the north to south direction, the river systems also flow from north to south. The Ayeyawady is the main river in the country and navigable for about 1,450 km from Yangon. The upper reaches of the Ayeyawady River extends deep into the scenic foot hills of the northern mountain ranges in Kachin State. The Chindwin River is navigable for some 563 km from its confluence with the Ayeyawady River. These two rivers constitute the most important inland water transport network for locally produced merchandise and forest products. The Thanlwin River, though it is the longest river in Myanmar, is hardly navigable along its entire length as the upper stretches are rocky and swift flowing. It is only navigable for short distance above Mawlamyine in Mon State. The Sittaung River is the shortest one among the principal rivers in Myanmar.

2.1.3 Geology and soils

2.1.3.1 Geology

Geomorphologically as well as tectonically, Myanmar can be sub-divided into four provinces which are north-south tending linear belts. These are, from east to west:

Geomorphic provinces	Tectonic provinces
1. Eastern Highland	1. Shan-Tanintharyi Block
2. Central Lowland	2. Central Cenozioc Block
3. Western Ranges	3. Western Fold Belt
4. Rakhine Coastal Plain	4. Rakhine Coastal Belt

As the geomorphic features are mere reflections of the underlying rock types and structures, the geomorphic provinces and tectonic provinces generally coincide to each other respectively. The four provinces differ from one another not only in physiography, but also in lithology, geological structures and geological ages.

2.1.3.1.1 Tectonic provinces

(i) Shan-Taninthayi Block-consolidates the Shan Plateau, eastern Kachin ranges and Taninthayi ranges. The presence of Precambrian orthogneisses and low grade metasedimentary rocks (Chaung Magyi Group), Paleozoic and Mesozoic carbonates, clastics, and igneous rocks enable this province to remain as a highland, locally with Karst topography in the limestone areas.

(ii) Central Cenozoic Belt – is relatively low-lying Central Belt drained by the Ayeyawady, Chindwin and Sittaung rivers. Locally, hills ridges and small mountain ranges are present, especially in the northern part. As the name implies, it is mainly constituted with Cenozoic sedimentary rocks consisting of sandstones, shales and clays. Mesozoic clastics and Cretaceous limestones occur only in the northern part. The Central Volcanic line (CVL) has divided this province into two parts since about Miocene Epoch.

(iii) Western Fold Belt – covers the *Rakhine Yomas*, Chin Hills and Naga Hills. It consists of a thick Mesozoic and Eocene flysch sequence, locally with bedded chert (radiolarite) and green-stone. The Western Range which is also known as Indo-Burrnan range arose as the result of folding, overthrusting and uplifting during the Early Himalayan orogeny at the close of Ecoeen.

(iv) Rakhine Coastal Belt – occupies Rakhine coastal plain. It is the southern continuation of the Assam Basin in the north eastern India where a thick Tertiary succession is also present. The Minbu and Assam basins are fairly similar not only in stratigraphy and lithology but also in the occurrence of oil and gas, especially in the Oligocene and Miocene formations.

2.1.3.2 Soils

A number of academicians from agriculture, forestry, geology and geography have reported the soils observed in various parts of the country in their own ways. In 1965, Myanmar soil scientists from Land Use Bureau conducted soil surveys in cooperation with Russian soil scientists and prepared the first Schematic Soil Map of Myanmar showing 24 major soil types, based on the system of soil classification used by the International Soil Science Society and FAO/UNESCO. About 106 major soil types are recognized worldwide.

2.1.3.2.1 Classification of soils

Soils can be classified into zonal soils, intrazonal soils and azonal soils.

(i) Zonal soils – are classified generally based on climate and grouped into four zones, namely Tropical Wet Zone, Tropical Dry Zone, Subtropical Zone and Temperate High Mountain Zone.

Soils of Tropical Wet Zone include red-brown forest soils, yellow-brown forest soils and lateritic soils and laterites.

Soils of Tropical Dry Zone include cinnamon soils, red-brown savanna soils, dark compact savanna soils, Solonetz (alkaline) soils, Solonchak (Saline) soils and primitive gravelly soils of savanna.

Soils of Subtropical Zone include red earths and yellow earths. Soils of Temperate high mountain zone include brown mountain-forest soils, mountain-meadow Alpine soils and mountain sod soils.

(ii) Intrazonal soils – grouped the complex of the meadow, swampy and alluvial soils of river valleys and lowlands. This group includes alluvial soils, swampy soils and various meadow soils (alluvial, gley, alkaline, saline, swampy and swampy carbonate soils).

(iii) Azonal soils – are youthful due to hardness of parent material, rapid rate of erosion or deposition and insufficient length of time. Such soils are saline mud, silt, alluvium, gravelly soils, turfy primitive soils and turfy carbonate soils.

2.1.3.2.2 Distribution of soils

Red-brown forest soils developed under tropical evergreen forests and wet tropical monsoon forests mostly at altitudes between 300 m and 1,300 m above sea level. These soils have the average humus content of 2% and the p^H value is between 5.5 and 6.5. Such soils are

generally found in the area between East-West trending the Ayeyawady River and northeast-southwest trending the Shweli River.

Red-brown forest soils, together with mountain red brown forest soils, primitive crushed stone soils are found in Taninthayi, Southern Mon-Kayin, Rakhine Yoma and south-western Chin areas.

Yellow-brown forest soils are widespread under wet tropical monsoon forests at altitudes between 100 and 450 m above sea-level. The humus content is on average between 2 and 4%. The p^H value is between 4.5 and 6.5 and the water holding capacity is 30-35%. Such soils occur in hilly areas between the Chindwin and Ayeyawady Rivers, in lower hills of the *Bago Yomas*, *Rakhine Yomas* and *Taninthayi Yomas*. At higher altitudes, these soils are replaced by Yellow-brown mountain forest soils. They are suitable for forest plantation.

Lateritic soils and laterites are found at altitude below 100m above sea-level. The humus content is 1.5 to 3% and p^H value is between 4 and 5. These soils occur in Taninthayi, Mon, Kayin, Southern Bago mountain ranges and southern Rakhine mountain ranges areas. Such soils are suitable for rubber plantation, fruit trees and horticulture.

Light Cinnamon soils occur along the belt surrounding the Dry Zone and dark Cinnamon soils develop- at relatively wet sites. Humus content varies between 1% in light cinnamon to 3-5% in dark cinnamon. The p^H value is between 5.5 and 6.5. These soils are suitable for agriculture when properly irrigated.

Red-brown savanna soils are typical soils of the Dry Zone and cover the central part of Myanmar. The humus contents are below 2% and nitrogen and available phosphorus contents are also low. The p^H varies from 6.5 to 8 and it may reach 9 in extreme cases. These soils are suitable for dry farming but soil erosion is the main problem.

Dark compact savanna soils are mostly found in flat, even terrain and alluvial in the dry zone of central Myanmar. The p^H value is ranging from 6 to 8.5 and humus content is only about 1%. Saline and alkaline should be checked and remedied. Suitable irrigation is essential for successful utilization of the land.

Gravelly soils of savanna are also found in the Dry Zone of central Myanmar. They consist of stone fragments with small residues of humus and such soils are not suited for agriculture. Only indigenous species such as Than, Dahat, Thanakha, etc. should be planted.

Red earths occur at altitudes around 1000 m. above sea-level and mountain red earths are found at relatively higher altitudes. These soils cover the area from eastern Mandalay division, eastern Kayin, Kayah to, large parts of Shan Plateau. The humus content is between 2 and 4% in the light red earths and may be up to 8% in dark red earths. The p^H value is between 6 and 7. Such soils are suitable for diversified agriculture.

Yellow earths soils occur on level surfaces or slopes at lower altitudes on the Shan limestone plateau. They are less suited for agriculture when compared to red earths. Mountain Sod soils are found in Mount Popa area and best suited for forestry purposes. Meadow soils are the best soils for paddy cultivation in Myanmar.

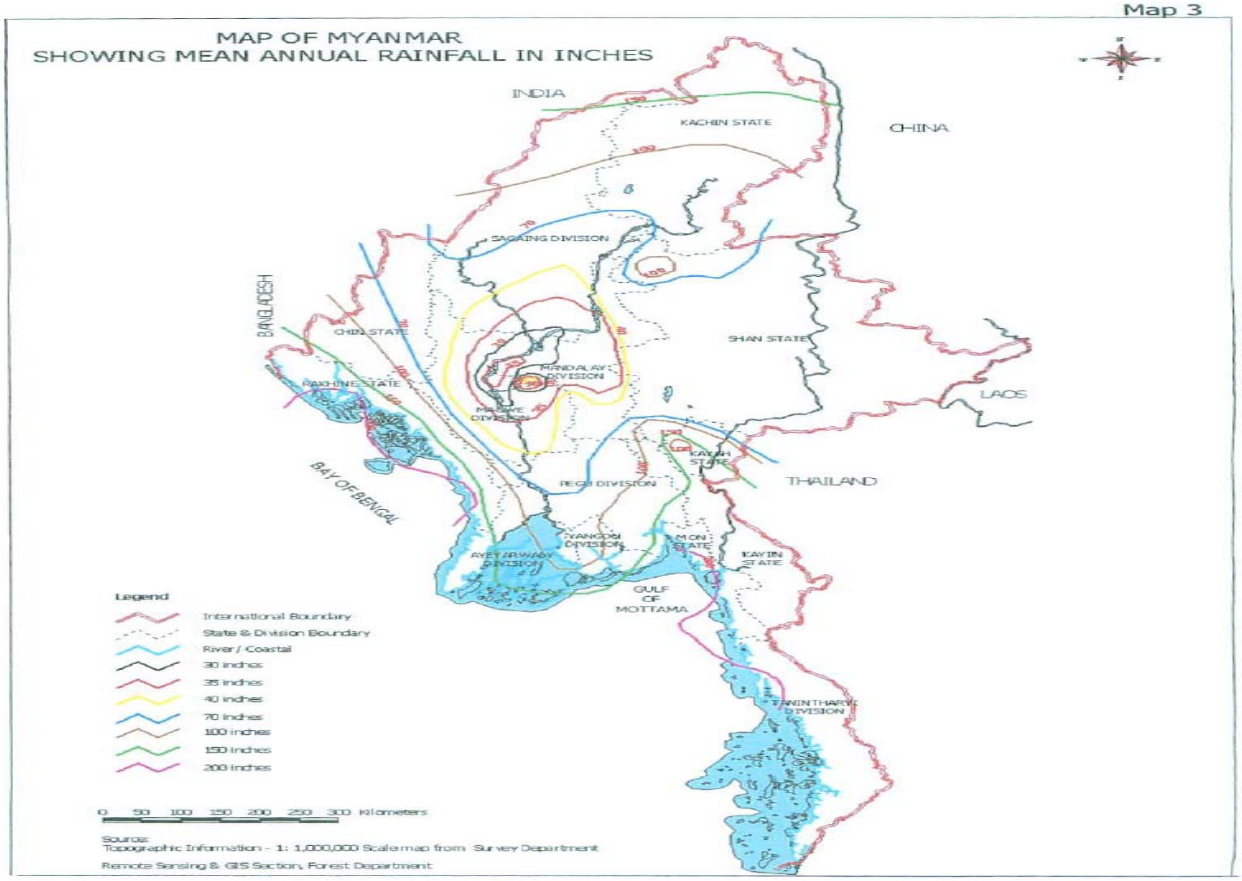
2.1.4 Climate

Most of Myanmar belongs to the tropical region. It is characterized by a tropical monsoon climate with three well-defined seasons: summer, rainy season and cool season. Summer months are from March to Mid-May; the rain falls from Mid-May to the end of October and the cool season starts in November up to the end of February. Due to widely differing topographical situations of the country, its climate conditions also differ widely from one place to another.

2.1.4.1 Annual rainfall

Annual rainfall and intra-annual distribution of rainfall in costal and deltaic regions is generally as high as 5,000 mm whereas it is only about 600 mm in the Dry Zone. Map 3 shows mean annual rainfall in Myanmar.

Map 3



The average annual rainfall of some meteorological stations during the last two decades is shown in Table 1.

Table 1. Annual rainfall at selected stations

Station	State/Division	Annual Rainfall	
		in mm	in inches
(a) Coastal and deltaic region			
- Thantwe	Rakhine State	5500	217
- Dawei	Taninthayi Division	5300	209
- Mawlamyine	Mon State	4800	189
- Hpa-an	Kayin State	4000	157
- Bago	Bago Division	3100	122
- Pathein	Ayeyawady Division	2700	106
- Yangon	Yangon Division	2700	106
(b) Hilly and mountaineous areas			
- Myitkyina	Kachin State	2300	91
- Hakha	Chin State	1800	71
- Taunggyi	Shan State	1600	63
- Loikaw	Kayah State	1000	39
(c) Dry Zone area			
- Magway	Magway Division	800	31
- Monywa	Sagaing Division	700	28
- Nyaung-Oo	Mandalay Division	600	24

Source: Statistical Yearbook 2002, Central Statistical Organization

According to the recorded data of annual rainfall at 29 stations representing all States and Divisions, average annual rainfall of the whole country was about 2,400 mm and coastal and deltaic regions had higher rainfall whereas hilly areas and the Dry Zone had lower rainfall than the country average. Especially, the areas in the Dry Zone of the central Myanmar received the least amount of annual rainfall which is three to four times less than the country average and six to eight times less than that of the coastal areas.

2.1.4.2 Intra-annual distribution of rainfall

In Myanmar, the rainy season generally starts in mid-May and usually ends by the end of October. About 90% of the total annual rainfall is received during the rainy season which lasts about five and half months and the rest in the remaining months. Distribution of rainfall at selected meteorological stations is given in Table 2.

Table 2. Distribution of rainfall at selected stations

Month	Amount of rainfall in millimetre				Remarks
	Dawei Sta: (coastal)	Taunggyi (mountain)	Nyaung-Oo (dry zone)	Average (29 stations)	
January	3	1	6	4	
February	11	4	13	12	169 mm
March	27	9	6	17	(7% of total)
April	75	49	30	44	
May	369	144	80	184	Mid-May
June	1195	204	110	506	
July	1233	231	93	521	2136 mm
August	1304	297	106	517	(90% of total)
September	659	329	124	317	
October	338	194	99	183	
November	47	90	43	61	68 mm
December	8	12	9	7	(3% of total)
Total	**5269**	**1564**	**719**	**2373**	

Source: Statistical Yearbook 2002, Central Statistical Organization

According to the recorded data on the distribution of rainfall during the last two decades, some costal and hilly areas receive a little rain starting from mid-April, and most country areas receive heavy rain during the period from June to August. Most areas have the highest amount of annual rainfall in July, but some in August and some hilly and dry zone areas in September.

2.1.4.3 Temperature and humidity

Temperature also varies from one place to another depending on location and elevation. During the summer months, March and April, the average highest temperature in Central Myanmar is generally above 43º C while it is about 36º C in Northern Myanmar and 29º C on Shan Plateau. Average temperature and humidity monitored at the stations in the states and divisions are given in Table 3.

According to the recorded data of the temperature during the last two decades, the average temperature varies from 21º C to 34º C in summer and from 11º C to 23º C in the cool season. The mean relative humidity ranges between 58 and 79%.

2.1.5. Water resources

Myanmar is essentially an agricultural country, and hence the agricultural sector has been designated as the main pillar of the country's economy. As more than 70% of the population are residing in rural areas, and 65% of the total labours force are working in the agricultural sector, the government has adopted five strategies to achieve greater progress in the agricultural development as follows:

- Development of new agricultural land;
- Provision of adequate irrigation water for agricultural purpose;
- Provision and support for increased agricultural mechanization;
- Application of modern agricultural technologies; and
- Development and utilization of high yielding quality seeds.

Table 3. Average Temperature and Humidity

Station	State/Division	Temperature (Deg.C)		Mean Relative Humidity (%)
		Mean Max.	Mean Min.	
Myitkyina	Kachin State	29	19	77
Loikaw	Kayah State	29	16	71
Hpa-an	Kayin State	33	23	77
Hakha	Chin State	21	11	74
Monywa	Sagaing Division	34	22	68
Dawei	Taninthayi Division	32	22	79
Bago	Bago Division	33	22	77
Magway	Magway Division	34	20	66
Naung-Oo	Mandalay Division	34	22	58
Mawlamyine	Mon State	32	22	75
Thantwe	Rakhine State	32	20	78
Yangon	Yangon Division	33	22	75
Taunggyi	Shan State	25	14	69
Pathein	Ayeyawady Division	32	23	78

Source: Statistical Yearbook 2002, Central Statistical Organization

As irrigation directly affects agriculture production through increasing cropping intensity and yield, the development strategy includes expansion of irrigation facilities in order to secure sustainable agricultural production. Double cropping and multi-cropping are being encouraged through the construction of large- and medium-scale multipurpose dams, and also pump irrigation systems. Number of dams and river-water pumping stations constructed during the period from 1989 to 2003 is given in Table 4.

As shown in Table 4, most new dams and river-water pumping stations have been established in Mandalay, Magway, Sagaing and Bago divisions. About 54% of the total dams and 61% of the river-water pumping stations are located in the Dry Zone of Central Myanmar.

Table 4. Construction of dams and river-water pumping stations

State/Division	No. of dams constructed			No. of river-water pumping stations
	before 1989	from 1989 to 2003	Total	
Kachin State	3	-	3	2
Kayah State	7	2	9	1
Kayin State	6	-	6	1
Chin State	-	1	1	-
Sagaing Division	8	14	22	48
Tanintharyi Division	-	1	1	2
Bago Division	16	37	53	55
Magway Division	11	25	36	44
Mandalay Division	61	35	96	70
Mon State	3	6	9	4
Rakhine State	2	4	6	1
Yangon Division	-	12	12	15
Shan State	17	2	19	-
Ayeyawady Division	4	7	11	22
Total	**138**	**146**	**284**	**265**
Extent of irrigated areas - in million ha. - in million acre	0.54 1.33	0.84 2.09	1.38 3.42	0.11 0.28

Source: Development in Myanmar (1988-2003), Ministry of Information, Myanmar

2.1.6. Biodiversity

In Myanmar, conservation of biological resources primarily wildlife, wild plants and pristine forests has traditionally been prioritized at the national level. Diverse forest ecosystems in Myanmar are homing nearly 300 mammal species, 360 reptiles and 1,000 bird species. There are also more than 1,200 species of butterfly of which six are identified as rare species even at the global level. Myanmar is also known to have about 7,000 plant species, of which 1,071 are endemic. Recorded number of vegetative species in the natural forests of Myanmar has reached 1,347 species of big trees, 741 species of small trees, 96 species of bamboos, 1,696 species of shrubs, 36 species of rattans and 841 species of orchids.

The wildlife conservation is not new to Myanmar since it dates back to the period of King Mindon by the establishment of a game sanctuary in the vicinity of Mandalay Royal City in 1860. In 1918, Pidaung Wildlife Sanctuary was established in Kachin State and since then protecting and conserving biological resources has been systematically undertaken throughout the country.

The 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 notified and amended again in 1883. In 1902, Burma Forest Act was promulgated in which wild

animal and their parts were declared as forest produce. Specific legislation to protect the wildlife was enacted in 1912 under "The Wild Birds and Animal Protection Act 1912". In 1936, 'Burma Wildlife Protection Act was enacted, providing effective protection of wildlife and the establishment of sanctuaries at the disposal of the government. In 1994, the new' Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law was enacted replacing the old 'Burma Wildlife Protection Act of 1936. The new Law highlights habitat maintenance and restoration, protection of endangered and rare species of both fauna and flora, establishment of new parks and naturally protected areas, and buffer zone management. In 1981, FD implemented 'The National Conservation and National Parks Project' with the assistance of UNDP/FAO until 1984. The project activities included development of institutions for conservation, surveys and feasibility studies for the establishment of national parks and nature reserves and preparation of management plans, among others. The project identified specific ecological conditions in the major natural ecosystems of terrestrial and marine areas and of their fauna. It also included descriptions of 10 biogeographical regions of Myanmar and proposed 20 sites for the establishment of the network of protected areas. After termination of the Project in 1984, its functions were taken over by the Nature and Wildlife Conservation Division under FD, which is responsible for the management of National Parks and other protected areas.

By the end of March, 2002, FD had already established 24 wildlife sanctuaries and 5 national parks, with a total area of about 1.38 million ha in 9 different bio-units. It means that the total area of protected areas system (PAS) is now about 2.03% of the total land area of Myanmar. Besides, there are 6 proposed wildlife sanctuaries and 3 proposed national parks, which are still in processing to be notified. The total area of proposed 9 units is about 1.82 million ha which is 2.69% of the total land area of the country. Hence the percentage of already notified and proposed PAS areas will be 4.72% of the country in the near future. As Myanmar Forest Policy (1995) stipulates to form a network of areas for protection of nature up to 5% of the country's landmass, FD continues to expand PAS areas covering all unique ecosystems of terrestrial and wetlands throughout the country.

Concerning biodiversity conservation, Myanmar has made commitments to the following international agreements and organizations:

(i) Global Tiger Forum, India in August 1994.
(ii) UN Convention in Biological Diversity in February, 1995.
(iii) Convention on International Trade in Endangered Species of Wild Fauna and Flora, in September, 1997.
(iv) Botanic Gardens Conservation International, England in November, 1998.
(v) The Cartagena Biosafety Protocol, a subsidiary agreement to the UN Convention on Biological Diversity in March 2001.

2.2 Demographic Information

2.2.1 Population growth and density

According to the statistics of Immigration and Manpower Department, the population of the country is estimated at 52.43 million as of the 1st of January, 2003. Distribution of population by State and Division is given in Table 5.

Table 5. Distribution and density of population

State/Division	As of 1-10-1987		As of 1-1-2003	
	Numbers (,000)	Density Nos / sq.mile	Numbers (,000)	Density Nos/sq.mile
Kachin State	992	29	1372	40
Kayah State	191	42	295	65
Kayin State	1155	98	1583	135
Chin State	394	28	497	36
Sagaing Division	4243	117	5685	157
Tanintharyi Division	1018	61	1464	87
Bago Division	4100	270	5350	352
Magway Division	3554	205	4899	283
Mandalay Division	5042	344	7286	497
Mon State Division	1865	393	2687	566
Rakhine State	2215	156	2929	206
Yangon Division	4369	1113	6089	1550
Shan State	3984	66	5081	84
Ayeyawady Division	5419	399	7217	532
Union	38541	148	52434	201

Source: Development in Myanmar (1988-2003), Ministry of Information, Myanmar.

Since the total population of the country was about 38.54 million before 1988, the population has increased by about 14 million within a period of 15 years. Consequently the population density increased from 57 persons per sq. km in 1988 to 78 persons per sq. km in 2003. In 1941, the total population was only about 16.82 million and hence the population of Myanmar tripled within about 62 years.

2.2.2 Employment by sectors

According to the labour force survey conducted in 1990 by the Department of Labour, the total population was 36.18 million out of which 27.28 million were 10 years old and above. Out of the population aged 10 years and above, employed population was 10.66 million (39.1% of 27.28 million) whereas unemployed population was only 0.69 million (2.5 %) and the others which were not included in the labour force (such as students, pensioner, housewives etc.) was about 15.93 million (58.4%).

The distribution of the employed population by occupation is shown in Table 6 based on the data from the labour force survey conducted in 1990.

Table 6. Distribution of employed population by occupation in 1990

Occupation/ Industry	Employed population(in thousands)			% of total employed population
	Male	Female	Total	
Agriculture, Forestry, fishery	4678	1346	6024	56
Wholescale, Retail trade, Restaurants etc.	713	974	1687	16
Manufacturing	708	504	1212	11
Community, Social & personal services	511	314	825	8
Transport, Communication & Storage	359	44	403	4
Construction	273	8	281	3
Mining and Quarrying	90	12	102	1
Others(Electricity, Financial Institution, etc.	106	28	134	1
Total	**7438**	**3230**	**10668**	**100**

Source: Statistical Yearbook 2002, Central Statistical Organization

As shown in the above table, the labour force in the agriculture, forestry and fishery sectors contributed about 56% of the total employed population.

2.2.3 Socioeconomic situation

The socioeconomic condition of Myanmar has gradually improved thanks to the tremendous efforts made by the Government during the last 15 years. Table 7 shows the progress achieved in the respective sectors comparing the status of 1988-89 and that of 2000-01.

2.3 Land-Use Status

2.3.1 Current land-use pattern

Myanmar is endowed with a rich diversity of natural habitats due to its unusual ecological diversity. As these diverse biological resources have been protected and conserved on a sustainable basis for about 150 years, about half of the country's total land area is still covered with forests. As a result, Myanmar can stand as one of the countries with highest forest cover in the Asia-Pacific region until now.

Myanmar being an agro-based country, the Government has systematically carried out special tasks with greater emphasis on the sustainable development of agriculture. During a period of 15 years from 1988 to 2003, the Government has constructed about 146 dams and reservoirs, 265 river-water pumping stations and launched a special programme for reclamation of inundated land as well as high land. Consequently, total net sown area of agriculture nearly doubled within a short period between 1996 and 2000. The land-use pattern in 2002 is given in Table 8.

Table 7. Progress of socioeconomic conditions

Description	Unit	As of 1988-89	As of 2000-01
Gross Domestic Product	Kyat million	47,141	88,134
Per Capita G.D.P	Kyat	1,200	1,794
Agriculture-net area sown	Million-acres	19.9	25.7
Fishery-fish ponds area	acre	7,059	131,312
Energy-natural gas	Cu. million	39,085	290,012
Industry-mills and factories	number	42,373	57,496
Electric-power	Mega watt	707	1,171
Construction-Bridges	number	57	222
Dams and cannals	number	172	290
Transport-Rail roads	mile	2,791	3,828
- Coastal ships	number	269	2,405
- River-going steamers	number	1,897	3,327
- Airport	number	37	44
Communication-Auto telephone	township	24	63
- Telephone	number	66,172	296,579
Education-University & College	number	30	97
- Basic education-High Schools	number	722	952
- Middle Schools	number	1,696	2,111
- Primary Schools	number	31,429	35,963
Health-Government Hospital	number	631	745
- Dispensaries	number	247	346

Source: Development in Myanmar (1988-2003), Ministry of Information, Myanmar.

Table 8. Land-use pattern in 2002

Land use type	Total area in 2002		percent of land area
	In sq. km	in sq. mile	
Net sown area	157,831	60,939	23.33
Fallow land	8,972	3,464	1.33
Cultivable waste land	74,759	28,865	11.05
Permanent Forest Estate	173,739	67,081	25.68
Unclassified forest	180,008	69,501	26.60
Other lands	81,268	31,378	12.01
Total	**676,577**	**261,228**	**100.00**

Source: Forestry in Myanmar, Forest Department, 2003.

As the forest cover includes both permanent forest estate and unclassified forests, its total area is currently about 52% of the country's total land area. The permanent forest estate comprises Reserved forests, Protected Public forests and Protected Areas System.

In addition to the present total net sown area, some area from fallow land and cultivable waste land categories can be brought under crop cultivation or livestock farming in future.

As the population is rapidly increasing in Myanmar, proper land use planning and management is of utmost importance to minimize the conflict over the land among the various sectors such as the agriculture, forestry, livestock breeding, mining etc. Environmental impact assessment (EIA) should be conducted to ensure that environmentally valuable lands are not encroached upon and that adverse environmental impacts can be avoided.

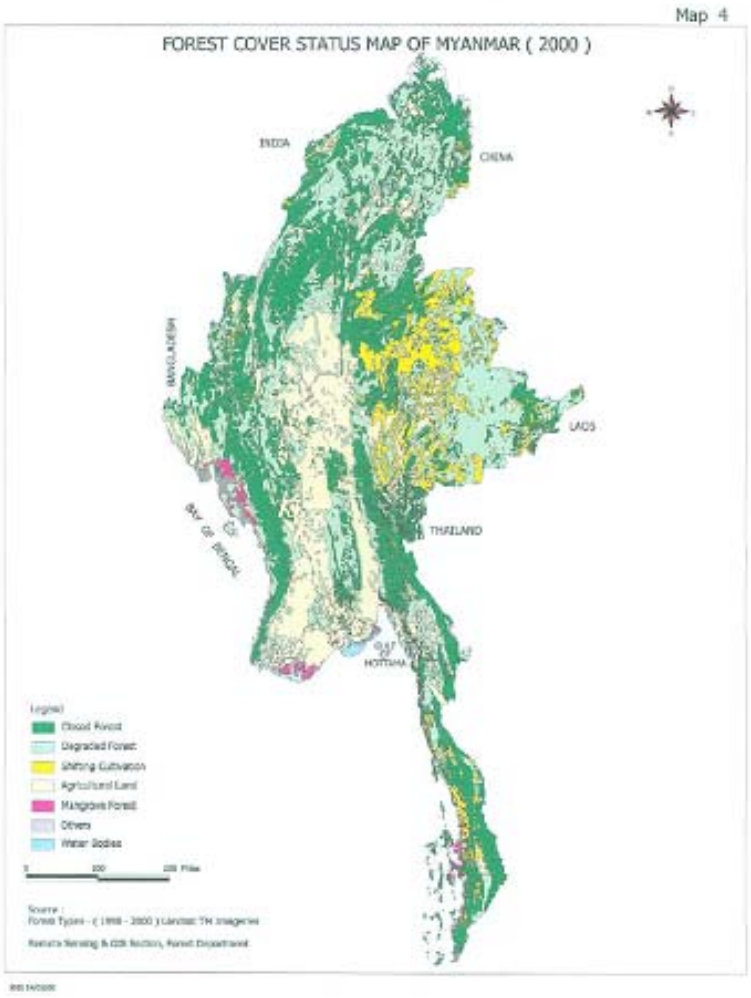
2.3.2 Status of forest cover

According to the forest resource assessment (FRA-2000) conducted by the Food and Agriculture Organization (FAO) in cooperation with the FD of Myanmar, the natural forests are still covering the considerable extent of the country's total land area. Closed forests or good forests constitute 37.38% while open or degraded forests compose 14.9% (See Table 9 and Map 4).

Table 9. Forest cover status in 2002

Forest Category	Area		percent of land area
	in sq. km	in sq. mile	
Closed forests	252,939	97,660	37.38
Open Forests	100,808	38,922	14.90
Total Natural Forest	**353,747**	**136,582**	**52.28**

***Source*:** Forestry in Myanmar, Forest Department, 2003.



2.3.2.1 Permanent forest estate (PFE)

Permanent Forest Estate (PFE) includes reserved forests and protected public forests constituted under the Forest Law and protected areas system (PAS) designated under the Protection of Wildlife and Protected Areas Law. According to Myanmar Forest Policy, 30% of the total land area of the country is to be gazetted as reserved forests and 5% under protected areas system. The status of PFE in 2003 is given in Table 10.

Table 10. Permanent Forest Estate in 2002

Category	Area		% of land area
	in sq. km	in sq. mile	
Permanent Forest Estate	173,739	67,081	25.68
- Reserved Forest	114,995	44,400	17.00
- Protected Public Forest	26,799	10,347	3.96
- Protected Areas System	31,945	12,334	4.72
Unclassified Forests	180,008	69,501	26.60

Total Forest Cover	**353,747**	**136,582**	**52.28**

Source: Forestry in Myanmar, Forest Department, 2003.

2.3.2.2 Forest-vegetative types and productivity

The natural forests of Myanmar mainly comprise 92% of Broad-leaved forests, 3% of conifers, 2% of Mangroves and 3% of bamboo forest. Out of total forested areas, only 65% are productive. Detailed information is presented in Table 11.

Table 11. Forest-vegetation types and productivity

Type of Vegetation	**Area in sq. kilometer**			**Percentage**
	Productive	Un-productive	**Total**	
Broad-leaved forest	206,550	119,080	325,630	92
Conifers	10,640	-	10,640	3
Mangrove	3,820	4,030	7,850	2
Bamboo	9,630	-	9,630	3
Total	**230,640**	**123,110**	**353,750**	**100**
Percentage	**65**	**35**	**100**	

Source: Forestry in Myanmar, Forest Department, 2003

Broad-leaved forests can be found throughout the country and types of forests vary depending on their occurrence. Deciduous forests and Dipterocarp forests naturally occur in the regions with pronounced dry season, and wet evergreen forest in areas of high moisture regime and rainfall, hill evergreen at high altitudes, dry thorn forests in places with scanty rainfall.

Conifers are found at high altitudes and in subtropical regions in Shan, Kayah, Chin and Kachin States. Mangrove and estuarine forests are located in the coastal and delta regions in Ayeyawady, Rakhine and Taninthayi Divisions. Generally, bamboos and canes are common associates growing as understorey of the deciduous and evergreen forests, but pure stands of bamboos are found in Rakhine State and Taninthayi Division.

2.3.2.3 Types of forest

Due to different localities, topography and climatic conditions, the forest flora in Myanmar are diverse and vary from sub-alpine in the north through dry and moist mixed deciduous to tropical rain forests in the south. There are eight primary forest types, out of which five types are located in terrestrial regions and the other three are in the wetlands and coastal regions. Major types of forest and their respective areas are shown in Table 12. Map 5 shows forest types of Myanmar.

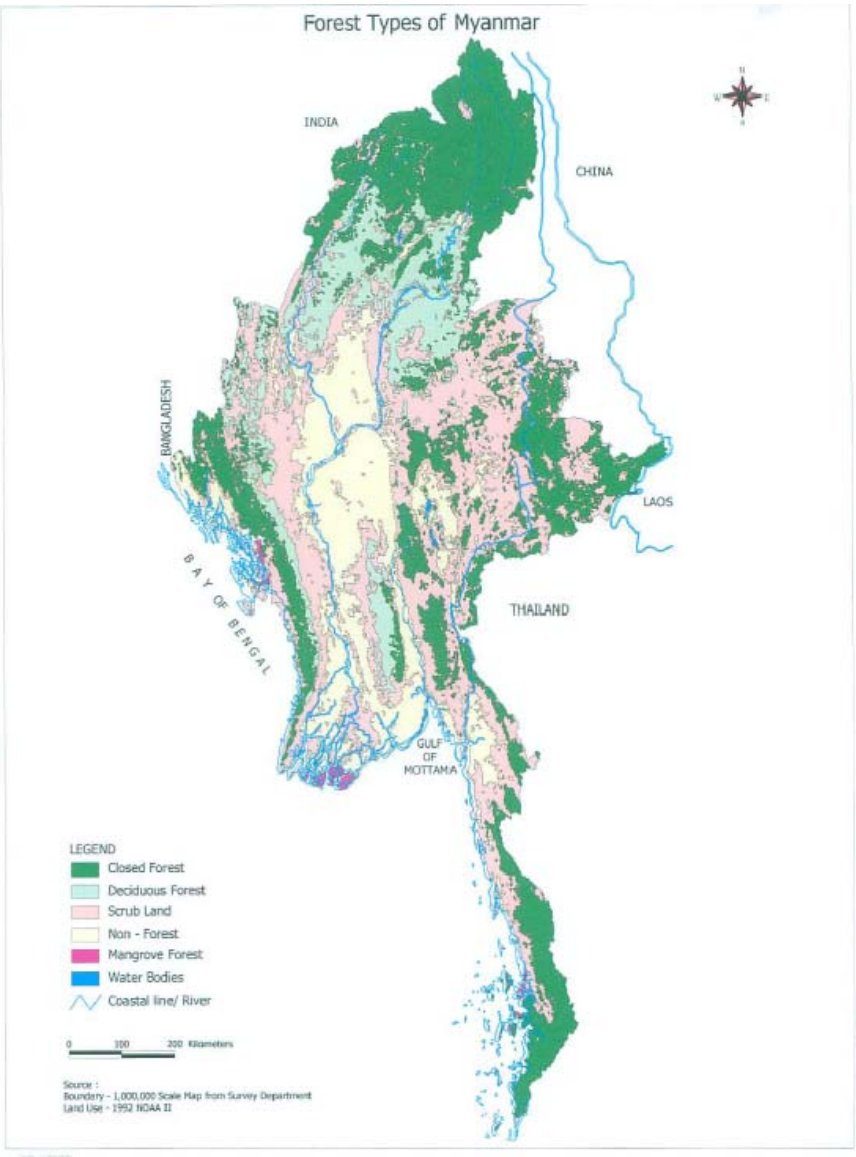


Table 12. Types of forest

Type of forest	Area in		percent of total forest area
	sq. km	sq. mile	
Tidal forest Beach and Dune forest Swamp forest	13,750	5,309	4
Tropical Evergreen forest	55,004	21,237	16
Mixed deciduous forest	134,068	51,764	38
Dry forest	34,377	13,273	10
Deciduous Dipterocarps Forest	17,187	6,636	5
Hill and Temperate Evergreen	89,378	34,509	25

Forest fallow	99,83	3,854	2
Total forest area	**353,747**	**136,582**	**100**

Source: Forestry in Myanmar, Forest Department, 2003

Various types of forest mentioned above are useful in their own ways. As the interface between the land and the sea, mangrove formations are important as sources of forest products for local people as well as providing habitat and shelter to estuarine fishery, fauna and for coastal protection. The mixed deciduous forests are economically the most important forest types as teak (*Tectona grandis*) and other commercial species are usually associated with these forests. Next to teak-bearing forests, dipterocarp forests and evergreen forests are also important timber producing forests in the country. The rapid decline of the dipterocarp resource in neighbouring countries is boosting the export demand for an increasing amount of Myanmar dipterocarps.

2.3.3 Changes in land use and forest cover

2.3.3.1 Land use change

Due to the rapid development in agricultural and forestry sectors within the last decade, the land use pattern has been prominently changed between 1996 and 2002. Changes in land use pattern between 1996 and 2002 are given in Table 13.

Table 13. Land use changes between 1996 and 2002

Land use type	As of 1996		As of 2002		Changes in 6 years	
	Sq: km	%	Sq: km	%	Sq: km	%
Net sown areas	87,663	12.96	157,831	23.33	+70,168	+10.37
Fallow Lands	13,747	2.03	8,972	1.33	-4,775	-0.7
Cultivable wastelands	81,290	12.01	74,759	11.05	-6,531	-0.96
Permanent Forest Estate	103,090	15.24	173,739	25.68	+70,649	+10.44
Unclassified Forests	240,677	35.57	180,008	26.61	-60,669	-8.96
Other lands	150,110	22.19	81,268	12.01	-68,842	-10.18
Total	**676,577**	**100**	**676,577**	**100**	**+140,817**	**+20.81**
					-140,817	**-20.8**

Source: Forestry in Myanmar, Forest Department, 2003

Note: Other lands include residential areas and unclassified land not suitable for crop cultivation.

It is noticeable in Table 13 that the agricultural land has been increased nearly double due to the development activities such as construction of dams and reservoirs, establishment of river-water pumping stations, reclamation of inundated and high lands, etc. As a result, fallow lands and cultivable wastelands decreased to some extent.

Similarly, due to the effective reservation programme under the guidelines of the Myanmar Forest Policy, FD has constituted noticeable amount of natural forest areas as reserved forests, protected public forests and protected areas forests and hence some area from other woody lands could be successfully designated under PFE within a short period of six years.

2.3.3.2 Forest cover changes

During the last 40 years, the forest cover of Myanmar was assessed four times in order to determine the total forest cover area, to evaluate the dynamic status of forests and to analyze forest-related changes. In the early 1960s, the first appraisal of forest cover assessment was conducted solely based on the visual interpretation of aerial photographs taken between 1951 and 1963. In 1980, FD carried out second appraisal using the landsat imagery data with the assistance of the UNDP/FAO project. Third and fourth appraisals were also done based on the satellite data using both visual interpretation and computer classification methods. Table 14 shows the status of forest covers in Myanmar at different periods.

Table 14. Forest cover changes at different periods

Year of appraisal	Forest cover area		Percent of total land area
	Sq: km	Sq: mile	
1955 (1st Appraisal)	387,003	149,442	57.2
1975 (2nd Appraisal)	356,656	137,705	52.7
1989 (3rd Appraisal)	343,701	132,703	50.8
1997 (4th Appraisal)	353,747	136,582	52.3

Source: Forestry in Myanmar, Forest Department, 2003

As shown in the above table, the forest cover gradually decreased up to 1990 due to population pressure and conversion of forest into other uses. But, during the last decade, FD and the newly instituted DZGD effectively maintained and improved the existing natural forests and also established various types of forest plantations on degraded and denuded lands with accelerated momentum. Consequently, the forest cover has increased to some extent during that period.

2.4 State of Land degradation and Desertification

2.4.1 Current situation of land degradation and desertification

Desertification, which is commonly known as encroachment or expansion of sand desert, is not well known in Myanmar. But, according to the definition of the Convention to Combat Desertification, it means land degradation or conversion of productive fertile lands into unproductive or worthless desert-like formation resulting from various factors including climate variations and human activities. Needless to say, deforestation is the first step in the process of desertification.

Deforestation rate in Myanmar has been analyzed based on the data of forest cover assessments conducted four times during a period of 40 years. The status of deforestation in four successive assessments is given in Table 15.

Table 15. Deforestation Rate in Four Successive Forest Cover Assessments

Assessment	1st Appraisal 1955	2nd Appraisal 1975	3rd Appraisal 1989	4thAppraisal 1997
Actual forest area (with>40% crown closure) in sq. km	385,635	323,216	292,579	252,939
Lost in actual forest (sq. km)	-	62,419	30,637	39,640
Interval (year)	-	20	14	8
Deforestation rate (sq. km/year)		3,121	2,188	4,955
Deforestation rate (acres/year)		0.77 million	0.54 million	1.22 million
- Percent of total land area		0.5	0.3	0.7
Overall deforestation rate between 1955 – 1997 (42 years)	←	3,160 sq. km/year (0.5% of total land area)		→

Source: Review of Land use and Land degradation status in Myanmar, FD, 2002.

As mentioned in the above table, the overall deforestation rate between 1955 and 1997 is about 3,160 square kilometres per year. It means that the actual forest area is annually decreasing at a rate of 0.5% of the total land area of the country.

Out of the 14 States and Divisions, 4 States and 3 Divisions are more seriously affected by deforestation during a period of 14 years from 1975 and 1989. The status of actual forest cover and the deforestation rate of those States and Divisions are stated in Table 16.

Table 16. Deforestation rate in seriously affected areas

State/Division	Actual forest area in sq. km			Decreased % of land area
	As of 1975	As of 1989	Decreased amount	
Kachin State	11,798	9,404	2,394	0.35
Chin State	15,708	10,977	4,731	0.70
Bago Division	19,680	13,601	6,079	0.90
Magway Division	25,540	10,994	14,546	2.15
Mandalay Division	12,444	9,859	2,585	0.38
Rakhine State	21,890	19,489	2,401	0.35
Shan State	41,722	39,362	2,360	0.35
Union (14 States and Divisions)	323,216	292,579	30,637	4.53

Source: Forest Cover of Myanmar, the 1989 appraisal, 1991.

2.4.2 Population and poverty

Poverty is defined as a pronounced deprivation of well-being related to lack of material income or consumption, low levels of education and health, vulnerability and exposure to risk, no opportunity to be heard, and powerlessness (World Bank, 2001). Thus, poverty alleviation can be defined as the successful lessening of the deprivation of well-being (State of the World's Forests, 2003). Based on the 1997 survey, the World Bank reported that the poverty incidences in rural and urban areas of Myanmar were estimated at 22.4% and 23.9% respectively, and Kayah State, Chin State and Magway Division have much higher incidences of poverty than in other States and Divisions (World Bank, 2000). It is likely that the actual poverty incidence is higher given that the infant mortality rate and maternal mortality rate are higher than the regional average. In addition, the incomes of landless farmers, small rain-fed farmers in the semi-arid areas, and the shifting cultivators in the mountainous regions are extremely low.

The population of Myanmar in 2003 was estimated at 52.4 million. Current population density is 520 persons per sq. km on the average. As Yangon is the capital of Myanmar, Yangon division is the most densely populated area with the population density of 4014 persons per sq. km. Mon State, Ayeyawady division and Mandalay Division area also densely populated having the densities of 1466, 1378 and 1287 persons per sq. km

respectively. Kachin, Kayah, Chin and Shan States and Taninthayi Division are sparsely populated because population density in the divisions is generally below 259 persons per sq. km.

According to the population census in 1983, 75% of the total population are living in rural areas. Labour force survey, conducted in 1990 by the Department of Labour, recorded that about 56% of the labour force are working in agricultural, forestry, livestock and fishery sectors. Realizing the vital role of socio-economic status of the rural people on the national development of the country, the Government has been implementing development programme with impetus by adopting plans and projects in these sectors. These development programmes are intended to promote the employment generation and hence to alleviate the poverty which is one of the main causes of land degradation.

In the agricultural sector, net sown area increased from 7.96 million ha in 1988 to 10.28 million ha in 2000 due to construction of dams, reservoirs and river-water pumping stations in water deficit areas and also due to the land reclamation programme. Since agriculture plays a leading role for the development of the rural people, cattle husbandry is primarily for draught power while pig and poultry husbandry is usually for subsistence living. Due to the technical assistance and encouragement of the Government, number of draught cattle increased from 9.1 million in 1988 to 11.7 million in 2003. Similarly the number of pigs increased from 2.4 million in 1988 to 4.8 million in 2003 and poultry from 27.8 million in 1988 to 63.0 million in 2003. In addition, prawn breeding area has been extended up to about 600 ha in 3 States and 4 Division during the last 3 years.

Forestry is an important sector in undertaking socioeconomic development of the rural people providing their basic needs for fuelwood, housing materials such as poles, posts and roofing materials, food for people and fodder for domestic animals etc. Community forestry is a special programme intended to improve the living standard of the rural communities.

Although satisfactory progress has been achieved in these important sectors for rural people in many parts of the country, the people in the Dry Zone of the Central Myanmar are still struggling to combat poverty due to adverse climatic conditions, low productive, infertile soil, and insufficient water availability.

To effectively reduce poverty, specific projects or programs need to be designed and targeted to benefit the poor through the selection of project areas where the poor are concentrated, and through the types of activity in which the poor can participate.

2.4.3 Agriculture and livestock

Developments in agriculture and livestock breeding sector will certainly provide the rural people with good opportunities to upgrade their status of socio-economic situation. However, these developments must be implemented with due considerations on environmental stability and proper land use practices, otherwise sustainable development cannot be achieved.

In order to gain surplus in rice and to achieve self-sufficiency in edible oil, the Ministry of Agriculture and Irrigation adopts the five reform measures as follows:

(i) Development of new agriculture land;

(ii) Provision of sufficient irrigation water;

(iii) Provision of support for agricultural mechanization;

(iv) Application of modern technologies; and

(v) Introduction of modern varieties.

In order to fulfil the objectives, the paddy, which is 'National Crop' is nowadays being grown even in summer with the water provided through irrigation schemes. Similarly, in addition to cultivation of major oil crops such as groundnut, sesame, sunflower, niger and mustard, cultivation of other kinds of edible oil crops including oil plam, soybean and flower sesame are also being extended. Irrigation including sprinkler irrigation method is also practiced in cultivation of oil crops.

Area extension is also being carried for perennial crops such as rubber, oil palm cashewnut, green tea, coffee, orange, lychee etc. The extended areas for these crops are now about 0.5 million acres in the year 2000 and has to be increased more in future.

As water plays a vital role in growing crops, extending multiple cropping areas and greening the environment, the Ministry of Agriculture and Irrigation has laid down six measures of activities for availability of water. During the period between 1988 and 2002 (January), about 129 dams have been constructed in 12 States and Divisions and hence irrigated area becomes increased up to 4.9 million acres. The majority of these dams are located in the Dry Zone of Mandalay, Magway and Sagaing Divisions and also in Bago Division.

Extension of agricultural land, construction of dams and reservoirs, and increasing of livestock breeding areas really contribute towards the socioeconomic development of local people. On the other hand, some forest areas have to be clear-felled for other land uses apart from forest land use, disturbing biodiversity conservation and environmental stability to some extent. Environmental Impact Assessment (EIA) should be therefore carried out for such development programme in order to ensure ecological balance, environmental stability and sustainable socioeconomic development of the local people.

2.4.4 Energy

Woodfuel still remains the dominant energy source in many countries of South and Southeast Asia, though some are trying to increase the supply of commercial energy sources to reduce the share of traditional energy.

In Myanmar, woodfuel is a vital energy source for household cooking and for some cottage industries. The commercial energy sources including crude oil, natural gas, coal and hydropower are mainly used for transportation, industrial and other purposes. Energy consumption by sources in 1990 is shown in Table 17.

Table 17. Energy consumption by sources in 1990

Energy sources	Energy consumption in thousand toe					percent
	Household	Transport	Industry	Other	Total	
Fuelwood	7181.5	-	-	-	7181.5	78.3
Charcoal	535.6	-	-	-	535.6	5.8
Biomass residues	227.8	-	-	75.9	303.7	3.3
Crude oil	7.3	362.5	134.0	109.8	613.6	6.7
Natural gas	-	-	194.6	167.1	361.7	3.9
Coal	-	-	23.6	-	23.6	0.3
Hydropower	48.3	-	88.1	19.5	155.9	1.7
Total	**8000.5**	**362.5**	**440.3**	**372.3**	**9175.6**	**100.0**

Source: Wood Energy Development in Myanmar, Energy Planning Department, 1990.

Note: toe = Tons of Oil Equivalent

As the population increases, woodfuel consumption has been increasing during the last three decades as compared to the use of other sources. Table 18 shows the trend of energy consumption by sources.

Table 18. Trend of Energy consumption by sources

Energy sources	Energy consumption in thousand toe				
	1975	1980	1985	1988	1990
Fuelwood Charcoal	78.9	73.6	74.8	78.6	84.1
Biomass residues Crude oil Natural gas Coal Hydropower	21.1	26.4	25.2	21.4	15.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Wood Energy Development in Myanmar, Energy Planning Department, 1990.

As shown in Table 18, woodfuel energy contributes from about 74% to 84% of total energy consumption in Myanmar.

As the woodfuel remains the dominant energy source for the majority of people in Myanmar, the accessible forests become generally very sparse due to heavy demand on woodfuel and forest products especially in the densely populated areas. In some localities with a high rate of population growth and a high degree of rural poverty, the hardwood species suitable for wood energy become scarcity due to commercial marketing of woodfuel and charcoal to urban consumers.

The Ayeyawady mangrove forest is a prominent example as it has been affected by serious deforestation and environmental consequences due to increasing population pressure and over exploitation of mangrove products including woodfuel and charcoal exporting to meet the demand of Yangon City. As a result, the local people are now facing the problems of acute shortage of woodfuel and mangrove products, salt intrusion in agriculture land, poverty and unemployment, and loss of mangrove ecosystem and habitats for marine life and wetland avifauna.

Similarly, in the Dry Zone of Central Myanmar, crop faming is not sustainable for their livelihood since there is a constraint of agro-climatic condition with erratic rainfall, high temperature and frequent droughts. This makes the local people rely on the over-exploitation of the natural resources including woodfuel for their daily lives as well as for cottage industries such as brick making, tobacco curing, jaggery boiling and milk condensing. In addition to woodfuel, agricultural residues such as rice husks, groundnut shells, stalks of paddy, wheat, pigeon-pea etc and forest-waste such as saw dust are nowadays extensively used as those are locally available at low cost or free of charge. In some areas, even animal waste such as cow dung is also used for fuel.

At present, a small percentage of households use electricity and other commercial fuels in the Dry Zone and hence most of the natural forests in the vicinity of the villages are affected by repeated cutting of trees for fuelwood. Due to fuelwood deficit and its high price, most rural families have no option but to use other but undesirable fuel-substitutes such as agro-residues and forest waste for household cooking which contribute about 25% of the total fuel consumed.

2.5 Rural Development in Myanmar

The Union of Myanmar is home to over 100 national races. Its administrative system is divided into seven states and seven divisions, 64 districts and 324 townships. Over 70 per cent of the country's total population are residing in rural races. Therefore, the townships, districts and states and divisions will develop only if the rural areas, where the majority of people live, develop. In other words, the Union will develop only if there is progress in the rural areas, the most basic regions of the nation.

Head of State has given guidance to repair and upgrade roads to facilitate the flow of rural goods to the markets in towns. Coordination will have to be made to effectively repair the roads linking the towns and villages to facilitate transport sector and raise the economic, health and education standards of the village people. In accord with the guidance, the five rural development tasks, namely transport facilitation; potable water supply; education promotion; health care promotion; and economic development have been laid down and are being implemented.

The expenditure amounted to a total of K 3,126.44 million, to which DAD contributed K 2,703.64 million and the local people donated K 422.80 million. The State and Division Development Affairs Committees have been building roads linking villages; villages and towns; and in the towns and districts, to raise the economic, social, health, education and transport standards of the rural areas. The 30-year rural road development plan from 2001-2002 to 2030-2031 is being implemented.

During the first five years of the 30-year plan, 72 km of tarred roads, 555 km of gravel roads, 182 km of laterite roads, and 1,443 km of earth roads totaling 2,180 km of rural roads were built in 2001-2002; 174 km of tarred roads, 275 km of lateriate roads and 2,381 km of earth roads totaling 2,830 km of rural roads were built in 2002-2003; and in 2003-2004, a target has been set to build 34 km of tarred roads, 248 km of gravel roads; 76 km of lateriate roads totaling 358 km of rural roads.

Table 19. Rural Water Supply

State/Division	Target for 2003-04 (villages)	Completion up to 31-12-03 (villages)
Sagaing Division	312	144
Magway Division	159	87
Mandalay Division	769	470
Others	1091	768
Total	2331	1469

***Source*:** The New Light of MYANMAR, Dated 11-2-2004

First priority is given to villages which have no water resources at all or where water is hard to find; second priority to villages which have insufficient water supply; and third priority to villages which are not accessible to potable water.

The five methods drilling tube-wells, building new mini reservoirs to store rain water, digging new wells and upgrading them, supplying water from springs, and diverting water from rivers and creeks are being employed to supply water to villages. Target and implementation with respective to rural water supply for 2003-04 is given Table 19.

Villages in the dry regions including Mandalay, Sagain and Magway Divisions have been designated as priority villages. In addition to the three divisions in the dry region, the 10-year water supply projects have been implemented in other states and divisions. Of the target of 8.042 villages in the three divisions, potable water supply has been ensured in 714 villages in 2000-2001; 1,098 villages in 2001-2002; and 1,020 villages in 2002-2003; and the target for 2003-2004 is 416 villages.

In other states and divisions, a project is being implemented to supply clean water to 344 villages where water is difficult to find, 5,489 villages which do not have access to sufficient water supply and 9,350 villages with no potable water supply totaling 15,183 villages. During the three-year period from fiscal 2000-2001 to 2003-2004, clean water supply projected has been launched in 5,024 villages in Kachin, Kayah, Kayin, Chin, Mon and Rakhine states, Taninthayi, Bago, Yangon and Ayeyawady divisions and northern, southern and eastern Shan State.

As there is improvement in the transport, there is also progress in the economic, health and education sectors. There are now three primary schools in every five villages. Education promotion is another priority given to development of rural areas. Special attention has been paid to school enrollment of the school age children, extension of elementary schools and opening of post-primary schools in the rural areas.

In the rural health sector, station hospitals and dispensaries have been extended, and more doctors, nurses and midwives have been assigned. The State is also providing necessary equipment and medicines.

Efforts are being made for progress of the agriculture and livestock breeding in the rural areas. The State has built over 150 dams and 265 river water pumping stations.

A project has been launched to set up 34 special poultry farms in two or four townships in every state and division. The farms are distributing meat to rural people at reasonable prices. Road transport, clean water supply, education and health care services are improving in the rural areas. The rural economy including farming is developing.

Of the five tasks, the task transport facilitation has been given priority. Improvement of the transport is required for development and modernization of the towns and villages. Beginning the fiscal 1997-98, the Development Affairs Department has been extending roads and bridges in rural regions, using 55% of its funds. During the four-year period from 1997-98 to 2000-2001, 453 km of tarred roads, 2101 km of gravel roads, 1132 km of lateriate roads and 1974 km of earth roads totaling about 5,660 km of rural roads have been completed. Table 20 shows the status of completion of rural roads between 1988 and 2003.

Table 20. Rural Roads

Type	**1988 (km)**	**2003 (km)**
Tarred	452.21	1,146.12
Gravel	1,099.43	5,063.25
Mandalay Division	1,084.94	2,215.16
Others	3,369.53	28,393.76
Total	6,006.11	36,818.29

Source: The New Light of MYANMAR, Dated 11-2-2004

Chapter 3. POLICY, LEGISLATION AND STRATEGY LINKING COMBATING DESERTIFICATION

3.1 Myanmar Forest Policy

The Myanmar Forest Policy was formulated in 1995, taking full cognizance of the forestry principles adopted at the United Nations Conference on Environment and Development (UNCED), held at Rio de Janeiro in 1992. Keeping in view of the important role of forestry sector in enhancing national socio-economic development, and ensuring ecological balance and environmental stability, it has been formulated in a holistic and balanced manner within the overall context of the environment and sustainable development.

The policy has identified six imperatives in accordance with the forestry principles adopted at the UNCED and the political commitments and statement of the goals and objectives of the national development policy. Each of these imperatives has to be given highest Government priority in order to achieve broader national goals and objectives. The imperatives identified are:

(i) PROTECTION of soil, water, wildlife, bio-diversity and environment;

(ii) SUSTAINABILITY of forest resources to ensure perpetual supply of both tangible and intangible benefits accrued from the forests for the present and future generations;

(iii) BASIC NEEDS of the people for fuel, shelter, food and recreation;

(iv) EFFICIENCY to harness, in the socio-environmentally friendly manner, the full economic potential of the forest resources;

(v) PARTICIPATION of the people in the conservation and utilization of the forests;

(vi) PUBLIC AWARENESS about the vital role of the forests in the well being and socio-economic development of the nation.

Some of the important policy measures directly and indirectly related to the prevention of land degradation are:

- Establish a land use advisory board with responsibilities to oversee and coordinate overall land utilization so that land is used for the purpose for which it is best suited.
- 30% of the total land area of the country should be gazetted as reserved forest and 5% under protected areas system.
- Make EIA of development projects obligatory -with related rules/regulations formulated and enforced.
- Establish plantation cooperatives and provide institutional finance for establishment of man-made forests on degraded/denuded lands.
- Reforest an area of 20,000 hectares annually to restore degraded lands and meet rural needs.
- Ensure a rational balance between national forest industry processing capacity and resource availability.

- Recognize the socio-economic importance of non-wood forest products in the list of priorities for forest development.
- Prepare a 10-year perspective plan for providing general guidelines and broad targets for sectoral development.
- Allocate a reasonable portion of the earning from forests for adequate reforestation and other forest development efforts.
- Strengthen the extension capabilities and develop mechanisms for greater public involvement in forestry programmes.

3.2 Myanmar Forest Law

The 1902 Forest Act had been used for the administration of the national forest estate for about 90 years after being amended and revised several times to reflect changing requirements.

In 1992, the new Forest Law was enacted replacing the old 1902 Forest Act and shifting from the concept of revenue generation to motivation and sharing of management responsibilities with people. The 1992 Forest Law highlights forest protection, environmental and bio-diversity conservation and extension of permanent forest estates and protected areas. It encourages community participatory approach in managing natural and man-made forests, particularly to satisfy the basic needs of the rural people. It also provides opportunities for the promotion of private sector involvement in reforestation and timber trade.

The basic principles of the Forest Law are:

(i) to implement the forestry policy of the Government;

(ii) to implement the environmental conservation policy of the Government;

(iii) to promote the sector of public co-operation in implementing the forestry policy and the environmental conservation policy of the Government;

(iv) to develop the economy of the State, to contribute towards the food, clothing and shelter needs of the public and for perpetual enjoyment of benefits by conservation and protection of forest;

(v) to carry out in accordance with international agreements relating to conservation of forests and of environment;

(vi) to prevent the dangers of destruction of forest and bio-diversity, outbreak of fires, infestation of insects and occurrence of plant disease;

(vii) to carry out simultaneously conservation of natural forests and establishment of forest plantations;

(viii) to contribute towards the fuel requirement of the country.

Some of the peculiar sections aiming to the prevention of land degradation, improvement of environment and socio-economic of the people are:

If permission is obtained from the Government:-

(a) the Government and any person or any organization have the right to carry out in joint-venture;

(b) any person or any organization has the right to carry out in accordance with the stipulation, cultivation and maintenance of forest plantations with the exception of village-owned firewood plantations cultivated by the villagers for their use.

The Director-General may grant permission with some stipulations to establish the village-owned firewood plantations in a reserved forest, protected public forest or on land at the disposal of the Government in the vicinity of the village:-

(a) firewood plantation established by the Forest Department for a certain period and then transferred to be maintained and use as village-owned;

(b) village-owned firewood plantation established, maintained and used by the villages by collective labour.

A person having obtained the right to extract forest produce on a commercial scale who has the responsibility of establishing forest plantations or carrying out natural regeneration under a permit for the State shall carry out the same at his own expense and in accordance with stipulation. Forest produce may only be extracted after obtaining a permit. However, if it is for domestic or agricultural or piscatorial use not on a commercial scale, forest produce may be extracted in an amount not exceeding the stipulated quantity without obtaining a permit.

3.3 Protection of Wildlife, Wild Plants and Conservation of Natural Areas Law

Myanmar has a wide variety of natural ecosystems ranging from land, forest ecosystems to marine, coastal and mountain ecosystems. The country has been divided into 9 biounits each representing a different agro/eco-climatic zone. There are about 7,000 plant species, more than 300 mammals, 360 reptiles and 1000 bird species which have been identified. The concept of bio-diversity conservation has been practiced in Myanmar nearly 150 year ago as a game sanctuary was designated at the environ of Mandalay Royal city with a decree by King Min Don in 1859. Wildlife conservation has been legally started since 1918, with establishment of wildlife sanctuaries in Kachin State and Mandalay Division. Map 6 shows existing wildlife sanctuaries and national parks in Myanmar.

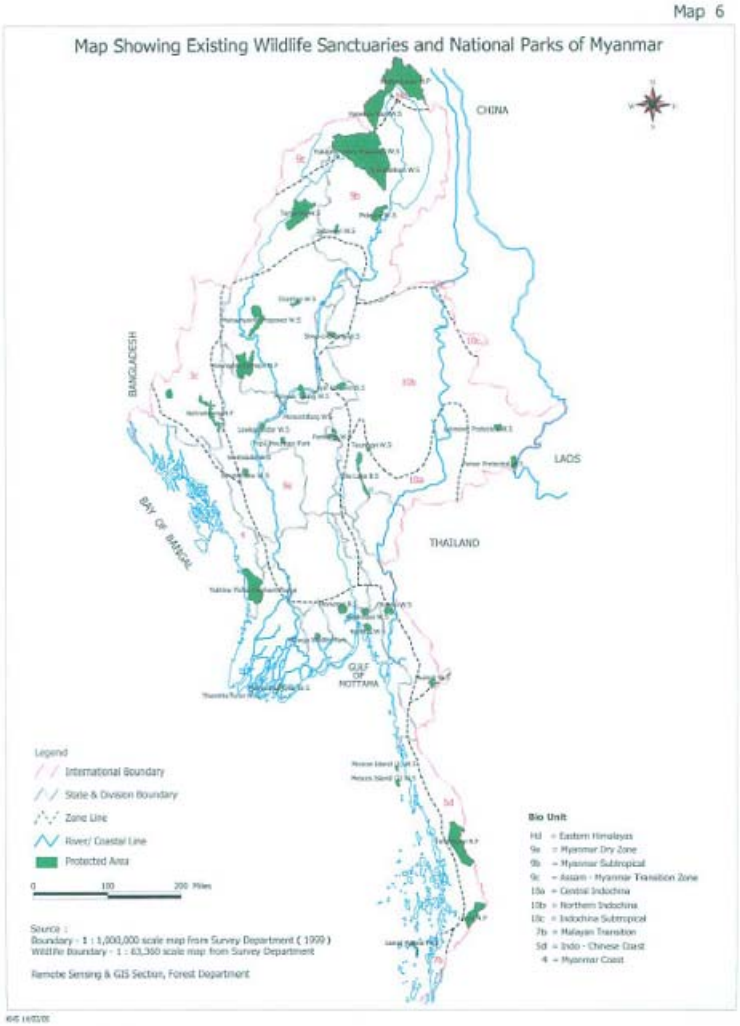
The Law relating to the protection of wildlife was enacted under 1936 Burma Wildlife Protection Act including basic legislation for:

(i) the establishment of wildlife sanctuaries;
(ii) prohibition of hunting within reserved forests without a licence;
(iii) protection of certain species including elephant, rhinoceros, tapir, bison, deer etc.;
(iv) closed seasons for the hunting of various other species of both mammals and birds;
(v) prohibition of certain hunting methods; and
(vi) powers of enforcement including arrest and seizure and confiscation of weapons and other articles used in commission of the offence.

Although Myanmar is well endowed with diverse natural resources of flora and fauna, some species are now being listed under endangered or threatened to be extinct due to the loss of habitats, unlawful hunting and illegal trades in wildlife products. As a result, the new law had been prepared, enhancing greatly the effort for environmental protection and bio-

diversity conservation and also perpetuation and sustainable utilization of the nation's biological resources.

Map 6



In 1994, the new Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law was enacted replacing the 1936 Burma Wildlife Protection Act. The new law highlights habitat maintenance and restoration, protection of endangered and rare species of both fauna and flora, establishments of new parks and naturally protected areas, and buffer zone management. The main objectives of the new law are:

(i) to implement the policy of protecting wildlife of the State;

(ii) to implement the policy of conserving the protected areas of the State;

(iii) to carry out in accordance with International Conventions agreed by the State in respect of the protection of wild species of both flora and fauna and representative ecosystems occurring in the country;

(iv) to protect endangered species of wild flora and fauna and their habitats;

(v) to contribute for the development of research on natural sciences; and

(vi) to establish zoological gardens and botanical gardens for the protection of flora and fauna.

3.4 Community Forestry Instructions

The FD issued the Community Forestry Instructions in 1995 with the object of supporting the economic development of the country, regaining environmental stability, providing basic of local communities, and encouraging active participation of rural population in trees planting and reforestation in barren and degraded lands.

By the definition of Community Forestry, the local community has the opportunity to participate in doing some forestry operations such as:

(i) establishment of woodlots where there is insufficient fuelwood and other products for community use; and

(ii) Planting of trees and exploiting of forest products to obtain food supplies, consumer products and income at farmers level;

According to the instructions, the community forests will be allowed to be established with the permission of the Government, on reserved forest, unclassed forest, protected forest and land at the disposal of the State. In order to establish village owned fuelwood plantations, they only need the permission of the Director-General of the FD. The implementation of community forests mainly stress on the participation of local community in managing forests for meeting the basic needs of the rural people in term of firewood, small timbers and non-wood forest products without detriment to environmental conservation. In line with the objective of the Instructions, Community Forest will be permitted to be established in the following areas:

(i) In degraded natural forests where natural regeneration is difficult;;

(ii) In areas where there is potential to meet the local demand for forest products;

(iii) Areas suitable for the establishment of Community Forest and where there is need to conserve soil and water resources;

(iv) Natural forests which for various reasons should be managed by the local community; and

(v) Forest lands traditionally managed by the local community.

Some of the salient points concerning the establishment of Community Forests are given below.

3.4.1. Duration of land lease

(i) The duration of land lease for the establishment of Community Forest is initially set for 30 years

(ii) After a period of 30 years, the District Forest Officer will, with the approval of the Director General of FD, determine whether or not to extend the lease depending on the performance and the desire of the users' group.

3.4.2 Assistance from the Forest Department

FD provides the following assistance to the users' group free of charge:

(i) Seed and seedlings necessary for the establishment of Community Forest for the first rotation; and

(ii) Technical assistance and expertise necessary for the establishment, cultural operations management and utilization of Community Forest so as to attain sustainable development

3.4.3 Exploitation of Forest products from Community Forest

(i) Users' group can exploit the forest products of the Community Forest in accordance with the prescription of the management plan.

(ii) No tax shall be levied on the users' group or members of the users' group concerning the forest products exploited for personal use.

(iii) Surplus forest products can be sold to non members of the village at reasonable prices. Taxation shall be exempted from the sale of these products.

(iv) The users' group can market the surplus forest products to areas outside the village.

(v) For marketing of the forest products to areas outside the village, tax shall be levied by FD at specified rates.

(vi) The users' group will use the incomes mainly for the implementation of the management plan and for the development of the Community Forest.

(vii) Only surplus incomes can be used for social welfare and economic development of members of the users' group in line with the wish of the members.

(viii) The users' group can utilize the forest products of the Community Forest and surplus cash to develop business enterprises that produce value added products.

3.5 Greening the Central Dry Zone of Myanmar

The Dry Zone of Central Myanmar is the most problematic region in terms of degradation of land resources because of continued deforestation and its severe climatic conditions. The total area of that region is about 8.72 million ha (21.55 million acres) covering 13 districts in Magway, Mandalay and Sagaing Divisions. Most of the lands in the dry zone area have been degraded long time ago due to repeated cutting of trees for fuelwood, incorrect cultivation practices, overgrazing and extreme climatic conditions. Realizing the status of this land degradation, all possible measures have been taken to prevent and check the environmental deterioration and land degradation of the area since the 1960s.

In 1954, a dry zone rehabilitation project was initiated by the Agricultural and Rural Development Corporation in collaboration with the FD to carry out planting activities on denuded lands. Realizing the fact that one of the main causes of deforestation is over-cutting of trees for fuelwood, the FD increased its capacity to establish more fuelwood plantations especially in fuelwood-deficit areas.

In 1994, the FD implemented a special 'Greening Project for the Nine Districts of the Arid Zone of Central Myanmar'. During the project period between 1994 and 1997, village supply plantations were planted with an annual target of 7280 ha (18,000 acres) on denuded lands in the vicinity of villages both for greening purposes and fuelwood supply.

In 1997, a new department entitled "Dry Zone Greening Department (DZGD)" was instituted in order to accelerate the implementation of greening and rehabilitation activities.

The main objectives of the new department are:

(i) to make the dry zone area green and pleasant;

(ii) to conserve soil, water resources and environs;

(iii) to supply the basic needs of the local people;

(iv) to develop socio-economic status of the rural people;

(v) to promote public awareness of the vital role of the forests in the well being and socio-economic development of the nation;

(vi) to accelerate people's participation in the conservation and utilization of the forests and also their environs;

(vii) to moderate the climate in favour of the agricultural production; and

(viii) to prevent and combat desertification.

The four main tasks are as follows:

(i) to establish forest plantations on degraded and denuded lands for local supply and greening the environs;

(ii) to protect and conserve the remaining natural forests;

(iii) to promote the utilization of fuelwood substitutes; and

(iv) to develop water resources

In addition to the above-mentioned four main tasks, the special projects for greening the mountain ranges have been drawn up and implemented. The projects intensified greening activities in 14 mountain ranges in order to ameliorate the micro-climate conditions and restore the degraded uphill forests.

As desert-like formation has been a threatening environmental issue facing the Dry Zone of Central Myanmar, the comprehensive or integrated plan for the period of 30 years from 2001-2002 to 2003-31 has been prepared and issued in December, 2000 for effective implementation. The plan consists of 11 chapters and provides detailed information and guidelines concerning biophysical and demographic information, land utilization, soil conservation, water resource management, formation of forest plantation, natural forest management, training, research and extension, utilization of woodfuel substitutes, institutions and infrastructure development, policy and legislation and Monitoring and Evaluation. The program for plantation establishment for the period of 2001-2002 to 2030-2031 is given in Annex (1). The programmes for water resource development are given in Annexes 2, 3 and 4. The programmes for community forestry development and conservation of natural forests are given in Annexes 5 and 6 respectively.

3.6 Protection and Restoration of Watersheds

As aforementioned, the topography of Myanmar can roughly be divided into three parts, namely the Western Hills Region, the Central Valley Region and the Eastern Hill Region.

The Himalayan Range has a link with the *Westen Yomas* of Myanmar which runs from north to south. The central Valley Region consists of Ayeyawady, Sittaung and Chindwin valleys with a few small mountain ranges. The Eastern Hills Region is the Shan Plateau with average altitude of about 915 m to 1,220 m above sea level. Shan Plateau has many high mountain ranges and some rivers flowing to the Ayeyawady and Than Lwin Rivers flowing to Taninthayi coastal strip.

The agriculture is the vital organ of the Myanmar economy and hence the activities for the development of agriculture are given priority in all effects. In order to achieve the food security in the regions through the sustainable development of agriculture, timely availability of sufficient fresh water is of utmost important in each and every region. Realizing the vital role of water in growing crops successfully, extending multiple cropping and greening the environment, the Ministry of Agriculture and Irrigation has been implementing six measures of activities for availability of water, 129 dams and 258 river-water pumping stations are among them.

In the beginning of the 1990s, the mangrove forests area was about 385,933 ha in Myanmar, but it has decreased to about almost half in 2002. As population increased, rate of forest degradation has also increased due to over cutting of woodfuel, posts and poles, encroachment of agricultural fields on forest land for food security, and increasing the numbers of fish and prawn ponds as well as salt evaporation ponds for commercial purposes. According to 1991 assessment, nearly 58,000 ha of forest areas were changed into other land uses between 1974 and 1989 in Ayeyawady Delta. It was found that forest depletion rate of mangroves (1.43%) is almost twice the rate for total high forest areas (0.79%) in the region.

Realizing the economic and ecological benefits of mangroves along the coastal areas, FD adopted the following remedial measures in order to conserve and rehabilitate the mangrove forests:

(i) natural regeneration with effective protection;

(ii) regeneration improvement felling;

(iii) artificial regeneration using indigenous species

(iv) formation of community-owned multipurpose plantations and village nurseries;

(v) distribution of improved cooking stoves to save woodfuel consumption;

(vi) distribution of seeds and seedling free of charge;

(vii) provision of extension services; and

The programme for bio-engineering works for soil and water conservation is given in Annex (7).

3.7 Rehabilitation of Mangrove Forests

Myanmar is one of the countries of Asia-Pacific region where mangrove is predominant and it has about 4% of the total mangrove area of the world. Mangrove forests are special ecosystems occurring on alluvial flats of the deltaic region or on sheltered muddy coastal areas within the tidal limits. Myanmar has more than 2,000 km coastal line along the Bay of

Bengal and mangrove forests are found in three regions, namely Rakhine, Ayeyawady delta and Taninthayi. These mangroves are the primary sources of firewood, sawn timber, posts and poles for the local people. They also serve as essential breeding and feeding grounds for diverse species. They have their own unique and distinct biophysical features, limitations and potentials. Although it is one of the most productive ecosystems and natural renewable resources, it has been considered in the past as wastelands which are of no economic value, compared to other types of commercial forests. On the contrary, mangroves have three main functions, namely physical, biological and economical functions. The physical function includes protection of coastal line from abrasion and tight wind and also protection of freshwater from intrusion of sea water. The biological functions are provision of nutrients for fauna, breeding place for fish, shrimp, prawn, birds etc. and habitat for many biota. The economical function includes source of wood, fuel, food, and industrial materials.

As the water flow is largely regulated by forests, important and critical watersheds of rivers, dams and reservoirs were identified by the FD and environmental restoration has been done either by protecting natural vegetation, or establishing plantation or by both means. In Myanmar, watershed plantation has been formed since 1981 and the total planted areas increased to 87,776 ha by the end of 2002. Out of that area, about 11,500 ha are special watershed protection plantations, which are designed only for maintaining and restoring the upland ecosystem of the selected important dams, formed by both the FD and the DZGD.

In the Central Dry Zone, there are 54 important dams with watershed areas of about 1.97 million ha, out of which 75% are already degraded and 50% are in a critical condition. As land degradation in watershed areas is also linked with the poverty of the local people, the Department is now doing some measures to upgrade the socio-economic status of the people by improving the practices of Community forestry, Agroforestry, proper grazing, water availability, utilization of wood fuel substitutes and income generation with their full participation.

3.8 Nation Wide Tree Planting Programme

The Dry Zone mainly consists of denuded land and degraded forests with few trees or patches of shrubs. Although dry land forests have relatively low potential for timber production, they furnish a wide range of wood and non-wood products which are vital for local people and also provide many important environmental services.

Some of those are:

(i) provision of basic needs of local people for fuelwood, poles, posts and small timber;

(ii) provision of raw materials for handicrafts and agricultural instruments;

(iii) provision of food and medicinal products for people;

(iv) provision of fodder for domestic animals;

(v) preventing wind erosion and maintaining soil fertility for agriculture;

(vi) helping to show the accumulation of carbon dioxide (CO_2) in the atmosphere, which is the main greenhouse gas;

(vii) regulating local climatic condition; and

(viii) making the environs green and pleasant.

Realizing the direct and indirect benefits of trees, the FD has launched the Nation-wide Tree Planting Programme since 1977-78 with the objective of raising public awareness and greening the non-forest areas. As it is a mass participation of individuals, communities, governmental and non-governmental organizations and civil societies, the Forest Department has distributed various kinds of seedlings increasingly year after year especially in the dry zone area. The seedlings distributed free of charge were planted with the voluntary services of the people including students in compounds of schools, hospitals, offices, monasteries, residential quarters, communal lands and in the vicinity of villages. Due to the active participation of the people, the average annual planting rate is more than 15 million seedlings in the last decade. As it is increased to about 17 million seedlings in 1999-2000, it should be noted that one seedling is being planted for 3 persons. Keeping such good momentum, the department is now preparing to increase the planting rate of one seedling for one person in near future.

3.9 Multi-sectoral Programme of Highlands Reclamation

Shifting cultivation, also known as hill cultivation or hill farming, which is a shifted farming system in upland areas, has been practised by about 2.6 million of people in Chin and Shan States for centuries. In the past, when the population is sparse and forest land is abundant, the rotation of the fallow period was long enough to make the soil fertile for the next cycle of cultivation. But, due to the population pressure and restriction on land use, the interval of fallow period was reduced and too short to allow natural recovery of the fertility of the soil.

As the shifting cultivation has been practised mostly on steep slopes of the watershed areas, soil erosion is rapidly intensified and the rivers, reservoirs, dams and lakes become shallow with heavy sedimentation. On the other hand, the original fertile topsoil is susceptible to be depleted through erosion and the remaining thin layer is no longer suitable for cultivation or even planting trees. As a result, bare hills without adequate soil cover are common in hilly regions in Myanmar.

As the shifting cultivation practice is regarded as the destructive agents of fertile soil and destroyer of bio-diversity and forest ecosystem, Myanmar has developed a national level Multi-sectoral Programme of Highlands Reclamation and has already carried out necessary measures.

The Programme clearly encourages the upkeep of traditional land use system, customary rights and cultural values. The FD, in cooperation with other sectors and organizations has been implementing the following works:

(i) Community forestry based on agro-forestry systems;

(ii) Provision of improved technologies, complementing traditional forest-related local knowledge;

(iii) Enhancing income-generating opportunities; and

(iv) Provision of awareness raising campaigns and extension services.

3.10 National Code of Practice for Forest Harvesting

Most countries in the Asia-Pacific region, through their forest policies, have provided strong support for sustainable forest management (SFM) according to the guidelines adopted at UNCED in 1992. However, defining and implementing the sustainable forest management is one of the most critical challenges still facing the countries in the region including Myanmar. Foresters and forest managers are now under increased pressures to meet the growing demands for forest products for both domestic use and export, while striving to maintain the integrity of the forests and enhance the livelihood of the people. The Code of Practice for Forest Harvesting in Asia-Pacific is a regional strategy to outline the key principles of improved forest harvesting in the region, particularly the harvesting of timber with reduced environmental and social impacts.

In Myanmar, the FD and Myanmar Timber Enterprise (MTE) are two main government institutions which are mainly responsible for implementation and development of the forestry sector. Individually, the FD is responsible for protection and conservation of bio-diversity and sustainable management of forest resources whereas the MTE is solely responsible for timber harvesting, milling and marketing of forest products. The National Code of Forest Harvesting Practices in Myanmar has been developed under the overall guidance of the Ministry of Forestry and with financial and technical assistance of FAO. A number of training courses have been given to the staff of the FD and Extraction Department of the MTE for its clear understanding and immediate implementation in the field.

The harvesting system being applied in Myanmar is exploitation-cum-cultural system known as Myanmar Selection System (MSS) practised since 1856. The essence of MSS is to ensure sustainable production of timber without deteriorating the original condition of the natural forests and to enhance the natural regeneration and growth of commercially important tree species while maintaining the ecosystem integrity. Under the MSS, the FD prescribed annual allowable cut (AAC) and species-wise exploitable girth limit, and MTE harvested only those trees which were selected and girdled or marked by the FD each year according to prescriptions of the management plans.

Felling operation is being carried out by the MTE in accordance with rules and regulation and guidelines prescribed in the Extraction Manual (MTE, 1948), Standing Order for extraction staff (MTE, 1970), Departmental Instructions for Extraction Department, Logging rules and standard for jungle rejection of Teak logs (1936), in order to meet the following objectives.

(i) to minimize damage to residual trees and seedlings;

(ii) to avoid the breakage of the stem of the tree felled;

(iii) to minimize damage to soils and streams;

(iv) to ensure the safety of fellers and other personnel;

(v) to maximize the value of the logs;

(vi) to minimize the wastage of the wood;

(vii) to avoid felling of unmarked trees; and

(viii) to facilitate post-harvest inspection.

The concept of timber harvesting has changed from just a practice of felling and extraction of timber to that of silvicultural operation supporting the growth of forests and improvement and upkeep of genetic diversity. The use of elephants in skidding and transportation of logs

through rafting are the common practices of timber harvesting in Myanmar which is recognized as the least impact logging system on the environment and biodiversity.

3.11 Criteria and Indicators for Sustainable Forest Management (C&I for SFM)

The 1992 UNCED provided a forum for international communities to focus and make commitments to the sustainable management of the world's forests. Myanmar had developed country specific criteria and indicators (C&I) for SFM in 1996 for the first time. In 1998, the International Tropical Timber Organization (ITTO) developed the ITTO guidelines for sustainable Forests and Criteria for the measurement of Sustainable Tropical Management. Consequently, Myanmar revised its C&I for SFM to conform with the ITTO new set and also with other international process.

The Myanmar C&I for SFM comprising 7 criteria and 78 indicators at national level and 73 indicators at forest management unit (FMU) level were finalized and issued in October 1999. It has been developed with repeated reviews by many forestry professionals in Myanmar and from abroad. The Japan Overseas Forestry Consultants Association (JOFCA), an NGO from Japan and FREDA, a forestry related NGO from Myanmar, were also actively involved in the C&I development process.

Seven criteria for SFM can be summarized as follows:

(i) Criterion 1: Enabling conditions for SFM.

This criterion assesses the existence and adequacy of enabling conditions and requirements for SFM, such as forestry policy, laws rules and regulations institutions, funding sources, technical personnel, trainings, and planning etc.

(ii) Criterion 2: Forest resources security

This criterion assesses the establishment of permanent forest estate (PFE), existence of integrated land use plan, extent of encroachment, grazing, illegal exploitation of forests etc.

(iii) Criterion 3: Forest ecosystem health and conditions

This criterion assesses the existence of natural disasters and human activities which affect the healthy biological functioning of forest ecosystems. Human activities include shifting cultivation, mining, fires, illegal cutting and improper timber extraction etc.

(iv) Criterion 4: Flow of forest produce

This criterion assesses the existence of procedures and specifications to achieve sustainable production of forest products in economically, environmentally and socially acceptable ways.

(v) Criterion 5: Biological diversity

This criterion assesses statistics regarding Protected Areas System (PAS), number and conservation of endangered, rare and threatened species of both forest flora and fauna, implementation of in-situ and ex-situ conservation of important genetic variation.

(vi) Criterion 6: Soil and water

This criterion assesses the extent and percentage of total forest area managed primarily for the protection of soil and water, management procedures for soil and water conservation, buffer zone management, assessing changes in water quality due to timber harvesting etc.

(vii) Criterion 7: Economic, social and cultural aspects

This criterion assesses the contribution of the forestry sector to national economic development, availability of forest products for local communities, public recreation, safety and well-being of the forest workers, preservation and protection of cultural identity, historical sites etc.

3.12 National Forest Master Plan

Myanmar has been managing its forest resources systematically and scientifically for almost 150 years on a sustainable basis. Since then the natural forests were managed under Working Plans, drawn for each management unit (district level), which include the formation of working circles such as Teak Selection, Hardwoods Selection, Local Supply etc. and prescriptions and guidelines laid down for each working circle. As Myanmar has never deviated from the direction towards the goal of sustainable forest management, about 52% of the total land area of the country is still covered with forests according to the forest resource assessment (FRA-2000) conducted by the Food and Agriculture Organization (FAO) in cooperation of FD of Myanmar.

In 1996, FD launched a special operation to update and reformulate the old Working Plans in line with modern forestry concepts. The Forest Management Plans have been completely updated for all 62 districts covering the whole country during 1997 and 1998. The new forest management plans emphasize not only on timber production, but also on Non-Wood Forest Products (NWFPs), biodiversity and environmental conservation, and socio-economic well-being of the people. The Plans are prepared for 10 years and need to be reviewed at mid-term and has to be updated and revised before their expiration.

In 1998, FD started the preparation of long-term National Forest Master Plan (NFMP) for a period of 30 years from 2001-2002 to 2030-31. A training workshop on National Forest Programme Strategic Planning was conducted in 1999 inviting experienced foresters and professionals including FAO personnel. The final document was issued in June, 2001. The NFMP consists of 19 chapters covering all aspects of conservation, utilization, protection and development of forest resources and environments. The Plan provides detailed guidelines on the annual targets and the possible ways and means to achieve them, based on the revision of the past management and prevailing conditions in the important sectors, such as natural forest management, forest plantation, forest protection, watershed management, community forestry, biodiversity conservation, timber harvesting, wood-based industry, marketing of forest products, bio-energy, non-wood forest products, human resources development, research and development, extension services, monitoring and evaluation, etc. The programmes for the forestry sector development mentioned in the NFMP are given in Annexes 8, 9, 10, 11 and 12.

3.13 Dry Zone Integrated Plan

The Dry Zone of Central Myanmar is roughly located between the latitudes 19° 20' to 22° 50' North and longitudes 93°40' to 96°30' East, having a total land area of 6.75 million ha (16.69 million acres) making up 9.3% of the total country area. Due to the adverse soil and climatic

conditions, low production of the agricultural crops, and degradation of the natural forests, the socioeconomic status of the local people is being lagged behind compared to those of the other parts of the country.

In 1953-54, dry zone afforestation activities were carried out by the Agricultural and Rural Development Corporation (ARDC) with participation of trained personnel transferred from FD. In 1963, the responsibility of the dry zone afforestation programme was taken by FD. The programme was systematically implemented after preparing the Dry Zone Afforestation Plan which included:

- establishment of forest plantation on denuded lands;
- protection of natural forests for soil and watershed conservation; and
- establishment of local supply forests for basic needs of the local people such as fuelwood, poles, posts and small timber

In 1994-95, the Forest Department launched a special project entitled 'Greening of the Nine Critical Districts of the Dry Zone', in order to prevent further environmental deterioration and accelerate greening activities, soil and water conservation, sustainable agricultural production etc. and hence improve the microclimatic conditions and socioeconomic status of the local people.

In 1997, the Dry Zone Greening Department (DZGD), based at Mandalay which is the second capital city of Myanmar and located in the Dry Zone, was instituted to implement the greening activities more intensively and effectively in 57 townships of 13 districts in 3 divisions, namely Mandalay, Magway and Sagaing with a total area of about 8.73 million ha (21.56 million acres). To provide general guidelines on effective implementation in the long run, the department has prepared a comprehensive plan for greening the Dry Zone for a period of 30 years from 2001-02 to 2030-31.

Dry Zone Integrated Plan consists of 9 chapters, namely Past history, Present Land-use, Soil Management, Development of water resources, Afforestation, Natural forest management, Training, research and extension, Development of woodfuel substitute and Infrastructure development. The Plan covers the following aspects which are critical in greening the Dry Zone.

- Soil improvement and promotion of awareness on soil management;
- Soil moisture conservation and development of water resources;
- Afforestation programme and people's participation in plantation establishment and protection;
- Protection and conservation of natural forests;
- Production of improved cooking stoves and utilization of appropriate woodfuel substitution;
- Implementation of training courses, research activities and extension services; and
- Facilities and infrastructure development;

3.14 Biodiversity and Environmentally Sustainable Projects

During the last decade, FD implemented the following various kinds of special projects concerning biodiversity and environ mental conservation in cooperation with international organizations as well as non-governmental organizations from abroad.

(i) Myanmar-Yomiuri Afforestation Project (MYAP)

The MYAP was successfully implemented in Nyaung-Oo Township, Nyaung-Oo District, Mandalay Division during the period from 1995-96 to 1998-99, with financial assistance of Yomiuri Shinbum, a youth NGO from Japan. During the project period, about 450 ha of forest plantation using fast growing exotic species and some indigenous species were established and some portion of the plantation was formed under Agroforestry system to provide additional income for taungya farmers.

(ii) The Information System Development Project (ISDP) for the management of tropical forests

FD implemented ISDP staring from 1995-96 for the management of tropical forests with the cooperation of the Forestry Agency of Japan of the Ministry of Agriculture, Japan. During the project period the Japanese Forestry Technical Association (JAFTA) has acquired recent Thematic Mapper (TM) satellite data from the Thailand Remote Sensing Centre (TRCS) and conducted Digital Image processing in Japan. Field inspection for ground truth was carried out in Myanmar twice a year. After final checking, the computer classification was conducted to produce forest type maps and related data in the form of Forest Register. During the period between 1995 and 1997, 18 landsat scenes covering about 52.62 million ha (130 million acres) were assessed. The forest type maps and forest registers provided by JAFTA are used in the preparation of District Forest Management Plans.

(iii) Environmentally Sustainable Income and Food Security Opportunities in Mangrove delta

The FD implemented the project starting from 1996 with the assistance of the UNDP/FAO in three townships in Ayeyawady Division. During the project period of two years, about 445 ha of village supply forest plantations were established to conserve mangrove ecosystems providing job opportunities for additional income and basic needs of fuelwood and housing material to local people.

(iv) Environmentally Sustainable Income and Food Security Opportunities in Critical Watershed(Southern Shan State)

With the assistance of the UNDP/FAO, the project was initiated in 1996 in five townships in Southern Shan State. The project mainly aimed to improve food production and income generation of rural people through environmental conservation and watershed management. During the project period, watershed plantations were established and a large number of seedlings were distributed free of charge under the Nation-wide Tree Planting Programme.

(v) Environmentally Sustainable Income and Food Security Opportunities in the Dry Zone

Under the UNDP's Human Development Initiative Programme, the project has been implemented jointly by the FD and FAO in cooperation with Ministry of

Agriculture and Irrigation and Ministry of Livestock and Fisheries. Village Supply plantation were established for the local population.

(vi) Dahat-Si Greening Project

The project was jointly implemented by the FD and Japan International Forestry Promotion and Cooperation Agency (JIFPRO) starting from 1997 for a period of two years. During the project period, about 150 ha of agroforestry plantation has be established in Nyaung-Oo township of Dry Zone area.

(vii) Model Forest Project

The FD had established two model forests: one in Oktwin Township and another in Paukhaung Township, both are in the *Bago Yoma* forests where natural teak grows extensively.

The FD implemented the first project in Oktwin Township, staring from 1998-99 with the assistance of the Japan Overseas Forestry Cooperation Association (JOFCA), an international NGO from Japan. The main objective was to assess the forest management level and applicability of the criteria and indicators identified for achieving SFM. The second project was carried out by the FD starting from 1999 for a period of five years with the financial and technical assistance of JIFPRO, in Paukkhaung Township. The project became a member of the Regional Model Forest Project (GCP/RAS/177/JPN) which was financed by the Government of Japan and executed by FAO.

(viii) Environmentally Sustainable Agro-forestry in the Inle Lake region of Shan State.

The project was implemented in 1999 with the financial and technical assistance of Karamosia, a NGO from Japan, in 3 townships in southern Shan State. The primary objective was to improve the environmental conservation and rural development of the Inle Lake region by providing educational training in agroforestry, agricultural practices, making natural fertilizer (Dochakkin), breeding of pigs and poultry, nursery practice and tree planting.

(ix) Study of the lchthyo-and Herpeto fauna of Myanmar.

FD implemented the project starting from 2000 for a period of three years with the assistance of US National Science Foundation (NSF) and California Academy of Sciences (CAS) in dry zone area and other mountainous regions. The main objective was to conduct research activities concerning different kinds of mammal and reptile.

(x) Teak-based Multi-stories Agroforestry System: and Integrated Approach towards Sustainable Development of Forests.

FD implemented the project starting from 2000 for two years with the assistance of the International Tropical Timber Organization (ITTO) in *Bago Yoma* forests in Phyu Township, Toungoo District. The main objectives were to rehabilitate the degraded forest in Mya-ya-bin gyaw reserved forest and to conduct research activities in relation to agroforestry systems with the participation of local people.

(xi) Ex-stu Conservation of Some important Commercial Bamboo Species of Myanmar

FD implemented the project starting from 2000 for two years with the assistance of the International Plant Genetic Resources Institute (IPGRI) based in Malaysia. The primary objectives were to conduct trainings on different methods of bamboo propagation and research on ex-situ conservation of 6 commercial bamboo species of Myanmar. The experiments were carried out at the Forest Research Institute, Yezin and in Ngalaik reserved forests in Yamethin District.

(xii) A Forest for the Green Earth

DZGD implemented the project starting from 2000 for a period of three years with the financial assistance from the Japan International Forestry Promotion and Co-operation Centre (JIFPRO) in Kyauk-ku protected public forest, Nyaung-Oo Township. The main objectives were to conserve the established village supply forest plantations and to establish community forests in the Dry Zone.

3.15 National Commission for Environmental Affairs (NCEA)

The National Commission for Environmental Affairs (NCEA) was formed under the Government Notification No. 7/90 on 14 February 1990 to advice the Government on environmental policies, to act as a focal point and as **a national coordinating body (NCB)** for environmental affairs; and to promote environmentally sound and sustainable development in Myanmar.

The Commission has been constituted with the Minister for Foreign Affairs as Chairman and members are heads of departments of various ministries concerning environmental conservation. Four specialized committees are formed under the Commission:

(1) Committee on Conservation of Natural Resources;
(2) Committee on Control of Pollution;
(3) Committee on Research, Education and Information; and
(4) Committee on International Co-operation.

The Commission's mandate includes: to provide advice to the cabinet on the formulation of environmental policies and to seek its approval; to issue guidelines for the implementation of environmental policies; to provide guidance and advice to the regulatory agencies on such matters as legislation, regulations, and environmental standards; to formulate short, medium and long-term environmental policies and strategies that take into account both the environmental needs and development requirements.

NCEA functions as a coordinating agency, collaborating closely with government departments in matters relating to the environment. It acts as the national focal point for environmental matters vis-à-vis other countries and international organizations. Different ministries involved in the NAP process and in combating land degradation have their own budgets for the purpose.

NCEA has established a database network where social, economic and environmental information are kept and routinely updated. The availability of international funding could further improve the NCEA's ability in collecting important data such as the dynamics of land degradation and desertification, runoff estimation, soil loss and erosion rate, information on socioeconomic conditions and farming systems, the cost of desertification and the effects of drought, etc. Information exchange activities in support of NAP are carried out by NCEA internally with all the relevant ministries, NGOs and Women's groups; and externally with UNEP, ASEAN and a number of International NGOs.

The Government of the Union of Myanmar proclaimed the National Environment Policy of Myanmar under Government Notification No. (26/94) on 5 December 1994. The policy calls for harmony and balance between environment and development through the integration of environmental considerations into the development process. The National Environment Policy forms the basis for developing environmental strategies, environmental programme and plans. NCEA actively participates in international environmental conservation activities and efforts. Myanmar signed the Framework of Convention on Climate Change and Convention on Biological Diversity at the United Nations Conference on Environment and Development, which was held in Brazil in June 1992. Myanmar is a party to the Convention on Biological Diversity, Convention on Climate change, Vienna Convention for the Protection of the Ozone Layer and London Amendment, Convention to Combat Desertification and Convention on International Trade on Endangered Species of Wild Flora and Fauna (CITES).

Myanmar also participated in several ministerial level conferences such as the Environment Congress for Asia and the Pacific (ECO ASIA) held in Japan, the 19th Special Session of the United Nations General Assembly, the 19th session of the Governing Council of the United Nations Environment Programme (UNEP) held at the United Nations office in Nairobi and ASEAN Ministerial Meeting on Haze.

The Commission has taken part in several regional projects including the Asia Least Cost Greenhouse Gas Abatement Strategy (ALGAS) project, which was implemented by 12 nations in the Asia region. NCEA is now in the process of developing a country programme for phasing out ozone depleting substances and it is also promoting Environmental Database Unit and collecting environmental data and information. NCEA has organized environmental workshops, seminars, regional and sub-regional conferences in Yangon in cooperation with the United Nations Environment Programme, Economic and Social Commission for Asia and the Pacific, other environmental organization such as Hanns Seidel Foundation (HSF) of Germany based in Singapore.

NCEA developed and published Myanmar Agenda 21 in line with the global Agenda 21 adopted at the United Nations Conference on Environment and Development.

3.16 Agriculture Sector and Land Development

Myanmar being an agricultural country, the agriculture sector is the backbone of its economy. The agriculture sector contributes 34% of GDP; 23% of total export earnings; and employs 63% of the labour force. People residing in rural areas are principally engaged in agriculture, forestry, and livestock and fishery sectors for their livelihoods. Since 1992-93, the Economic Development Year, integrated development strategy has been applied for agricultural development, with specific sectoral objectives and policies. The Agriculture sector has laid down the following three main objectives:

(a) To achieve surplus in paddy production;
(b) To achieve self-sufficiency in edible oil; and
(c) To step up the production of exportable pulses and industrial crops.

The Policies laid down are as follows:

(a) To allow freedom of choice in agricultural production;
(b) To expand agricultural land and to safeguard the rights of farmers; and
(c) To encourage the participation of private sector in the commercial production of seasonal crops and perennial crops and distribution of farm machines and other inputs.

3.16.1 Development of agricultural land

One fourth of the total land area of the country is cultivable. Land expansion and reclamation of fallow land to extend new cultivable land have been undertaken in the past by successive governments with the dual objects of ensuring food security and earning more from the export of agricultural products. Presently, there are 10.45 million ha (25.8 million acres) of net sown area in Myanmar. Expansion of new agricultural land out of the remaining 0.60 million ha (1.7 million acres) of fallow land and 7.21 ha (17.8 million acres) of culturable land is being encouraged. Most agricultural lands are currently cultivated by small-scale farmers. The average size of holdings is about 2.27 ha (5.6 acres). About 61% of total net sown area are hold by the farm size less than about 4.05 ha (10 acres).

Development works of agricultural land includes reclamation of fallow and cultivable waste land; development of farmers' embankment and paddy-fish integrated farming in deep water areas; and protection of soil erosion and development of terrace farming in high-lands and slope land areas. Land consolidation is also being undertaken in the existing agricultural land with proper drainage, irrigation and farm roads. Besides the traditional small-scale crop cultivation, development of modernized large scale agricultural business by the private sector is encouraged. The main objective of this scheme is for the emergence of new agricultural land in flooded area, deep water area and existing fallow, waste and virgin land where the present productivity is low and the cost of land reclamation is rather high. The private sector is encouraged and granted rights to develop these areas for cultivation of paddy, pulses, oilseeds, industrial crops, rubber, oil palm, etc.

3.17 International Obligations

Myanmar has indicated its commitments to the sustainable development of natural resources and environment by acceding to or ratifying the following international conventions.

(i) The International Centre for Integrated Mountain Development (ICIMOD) in 1993;

(ii) The International Tropical Timber Organization (ITTO) in November 1994;

(iii) The United Nations Convention on Combating Desertification (UNCCD) in January 1994;

(iv) The UN Convention on Biological Diversity (CBD) in November 1994;

(v) The UN Framework Convention on Climate Change (UNFCCC) in November 1992; and

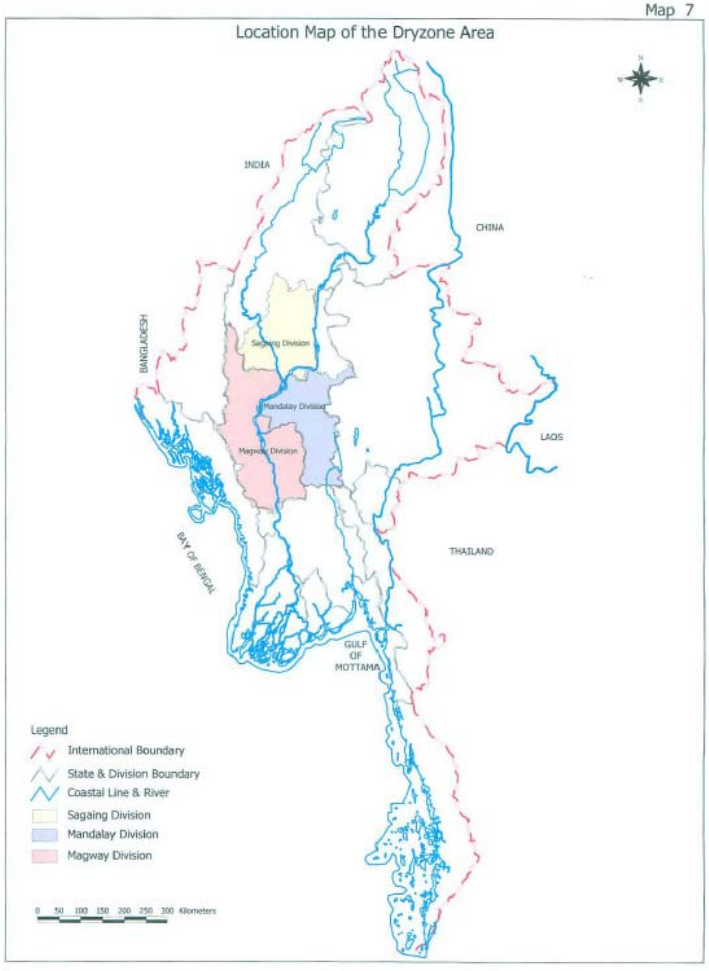
(vi) The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) in 1997.

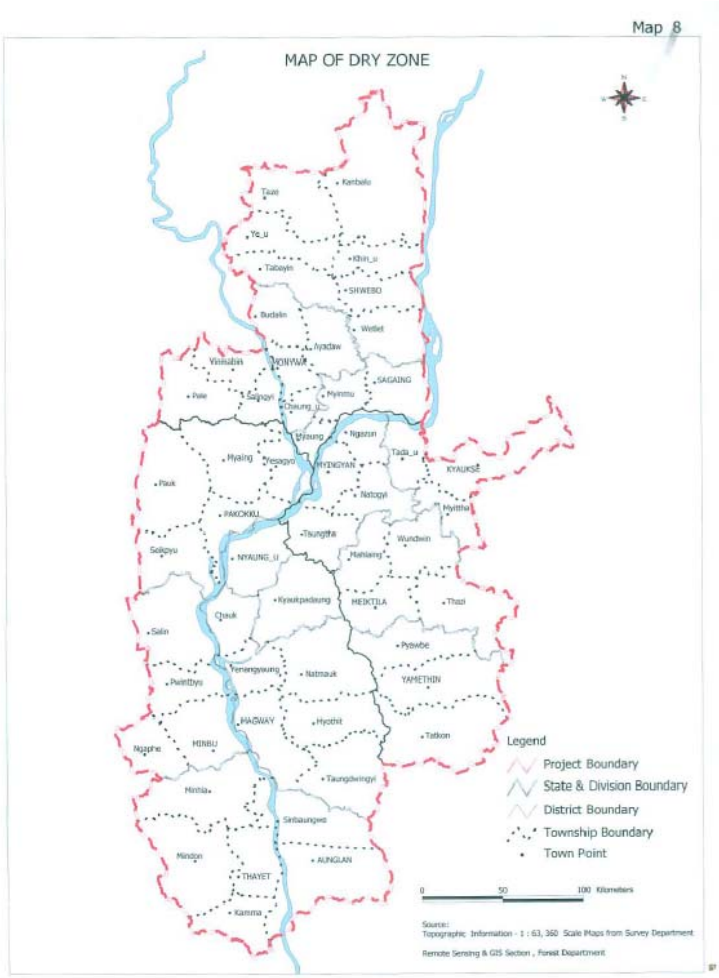
Chapter 4. CURRENT STATUS OF THE DESERTIFICATION-AFFECTED AREAS

4.1 Priority Areas

"The National Workshop on preparation of the United Nations Convention to Combat Desertification National Action Programme" held in Yangon, Myanmar on 20-21 December 2001 identified priority areas for the NAP objectives and recommended the project proposals with key intervention areas and themes. The priority areas comprise seven regions of the country, namely the Central Dry Zone of Myanmar, Shan State, Ayeyawady Delta, Chin State, Upper Sagaing area bordering with Chin State and Kayah State. Map 7 shows location of the Central Dry Zone. The priority areas fall into two broad classifications, namely severely affected area and moderately affected areas. Severely affected area includes the Central Dry Zone of Myanmar while moderately affected areas include Shan State, Ayeyawady Delta, Chin State, Upper Sagaing area bordering with Chin State and Kayah State. Since the Central Dry Zone has been experiencing the effects of desertification more severely than any other areas in the country, this chapter will focus mainly on the situations of the severely affected area, which is the Central Dry Zone of Myanmar (See Map 8).

Map 7





4.2 Central Dry Zone of Myanmar

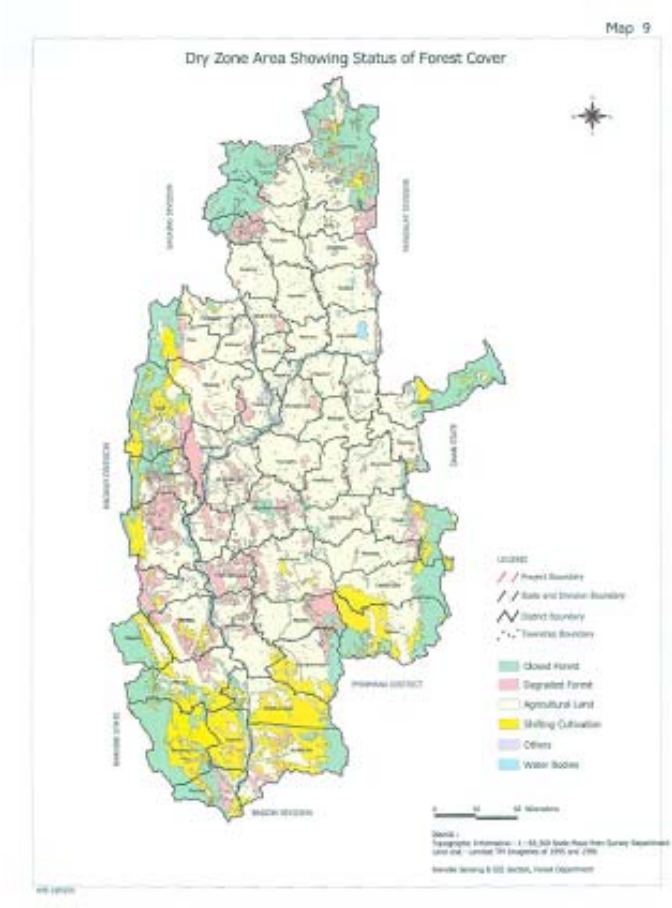
4.2.1 Land-use

Agriculture is the major land use type constituting about 55% of the total area of the Dry Zone. About 28%, more than one-fourth of the region is still covered with forests of which good forest accounts for only about 20% (See Table 21 and Map 9). These forests are managed under permanent forest estate (PFE). Water bodies make up only 1.4% of the Dry Zone's surface reflecting the scarcity of water resources. Other land uses include swamp areas, sand areas and settlements (Than 2002).

Table 21. Land-use Types of Central Dry Zone

Sr.	Land Use Type	Area (sq. mile)	% of Total Land Area
1	Close Forest	6,641.55	19.7
2	Open Forest	2,837.25	8.4
3	Forest Affected by Shifting Cultivation	4,381.52	13.0
4	Agriculture	18,691.24	55.5
5	Other Land Use	659.80	2.0
6	Water Bodies	472.15	1.4
	Total	33,683.53	100.0

***Source*:** Forest Department, 2002



4.2.2 Agriculture

As the main economy of the Central Dry Zone is agriculture, this is the major land use type constituting about 55% of the total area of the region. The fertile alluvial plains provide natural good lands for cultivation. In the Ayeyarwady and Chindwin Rivers and major streams, there are alluvial islands formed at the end of the flooding season. A large variety of agricultural crops with economic values such as onion, tobacco, potato, tomato and beans (pulses) etc. are grown. The undulating lands between the alluvial plains were also cultivable. Irrigated areas have existed since the historical Bagan period and they have ever increased. Canals, tanks, wells, and ground water pumps were lately introduced for the water sustenance of the growing population. Rainfall is the most important climatic element that determines the crops and cropping system in the Dry Zone. Small amount and unreliability of rainfall is connected with '*Ya*' or dry farming and its associated multi-crop cultivation.

Multiple cropping and double cropping are typical for the Dry Zone because single cropping is not safe for the farmers facing the meager and unreliable rainfall. The major rice fields are found in the irrigated alluvial plains. Double cropping is practiced in the *Ya* lands as well as on the irrigated tracts.

4.2.3 Shifting cultivation

Shifting cultivation in the Dry Zone can be classified into two major types. The first type is shifting cultivation in the forested area, i.e. *Taung Ya,* and the second type is agricultural

shifting plain land where no forested area exists in and around the vicinity of *Ya*. Shifting cultivation with patches of bamboo is also found in most areas in Thayet Township. The total forested area affected by shifting cultivation amounts to about 4,380 square miles constituting 13% of the total area of the Dry Zone (See Table 21). Due to demographic pressure, shifting cultivation that used to be sustainable has become no longer so with ever shorter rotations (Than 2002).

4.3 Geographic and Climatic Conditions

4.3.1 Topography and drainage

Generally the topography of the Dry Zone of the central Myanmar is flat. There are no high mountain ridges and only low hilltops exist. Some northern ridges such as Shan Plateau and the *Bago Yomas* are intruding into some areas of the Dry Zone. In the north, the Minwun mountain ranges reach up to the northern part of Shwebo. The elevation of Sagaing Mountain, which is part of the Minwun mountain ranges, is about 253 m above sea level and is the highest in Sagaing Township. In the west, Pontaung, Ponnya and Mahu ridges which are parts of the *Northern Yomas*, are intruding into the Dry Zone. The mountain ranges of the *Bago Yomas* situated between the Sittaung and Ayeyawady valleys also intrude into the Dry Zone in Kyaukpadaung, Yemethin, Taungdwingyi and Magwe Townships. Mount Popa in the north of Kyaukpadaung Township, is the highest elevation with 1,494 m above sea level in the Dry Zone of central Myanmar. The hills, which are connected with the eastern Shan Plateau, are found in Kyaukse, Myitha and Tatkone Townships.

Plain lands are formed in the east. There is a plain stretching from Singu Township in the north to Tatkone Township in the south, extending about 258 km long and about 16 km wide. This plain could be divided into two portions. The first portion is from Singu to Mandalay, which is the basin of the Ayeyawady River and reaches the foot-hill of Shan plateau. Since this portion is a lowland area, it is frequently flooded and natural vegetation is found only at the foothills of Shan plateau. The second portion of the plain lies between Mandalay and Tatkone Townships stretching about 193 km in length. This portion is the basin of the Samon and Paunglaung Rivers, and black cotton soils are found in Kyaukse plain and Yellow and Red Sandy soils are found in lower areas. Mandalay hill is 1,249 km above sea level in this area and the elevations of other towns are: 77 m (Mandalay), 92 m (Myitha), 159 m (Thazi) and 189 m (Yemethin) above sea level respectively. Good growth of thorn forest is found on the plains extending from Singu to Mandalay. Degraded thorny forests exist between Mandalay and Tatkone. Natural forests have been strongly affected due to agricultural activities in these areas.

The Mu River flows between the Ayeyawady and Chindwin Rivers forming the Mu River basin. The Mu River valley extends about 97 km from north to south, connecting with Minwun and Sagaing mountain ranges in the east. The Kaingnaya Mountain situated near Sagaing is 469 m above sea level. In west, continuous ridges about 45 m in height are present near Butalin and Ayartaw Townships. The highest peak in this area is 487 m above sea level. Clayey soils are mostly found and natural vegetation is very rare due to irrigated agricultural and dry land agriculture. In this area, Shwebo and Wetlet are 118 m and 84 m above sea level respectively.

In the west, where Chindwin basin, Monywa and Pale plains are situated, Kyenitaung within Salingyi Township is the highest mountain with 318 m. This plain is connected with Ayeyawady basin in the south. It extends about 97 km from north to south with coarse textured yellow brown forest soil along chindwin river basin. Myaing Township is the highest in topography in this area, and Nat-taik taung is the highest mountain with 1488 feet above sea level in elevation. Shinmataung of Yesagyo Township is 717 m high in this area. Thorny good forests are found in this area, natural forests nearer to the *Rakhaine Yomas* in the west. East of the river, yellow and red sandy soils are found in Monywa area and clayey soil appears at the junction of Ayeyawady and Chindwin River. At these areas due to agricultural expansion, natural vegetation are totally lost. In this area Kani Town is 124 m and Monywa is 73 m in elevation.

The portion from Mandalay to Thayet is the Ayeyawady River basin area extending about 322 km. From east to west, width is about 32 km and this area is mainly developed with agricultural activities. In this lower plain, the portion from Mandalay to Magwe is broader and from Magwe to Thayet is narrower due to introduction of ridges from east and west. Minbu plain flown in by Mon, Man and Salin Chaungs (streams) is broader and developed with agricultural activities. The elevations of the towns of this plain are: 59 m (Myingyan), 56 m (Pakokku), 51 m (Magwe), and 50 m (Minbu) above sea level. The Taungtha mountain ranges near Taungtha Town are 536 m above sea level.

4.3.2 Rainfall

The Central Dry Zone of Myanmar is characterized by an annual rainfall of less than 1,000 mm and thus the region is designated as "Dry Zone". As the rainfall pattern is related to location and topography, the mountain ranges running in the north-south direction constitute the effective climatic barriers for the south-west monsoon in the summer and for the north-east monsoon in the winter seasons. As a result, the region receives sporadic and low annual rainfall that ranges between about 500 mm and about 1,000 mm with high variability and uneven-distribution with a wet season occurring during the months of August and September and drought period in July.

The Central Dry Zone receives only 3.2% of the country's total rainfall and the average annual rainfall is about 711 mm.

Temperature gradually rises during the period between mid-April and mid-May which is the pre-monsoon period in Myanmar during which low pressure is created in the Dry Zone. It generally rains when pre-monsoon cycles from west came in. Sometimes, cyclones from the east also blow and it eventually rains throughout the Dry Zone from late May to June and from September to October. Heavy rain is usually received in July and August and dry spell occurs when dry desiccated winds blow from the south.

Monthly distribution of rainfall varies: the heaviest rainfall is normally received in September. The heaviest intensity of rainfall during 24 hours generally falls in pre-monsoon months of April and May.

The climatic condition of the Central Dry Zone is variable from year to year. April is the hottest month and January the coldest. Rainfall is also controlled by the monsoon circulation system. Generally the Dry Zone receives monsoon wind in end-May but sometimes the

monsoon arrives one week early or late. September is the month with the heaviest rainfall and there are some periods without precipitation. The length of the dry spell is also variable.

4.3.3 Temperature

The Dry Zone of Central Myanmar experiences intense heat. Monthly temperature range from a minimum of about 10º C in December, January and February to a maximum of about 43º C in March, April and May. The mean temperature difference is around 10º C. Meiktila, which is located in the centre of the Dry Zone, received an average minimum temperature of 21º C during 1950-60 and an average maximum temperature of 32º C. During that period, the hottest year recorded was 1959 with 43º C in April and the coldest year was 1960 with 9º C in January. The maximum temperature reached 110º F in April 1954 and the minimum temperature fell to 8º C in January 1954 in Mandalay. Average maximum and minimum temperatures were 33º C and 21º C respectively. The hottest month in the Dry Zone is April or May and the coldest month being December or January.

4.3.4 Drought period

Dry spells usually take place in Myanmar during the peak monsoon period due to monsoon break and in the ending part of monsoon season mainly due to extension of sub Tropical High in the Northwest Pacific. These dry spells (droughts) lasted a few weeks in certain years. Droughts occurred in 1957-58, 1971-73, 1979, 1982-83, 1986-89, 1991-94 and 1998. All ENSO years coincided with these long dry spells but others were due to break or failure of monsoon. The drought took place in 1998 was the longest ever recorded in the country.

The climate of the Dry Zone of Myanmar is controlled by the monsoon circulation system. According to Copen's classification, inner part of the Dry Zone is drier than outer perimeter which receives more precipitation. It is generally believed that the extreme climate in the Dry Zone is the consequence of deforestation mainly due to brick-making for the construction of the pagodas during the Bagan era.

4.3.5 Current climate trend

With the global warming (climate change) significantly taking place in the 1990s, the Central Dry Zone of Myanmar had been experiencing warmer temperatures and lesser rainfall as compared to the other parts of the country. The most pronounced years were 1997 and 1998. The intense one was in 1998. Some of the prominent facts in 1998 are as follows.

Warmest temperature records:

Mandalay	44° C
Meiktila	43° C
Nyaung U	44° C
Yamethin	42° C
Pyinma	43° C
Magway	45° C
Minbu	45° C

Significantly less annual rainfall

Katha	1052 mm	– 3rd lowest
Monywa	489 mm	– 4th lowest
Meiktila	629 mm	– 5th lowest
Nyaung U	360 mm	– 3rd lowest
Pyinmana	871 mm	– 2nd lowest
Chauk	444 mm	– 4th lowest
Magway	443 mm	– 6th lowest
Minbu	403 mm	– 2nd lowest

Source: Department of Meteorology and Hydrology, 2000

4.4 Population and Socio-economic Situation

4.4.1 Population

It is generally believed that human beings had lived and evolved on the soil of the Dry Zone throughout the successive epochs of history. According to the archaeological findings of Pondaung primate fossils in Pondaung Ponnya region (1920), Moegaung village of Pale Township (1925), Shwemyetin Taung of Monywa Township (1980), human being have lived and evolved on the soils of the Dry Zone since 100,000 to 400,000 years ago. Throughout the history, the Dry Zone is the most populated area in Myanmar.

In 1941 before independence, population density in the Dry Zone was 518 persons per sq. km. It became 226 in 1971 and increased up to 442 in 1993. Population growth doubled over a period of 82 years between 1891 and 1973. Status of population in the Dry Zone from 1891 to 1973 is shown in Table 22. Average annual growth rate of population was 2.7% and population density was about 1,165 per sq. km in the Dry Zone in 82 years. Due to ever increasing population pressure with subsequent increased demands for agriculture and forestry products and pasture land, the renewable natural resources in the Dry Zone have been depleted more rapidly than the land itself can renew them.

Table 22. Status of Population growth (1891 to 1973)

Sr.	Name of District	Annual Population increase	Annual Growth Rate (%)
1.	Monywa	26372	3.65
2.	Sagaing	12329	2.55
3.	Meiktila	15919	2.54
4.	Myingyan	23054	2.60
5.	Yamethin	21656	2.81
6.	Pakokku	22152	2.50

7.	Magway	22631	2.60
8.	Minbu	10865	2.50
9.	Thayet	10008	2.23

Source: Dry Zone Greening Department, 2001

4.4.2 Socioeconomic situation

In Myanmar the utmost fuelwood deficit areas are located in the Central Dry Zone. Fuelwood is used almost exclusively for household cooking in rural areas supplemented with a limited amount of agricultural residues. Fuelwood consumption in the Dry Zone is predicted to go beyond its capacity and land degradation will cause widespread environmental deterioration unless other alternative fuels are made available.

A major concern is an acute shortage of fuelwood which is a basic and essential commodity, compounded by environmental deterioration. There has been a sharp decline in supply of fuelwood and underground water, and stagnant agricultural production under unhealthy farm environment over the last decade in the Dry Zone. In the dry season availability of water declines due to decrease in ground water recharge and increased surface runoff over degraded lands in the rainy season. Uncontrolled water run-off leads to low moisture retention in the subsoil and soil erosion. Devoid of tree cover and shelter-belts, croplands are exposed to desiccated southerly winds during the summer resulting in loss of top soil. The acute imbalance between forage/fodder supply on the one hand and livestock population on the other also exerts strong environmental pressures.

4.5 Deforestation and Land Degradation

Although half of the total land area of Myanmar is still covered with forests, the distribution pattern is uneven - almost bare of forest in the Central Dry Zone. An assessment to detect the change of forest cover conducted in 1990 revealed that the actual forest area had decreased at an annual rate of 220,000 ha or 0.64% of the actual forested area during a period of 14 years from 1975 to 1989, indicating a total loss of forest cover of about three million hectares.

The decline in the extent of forest cover particularly in the Dry Zone of central Myanmar can be attributed to excessive cutting of trees for fuelwood to meet the ever increased demand for energy under a rapid population growth, insufficient supply and high cost of non-wood energy sources and inefficient utilization of fuelwood.

Presently, there is only 19.7% of the Dry Zone under closed forest which is too low to meet the environmental as well as socioeconomic needs. Deforestation in the Dry Zone area is taking place at an alarming rate. It is estimated that annual deforestation rate is 4.07% in Magway Division, 1.48% in Mandalay Division and 0.68% in Sagaing Division respectively. This situation is compounded by the scarcity of water.

Due to deforestation and consequently soil degradation, desertification has started to take place in the Central Dry Zone. Productivity of agricultural land has declined as a result of soil degradation. Development activities in the Dry Zone should, therefore, include a forestry component which should not be seen separately but must be integrated with agriculture and livestock components in order to optimize land use.

4.6 Available Water Resource

Water supply has been a problem until lately. The Government of Myanmar is currently taking intensive measures to supply sufficient water from all available water resources. Soil and water conservation are essential and utmost important to reduce pressure on scarce land resources, increase productivity, stimulate employment and prevent environmental degradation.

Availability of safe and sufficient water for domestic use, cattle and forest nurseries is of prime importance to improve social conditions and to green the environment of the Dry Zone. The activities undertaken in developing water resources include construction of small dams and ponds, digging of artisan wells and pumping of water from rivers and creeks at the village level. DZGD has constructed about 200 small dams and ponds, and has dug more than 10 artisan wells during its 2 year's period of establishment.

Concerning water resource management, DZGD mainly focuses on the following.

- Water saving technology in desertified areas.
- Collection of surface run-off
- Watershed management for agriculture depending on rainfall
- Anti-salinization for irrigation agriculture

4.6.1 Surface water

The Ministry of Agriculture and Irrigation has adopted five methods to provide water for crops production. Among them, pumping water from rivers and streams and utilization of underground water for irrigation had been undertaken by Irrigation Department and Agricultural Mechanization Department till early 1995 (See Tables 23 and 24).

Table 23. River Pumping Irrigation Projects (Completed)

Sr.	State/ Division	Electric Pumping		Diesel + Electric Pumping		Diesel Pumping		Total	
		Qty	beneficiaries	Qty	beneficiaries	Qty	beneficiaries	Qty	beneficiaries
1.	Sagaing	4	12150	4	9870	40	37358	48	59375
2.	Magway	15	40286	-	-	31	10015	46	50301
3.	Mandalay	15	16465	1	4128	52	22997	68	43590
		34	68901	5	13998	123	70370	162	153266

***Source*:** Water Resources Utilization Department, Ministry of Agriculture and Irrigation, 2001

Table 24. River Pumping Irrigation Projects (Ongoing)

Sr.	Division	Qty.	Beneficiaries
1.	Sagaing	3	60000
2.	Magway	5	42700
3.	Mandalay	1	7200
	Total	9	109900

***Source*:** Water Resources Utilization Department, Ministry of Agriculture and Irrigation, 2001

4.6.2 Ground water

On the 8th of February 1995, the Underground Water Division of the Irrigation Department and the Rural Water Supply Division of the Agricultural Mechanization Department were merged into the Water Resources Utilization Department for closer cooperation and more efficient utilization of water resources. Activities with respect to ground water availability are shown in Tables 25 and 26.

The main functions of the Water Resources Utilization Department are as follows:-

- To increase the agriculture production in Myanmar by pumping water from rivers and streams, and also utilization of groundwater feasible potentials.
- To promote the socio-economic conditions of rural population by supplying portable water from tube wells and piped water.
- To supply cropwater and drinking water from spring sources by gravity flow systems in the mountainous region of the border area and remote areas.
- To introduce sprinklers and drip irrigation systems to farmers.

Table 25. Groundwater Irrigation Facilities (Completed)

Sr.	Division	Groundwater		
		Tube Wells	Cluster Wells	Beneficiaries (Areas)
1.	Sagaing	836	1968	50199
2.	Magway	1289		10537
3.	Mandalay	789	851	10817
	Total	2914	2819	71553

***Source*:** Water Resources Utilization Department, Ministry of Agriculture and Irrigation, 2001

Table 26. Future Plan for Groundwater Irrigation (As per Thirty-Year Master Plan)

Sr. No.	States/ Division	2001-2005		2006-2010		2011-2015		2016-2020		2021-2025		2026-2030	
		Qty	Area	Qty	Area	Qty	Area	Qty	Area	Qty	Area	Qty	Area
1.	Sagaing	1320	10560			320	8000	600	10500	510	12740	325	8100
2.	Magway			503	18500	1002	29800	900	22500	1040	25960	846	33800
3.	Mandalay			400	10000	402	14000	502	16550	460	11610	10	24000
	Total	1320	10560	903	28500	1724	51800	2002	49550	2010	50310	1181	65900

***Source*:** Water Resources Utilization Department, Ministry of Agriculture and Irrigation, 2001

4.7 Disasters Encountered

4.7.1 Drought

The Dry Zone is prone to drought. The first worse drought that hit the area was during 1979-1980. The second worse drought that hit lower Sagaing and Mandalay took place during 1982-1983. The third worse drought hit the whole area of the Central Dry Zone during 1993 and 1994.

4.7.2 Floods in central lower Myanmar

In the central and lower reaches of the Ayeyawady River, the water level touches the danger levels in the third week of July and in the following weeks the danger levels were under water in many places. Water stage of 1,449 cm (26-7-97) in Henzada was found to be the highest ever recorded and extensive inundation occurred in the region.

Prolonged and wide spread heavy rain in the catchment of the Sittong River and the Shwegyin River caused long lasting floods in Bago, Shwegyin, Wall and Nyaung-le-bin Townships. The areas were under water for about two months causing communication disruption and socioeconomic problems among other losses.

Due to heavy rain from 23-8-97 to 25-8-97 with the highest amount of rainfall of 21 inches on 23-8-97 ever-recorded, Dawei District was hard hit under water. Landslides and dead were reported in Ye Byu Township. Floodwater was about 25 feet above the ground in low-lying areas.

4.7.3 Storm

Myanmar is also prone to storm as it has a long coastal line of about 2,830 km connecting with the Bay of Bangal. According to the records from monitoring for 115 years from 1877 to 1992, about 12 storms had occurred on average annually in the Bay of Bangal. About 2-3 storms out of 12 entered the Tanintharyi coastal area. The Central Dry of Myanmar lies in the rain shadow area of the *Rakhine Yomas* and has suffered a few storms. The serious storm that hit Monywa District in October 1967 reached a record high claiming about 1,000 lives of human beings and about 1,000 lives of draught animals. The total loss amounted to about 5 million Kyats.

Chapter 5. MAIN CAUSES AND IMPACTS OF LAND DEGRADATION AND REVIEW OF PAST MAMANGEMENT

5.1 Main Causes of Land Degradation

Main causes of land degradation include, *inter alia*, demographic pressure, agricultural expansion, overgrazing, shifting cultivation, and illicit logging and excessive use of woodfuel.

5.1.1 Demographic pressure

When the population is beyond the carrying capacity of a given area, the over- population always has certain impacts on the socioeconomic and ecological conditions. The natural resources, particularly forest and land resources are always limited. The regeneration capacity of the forests is generally unable to meet an increased demand for forest products under an ever-growing population. The forests are generally by over cutting and eventually denuded. Degradation of land becomes more apparent where the forests have been depleted. The effects of desertification will also become distinct when the land is no longer productive. The human population of the Dry Zone is about 18 million constituting 34% of the country's total population of about 53 million in 2003 (Population Department 2003) with an annual growth rate of 2.02% at the national level. The average population density in the Dry Zone is 123 per sq. km. This accelerating population growth (in some years up to 3%) reduces the water and soil resources available for each individual land user, and at the same time demand for food, timber, and fodder increases dramatically. In this circumstance, the farmers tend to shift towards an extensive use of natural resources, i.e. shorten or abandon the period of crop rotation, and increase extraction of biomass. Agriculture turns into a purely nutrient mining system which ultimately develops into a permanent productivity crisis. Due to the population pressure, landlessness and further fragmentation of land continue also due to lack of alternative job opportunities in the central Dry Zone. Wealthier farm households however able to acquire more and more land leading to an extremely skew farm size distribution.

5.1.2 Agricultural expansion

Due to the increasing population and consequently an increased demand for lands for cultivation, encroachment upon forests lands to expand cultivation is a significant threat to the forests resources in the central Dry Zone. This is in fact a land use conflict between the forestry and the agriculture sectors. Agriculture land use covers 55.5% of the total land area of the Dry Zone while close forests (i.e. good forests) have been cut back to only 19.7%. According to the Integrated Plan for Greening the Dry Zone of Central Myanmar (2001-2002 to 2030-2031), about 7.5 million acres (approximately 3.03 million ha) are scheduled to be conserved at the end of the planning period which would constitute 35% of the total land area of the Dry Zone. This plan target could be impaired if the current rate of agricultural expansion cannot be controlled. In order to meet the target, effective measures need to be taken to increase the productivity of lands through vertical development, i.e. using more inputs and high technology rather than horizontal expansion by the increase in cultivated lands.

5.1.3 Overgrazing

Increasing livestock numbers beyond reasonable limits and carrying capacity of the land is a common feature found in dry zone areas. According to the reports of the Dry Zone Greening Department, the Dry Zone is hosting 99% of all the country's sheep, 72% of its goats, and 39% of its cows. Total land size of the Dry Zone however is only 13% of the country's total land area. This heavy livestock breeding in relation to the available land for grazing leads to severe land degradation problems by the destructive nature of the domestic animals under poor management and control systems. Because of the need for additional arable land, grazing lands are constantly reduced and livestock forced to graze on marginal areas, destabilizing and destroying vegetation cover and causing erosion. In the Dry Zone, grazing lands are scarce, mostly marginal and degraded lands that provide only a limited amount of fodder in poor quality. In some areas, draught constraints the availability of adequate fodder and drinking water for the animals. Thus, domestic animals contribute to the general negative trend of land degradation by the effects of overgrazing.

5.1.4 Shifting cultivation

Shifting cultivation is one of the major causes of forest degradation and depletion in Myanmar as in other tropical countries, threatening the sustainability of the forest estate and the forest resources. However, it is not merely an economic practice for the landless poor living in and around the forests. It is both a cultural practice and a way of life evolved in consonance with the physiographic set up and has thrived for thousands of years, especially for the ethnic groups residing in the hilly and frontier regions. An estimated 2 million families or 10 million people are involved in shifting cultivation.

Therefore, shifting cultivation (*or taungya*) cannot be completely done away with. The *taungya* cropping system must be upgraded and applied scientifically, integrating traditional processes in order to enable and sustain increased production, and at the same time assist in environmental conservation and forestry development (Tint 2002). The extent of shifting cultivation was estimated and given is presented in Table 27.

Table 27. Extent of shifting cultivation in Myanmar

Type of forest	Extent of shifting cultivation (km^2)			Total (km^2)
	25 % SC	50% SC	75% SC	Total (km^2)
1. Closed forest	13,877	17,784	13,451	45,112
2. Degraded forest	3,343	18,850	34,475	56,668
Total	17,220	36,634	47,926	101,780

Source: Planning and Statistics Division, Forest Department

5.1.5 Illicit logging and excessive use of fuelwood

Illicit logging is a common issue in developing countries in the tropics. Myanmar is no exception. Illicit logging, when cannot be controlled properly, can contribute to severe deforestation. The fundamental causes of illicit logging are, *inter alias*, increased demand for forest products, particularly timber, and high timber prices due to supply-demand imbalance. A shortage of fuelwood in many areas of the Dry Zone is another significant issue in relation

to deforestation and land degradation. Firewood collection is a major cause of forest degradation in Myanmar. Firewood is used for household cooking and also in small cottage industries such as brick making, cheroot production and jaggery boiling. According to the reports of DZGD, deforestation rate of the Dry Zone is about 800 ha per year. Deforestation contributes to the degradation of the environment in watersheds, which in turn leads to reducing the land productivity of farmlands and income of farmers. A critical constraint is the lack of alternative sources of energy such as kerosene, natural gas, coal and rural electricity.

Formerly, there were sufficient local supply reserves and public forests to provide fuelwood. Presently, however, local supply reserves have been degraded to the extent that some of them had been written off. Public forests have also suffered from the same fate of over exploitation and encroachment. As a result, most of the firewood and also charcoal have been coming from the commercial natural forests that are accessible. This process will continue if not enough Local Supply Working Circles can be rehabilitated and/or other means of supply cannot be ensured. Therefore, fuelwood exploitation is a key issue, with considerable destructive impact on Myanma natural forests. As the remedial measure, fuelwood plantations have been established across the country. The total planted area has reached about 201,600 ha by the end of 2002. In addition, fuel-efficient stoves have been distributed free of charge or at an affordable price to local communities.

5.2 IMPACTS OF LAND DEGRADATION

5.2.1 Impact on forest resources

Concern about deforestation and forest degradation, which is evident in many places throughout the world, has given rise to a number of analyses of the causes and effects (e.g. UN, 1996; Kaimowitz and Angelesen, 1998; and Contreras-Hermosilla, 2000). The causes of forest degradation and loss are complex and vary widely from place to place. A distinction is made between direct and underlying causes. Major direct causes include forest destruction and conversion into farmland and pastures; insect pests and diseases; fire; overharvesting of industrial wood, fuelwood and other forest products; mismanagement of production forests, including poor harvesting practices; overgrazing; air pollution; road construction and mining and extreme climatic events such as storms. Habitat degradation caused by these factors and the overharvesting of wildlife are major factors contributing to local depletion of forest-dwelling wildlife populations. Underlying causes include poverty, population growth, markets and trade in forest products, and macroeconomic policies. Deforestation and degradation when unchecked over time will lead to desertification. Desertification is a process during which forest resources will be depleted due to unfavorable conditions in terms of poor fertility, insufficient moisture and devastating microclimate situations.

5.2.2 Impact on biodiversity

Regarding biological diversity conservation, habitat disintegration is the major threat. Under the conditions of land degradation, plants cannot grow well as the soil is lacking fertility, and water supply is insufficient. It has been estimated that half of the world's biological diversity is contained in forests and that probably more than four-fifths of many groups of plants and animals are found in tropical forests (CIFOR/Government of Indonesia/UCNESCO, 1999). Many countries have prepared national biological diversity action plans. The Convention on Biological Diversity, which was adopted in 1992, provides an international legal framework

for biological diversity at the ecosystem level, complementing international protection offered at the species level by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Various wild plants and animals are still well protected and conserved in protected areas system (PAS) established in Myanmar as part of the permanent forest estate (PFE). The extent of PAS in Myanmar is approaching 5% of the country's total land area. It is critical to protect and conserve the remaining biological diversity in the Dry Zone of Central Myanmar before it will be lost forever through effective management of already established PAS in the region and strict protection of the existing natural forests. Since its inception, DZGD has been conserving about 100,000 acres of natural forests annually, and the target of natural forest conservation is 1.8 million acres to be accomplished at the end of 2030-2031.

5.2.3 Impact on soil fertility and water resource

Water pollution impairs water use downstream and seriously affects human health. The exceptionally high quality of water discharged from forested watersheds is the main reason that protected forests are preferred for municipal watersheds. Forests efficiently cycle nutrients and chemicals and decrease the sediments exported, thus reducing pollutants such as phosphorus and some heavy metals. The lower rate of rainfall runoff also reduces the load of all nutrients and pollutants entering water bodies. Under the process of desertification, watershed ecosystems will be destroyed and its ecological functions to cycle nutrients and chemicals and decrease sedimentation will be no longer available.

5.2.4 Impact on climate change

The mitigation of global climate change was first proposed in the 1970s (Dyson, 1977). It is now generally accepted that this change in global temperature is due to increased concentrations of greenhouse gases, mainly carbon dioxide, methane, and nitrous oxide. The most important gas, CO_2, accounts for some 65% of the "greenhouse effect". Carbon, however, is stored in living biomass, including standing timber, branches, foliage and roots; and in dead biomass, including litter, woody debris, soil organic matter and forest products. Any activity that affects the amount of biomass in vegetation and soil has the potential to sequester carbon from, or release carbon into, the atmosphere. Overall, forests contain just over half of the carbon residing in terrestrial vegetation and soil, amounting to some 1200 Gt of carbon (FAO 2001). The Dry Zone of Myanmar is presently experiencing the intense heat under the process of desertification. Although the forest vegetation cover in the Dry Zone has been much improved currently accounting for 20% of the total area, there is a long way to go until the region can claim to have a good climate as enjoyed by other parts of the country. People residing in the vicinity of forests of the Dry Zone however, start to benefit from better climate conditions. Concerted efforts are being done to mitigate climate change through the conservation of forests.

5.3 REVIEW OF PAST MANAGEMENT

5.3.1 Forest management

Forest Management in Myanmar has always been natural forest management founded on the concept of sustained yield from the rich natural forests. In Myanmar, forests are managed according to the prescriptions of the District Forest Management Plans under which five working circles are generally formed.

(1) Production Working Circle (PWC)

(2) Planted Forests Working Circle (PFWC)

(3) Watershed Forests Working Circle (WFWC)

(4) Local Supply/Community Forests Working Circle (LS/CFWC)

(5) Non-Wood Forest Products Working Circle (NWFWC)

The working circles are formed on the basis of the objective of management and also on the nature and form of the forest produce required. A working circle consists of a group of forest reserves, which is again divided into felling series according to the drainage patterns and geographical conditions. The felling series are subdivided into annual coupes which consist of a compartment or a group of compartments.

Extraction of teak is organised in the PWC which includes all teak bearing forests. Felling is regulated by area with tree number check. The felling series to be worked is divided into approximately 30 equally productive annual coupes. Each year, trees are selected for felling in one of these annual coupes and the process continues until the whole felling cycle of 30 years is completed.

Traditionally, the yield capacity of the forest is determined from data obtained from the 10% enumeration of trees below felling limit carried out along with girdling operations. Here, complete enumeration of teak is carried out down to 1.2 m gbh. Starting from 1981, however, a nation wide inventory on a continuous basis has been conducted by the National Forest Management and Inventory Project. The data thus obtained serve as the basis for yield calculation, control and management of Myanmar forests.

Myanmar initiated formation of teak plantation as early as 1856 on a small scale using *taungya* method. Large-scale plantation forestry began in 1980, and about 30,000 ha of forest plantations have annually been formed since 1984. Plantation forestry has always been the supplement to the natural forest management. It is asserted in the 1995 Myanmar Forest Policy that existing natural forests will not be substituted with forest plantations.

5.3.2 Agriculture and pasture management

Under the section 18 of the Constitutional Law, the State is the sole owner of all types of lands in Myanmar. Only right of utilization is granted and leased out. Leasing a land for any purpose in accord with the existing laws is kept in the hands of the national peoples. Along with the state of ownership of land, forms of private tenure and communal tenure systems are also exercised. Regarding agriculture, only cultivation rights are recognized in the agricultural lands, but lands are not transferable without the permission of government authorities. Private citizens, co-operatives or state enterprises are equally eligible for cultivation rights both on fallow lands and culturable wastelands. Right of cultivation on small areas can be granted by Township Head of Settlement and Land Records Department (SLRD) under the Ministry of Agriculture and Irrigation. For large areas, the rights to cultivate and use fallow and cultivable waste lands are sanctioned by the Central Committee formed for the management of culturable land, fallow and waste land.

Regarding the development and conservation of forest resources including forest lands, the Forest Department is the sole responsible agency on behalf of the Ministry of Forestry. According to the 1995 Community Forestry Instructions, the Forest Department may allocate reserved forests, protected public forests or lands at the disposal of the State for the establishment of community forests.

Under the Land Nationalization Act, 1953 and the Tenancy Act and Rules, 1963, giving right of tilling the land to the actual tiller, the number of farmers with large holdings has substantially decreased but on the contrary the number of farmers working on smaller holdings increased. Table 28 shows the total number of farmers or farm families working on different sizes of holdings and the total acreage in each group.

Table 28. Number of farmers and sizes of holdings

Size of Holding	No. of Farmers (,000)	Total Acreage (,000)
Below 5 acres	2,790	6,611
5 to 10 acres	1,120	7,990
10 to 20 acres	492	6,839
20 to 50 acres	100	2,747
50 to 100 acres	2	116
Above 100 acres	1	574
Total	4,505	24,877

Source: Information on Myanma Agriculture, 1996.

In 1985, the Pyithu Hluttaw (the Parliament) adopted the cattle Trespass Law as its Law No. 11, overriding the Cattle Trespass Act. The Law prescribes duties of the cattle prison, penalties, punishments and procedures for the disposal of the cattle. The Law deals with the punitive measures to be taken against the cattle trespassing into agricultural lands or other prohibited areas. As Myanmar is basically an agricultural country, but agricultural has not yet been fully mechanized, cattle are still essential in the practice. There must be enough pastures for domestic animals, and proper legislation and regulations to effectively manage the pastures and the animals. Some pasturelands have been converted into permanent agriculture as a drive to boost agriculture production (Tint 2002).

5.3.3 Land use management

As already aforementioned, the State is the sole owner of all types of lands in the country. The State may lease land for a particular purpose of utilization of land.

In Myanmar, state-ownership is exercised for the development and conservation of forest resources. The 1995 Community Forestry Instructions highlight the issue of land allocation for community forest on a usufruct basis. The Instructions also stress the importance of local community participation in the process of sharing responsibility for sustainable forest management (SFM), addressing the basis needs of the rural poor for the fire-wood, small timbers and non-wood forest products (NWFPs) as well as existing and potential environmental restoration issues. Therefore, the goal of community-based tenure orientates the land use more towards the promotion of conservation, maintenance of forest covers and provision of much-needed forest products.

Following these instructions, the FD may allocate reserved forests, protected public forests, or lands at the disposal of the Government for the establishment of community forests with no constraints whatsoever for the communities. The use of forest land or other land at the

disposal of the Government can be granted to individual villagers or to an organization for the purpose of establishing forest plantations.

Chapter 6. KEY ISSUES IN COMBATING DESERTIFICATION

6.1 Policies and Policy Conflicts

Policy conflicts both within and among ex-sectoral policies have been the bane of forest conservation and development in Myanmar. The ex-sectoral policy conflicts often occur because of inadequate consultation between responsible agencies like agriculture, mining, fisheries, etc. although ex-sectoral policies have significant interfaces. Adequate consultation between the concerned sectors for the harmonization of ex-sectoral policies is critical. Considering the multi-faceted nature of forestry, its interface with other sectoral policies is significant. However, little cognizance has been taken of the ex-sectoral policy spill-overs, which could negatively affect the forest resources. For example, in the drive for promoting agricultural development, dams and reservoirs are being constructed at a rapid rate. This, in turn, has brought under submergence of large forest areas, thereby adversely affecting forest and biodiversity conservation.

Within forestry, the basic objective of sustainability of forest resources involves conflicts which, when left unresolved, diffuse the impacts of strategies for forest conservation and development. An example of such conflict is the use of forests for biodiversity conservation on one hand and log production on the other. Inconsistencies in policies lead to macro-economic processes affecting forestry. While forest policy objectives strongly focus on value-added processing in the country, economic policies continue to strongly affect capital goods and also production equipment.

It is clear that forestry sector development and its long-term sustainability is constrained due to lack of close interaction with other sectors of the economy and the lack of a holistic vision which takes cognizance of sustainable development as an imperative in all policies and the resource conservation as a major goal along with provision of employment, income and food security.

6.2 Information and Planning

Forestry today is required to fulfil several obligations - environmental, social, economic, recreational, etc. in addition to the supply of forest products. This role of forestry calls for a systematic planning approach and therefore also for a strong database. Forestry data are necessarily related to demographic, social, economic and environmental data to a much more greater extent than in the past. However, in Myanmar, the available data other than the source data are diverse, scanty and inadequate for effective recommendations, they only allow for rough estimates.

Production of data is meaningless if there is no demand for it and if it is not continuously adapted to the demand. This implies that there has to be a strong and resourceful planning unit within the Forestry Department with the knowledge and capability to influence data collection and to ensure that data are presented in a useful way.

There is also a lack of a need-based working system as a strong and demanding unit which could ensure linkages between land use capability, land carrying capacities, resource production, forest industries and marketing, and integration of the forestry sector with all other related sectors of the economy so that forestry planning would contributes effectively to the overall planning process of the Government. As a strategic plan for the forestry sector development, the National Forest Master Plan (NFMP) for the period from 2001-2002 to

2030-2031 has been formulated and already put into action. For greening the Central Dry Zone of Myanmar, the Dry Zone Integrated Master Plan for the same period was drawn up, and activities are being carried out in accordance with the plan.

6.3 Institutional Framework

The importance of institutional support as a means and mechanism for policy implementation has been well recognized. However, institutional weakness is beset with problems of both the number and skill of available manpower for coping with the multifarious activities which require diverse expertise within the forestry sector. Institutional weaknesses needing priority attention include strategic planning and policy analysis, resource management, environmental impact assessment, biological and economic research, forestry extension and establishment of inter-sectoral linkages. While general recognition prevails that investment in human resource capital to produce quantitatively measurable rates of return is of paramount importance, yet necessary investment has been overlooked, and temporary solutions have been sought through reorganization as against restructuring of the forestry institutions to meet the new challenges. Building up a critical mass of human resources with required skills therefore is a basic need for any progress in the institutional framework.

6.4 Budgetary Resources

Current budgetary allocation accounts for only 10% to 15% of the revenue generated by the forestry sector at current prices. In real terms it may be well below 5%. It is argued that though forestry is by far the second largest revenue generating sector in Myanmar's economy, it is very slowly growing. Consequently there is a problem to maximize the economic surplus necessary for capital formation and future growth. Accordingly the general premise in the Ministry of National Planning and Economic Development and in the Ministry of Finance and Revenue is that if the best use of the scarce resources is to be ensured for economic development, then there has to be greater transfer of the resources to more productive sectors like those manufacturing and processing. Ironically, due to heavy subsidized forest produce, the real value of the forestry sector is overlooked, as these subsidies are not included in the national accounting system while computing the sector's contribution to the gross domestic product. Nor has any attempt ever been made to quantify the intangible benefits from the forests in terms of protection of downstream agriculture, critical watersheds, soil erosion, etc. Thus the forestry sector was and is even now considered as residuary in budgetary allocation. This severely limits forest management and also any efforts to conserve the capital resource base.

6.5 Adhocism in Land Use

Given the importance of the forestry sector in the national economy, the fullest possible sustainable utilization of the forest resources is not only desirable but also necessary. One policy-related issue to Myanmar is adhocism in land use. The absence of clear cut land use policy and planning has several impacts among which are loss of forest cover and low productivity. The low productivity does neither allow for cost-effective management or utilization of the resources nor is it comparable socially and economically with other land use alternatives. This in turn results in low priority in the allocation of public expenditure. There is considerable scope for increasing productivity and consequently enhanced contribution to the gross domestic product. Infrastructure is lacking in semi-and inaccessible forests in order to tap the full potential of the existing natural resources without causing environmental damage. In this context, the development of a system of balanced and complementary land

use policy and plan is of paramount importance. As a result, PFE will become more secure, and more effective coordination among agencies concerned will be obtained.

6.6 Shifting Cultivation

Shifting cultivation was regarded as a traditional form of land use at a time when the population was small and forest cover was much more extensive. This type of traditional agriculture is popularly known as *Taungya* in Myanmar. About 2 million families practise shifting cultivation in an area of about 2.43 million hectares which constitute mostly the unclassed and degraded forests. However, with the passage of time and the rapidly growing population in this cultivation area, there has been a major increase in the frequency at which the shifting cultivation blocks are being cultivated. This has led to changes in the vegetation structure of the forests being transformed into degraded secondary shrubs without any production potential. This fact is more vivid in coastal, eastern and north eastern Myanmar which bear ample testimony to the damage to soil and vegetation. Since shifting cultivation is no longer remunerative in the existing areas, there are attempts to overcome the loss in productivity through expansion of shifting cultivation areas, accelerating overall land degradation.

The impact of shifting cultivation on forest resources differs locally. Much of the organic rich topsoil is easily eroded due to lack of control measures in most cases, thus preventing further agricultural use in the following rotations. Fires are commonly applied in slash and burn and frequently get out of control, thereby causing heavy damage to surrounding areas. The secondary forests affected by shifting cultivation are characterized by an open canopy with invasion of bamboo in mixed deciduous and grasses and shrubs in *Dipterocarp* forests. It is now being recognized that any further expansion of shifting cultivation on forest land would be at the very cost of environmental and ecological stability.

In the absence of concerted efforts to rehabilitate both the cultivators and the shifting cultivation areas, the latter would be rendered unproductive and lost forever. It may also imply the loss of forest cover in perpetuity which the country can ill afford, particularly in view of the most important role of forests in the national economy.

6.7 Wood Processing and Utilization of Forest Resources

The Government has embarked on a programme to promote wood-based industries in Myanmar to increase export revenue from the forestry sector which has been about US$ 200 million annually at present. The export revenue in 2002-03 was about US$ 203 million with about 78% deriving from timber exported in log form and conversions. The Myanma Timber Enterprise (MTE), a state-owned economic enterprise (SEE), is making efforts to develop it's downstream wood-based industries to produce more value-added products in order to augment foreign exchange (FE) earnings. The issues constraining the development of the industry include inadequate infrastructure, inappropriate investments, outdated technology, shortage of skilled labor, inefficiency and high transport costs. Private industries in addition to these limitations are confronted with uncertainty in the availability of raw material supplies. The absence of assured log supply has not only discouraged investment for processing but also increased the reluctance of saw mills and others partners to upgrade processing in has it order to reduce wasteful use of the timber resources. The present recovery of the wood-based industry in Myanmar is relatively low as compared to the average recovery observed in some ASEAN countries. Most of the processing units operate

at 50% of their installed capacity, implying 50% of the investment lying idle and thereby adding to costs. This together with low recovery rates and poor labor productivity makes the industry less attractive profit-wise and handicaps it price-wise in the world market.

6.8 Livelihood Strategies of Local People Living Near the Forest

One of the underlying causes of deforestation is poverty. Although the land resource is limited, the population is ever increasing and the demands for the basic needs of life, i.e. food, fodder, shelter and clothes consequently increase. The livelihood of the people living by the forests is more or less land-based but most of them are landless. Consequently, they practice shifting cultivation and relies on forest products for their subsistence living. However, the way they utilize the land and forest resources are not sustainable but wasteful. This leads to deforestation and eventually land degradation which is the initial step of desertification. As such, adequate livelihood strategies should be formulated and adopted to provide them with the livelihood options. The following are the mechanisms for sustainable livelihood options.

(i) Promotion of ecologically sound and economically feasible land use practices such as sustainable agriculture techniques, community forestry and agroforestry;
(ii) Dissemination of technologies for the production of value-added commodities through trainings and extension programmes;
(iii) Setting up demonstration sites to promote income generating activities; and
(iv) Holding of seminars, workshops and meetings to exchange views and experiences among the various stakeholders.

Local community residing in and around the forests has heavy reliance on shifting cultivation and extraction of forest products due to lack of other livelihood options. Deforestation and forest degradation are the long-term impacts resulting from livelihood strategies of the local people living by the forests. To make matters worse, lack of appropriate technology and consequently wasteful utilization of forest resources lead to rapid degradation and deforestation. This situation urgently calls for actions to facilitate changes such as promotion of alternative income-generating activities and employment and introduction of sustainable farming practices in the place of shifting cultivation and other unsustainable land use systems. Expected effects would be a reduction in forest dependence and forest degradation.

Deforestation, land degradation and desertification are all land-based issues. The sectors related to land use should form a partnership in addressing the above-mentioned issues. Forestry, agriculture and livestock sectors need to work towards the development of agroforestry in socially acceptable, environmentally benign and economically viable forms.

Agroforestry is a land-use practice using the beneficial effects of trees and shrubs. The potential of this practice has been proven, particularly in the tropics where soils are generally degraded and infertile, and where the use of fertilizers is a constraint for poor farmers. As a result, agroforestry systems have been introduced and applied under diverse natural settings to meet different objectives, including soil and water conservation and afforestation as well as reforestation. In the broadest sense, "agroforestry" encompasses any and all techniques that attempt to establish or sustain forests or trees and agricultural production on the same land-management units. All forms of agroforestry are characterized by:

- the deliberate growing of woody perennials on the same unit of land as agricultural crops and/or animals, either in spatial mixture or temporal sequence; and

- significant interaction (positive or negative; ecological or financial) between the woody and non-woody components of the system (Nair, 1993).

Today, agroforestry is regarded as a land use option with greater potential, particularly for small-scale farmers who have inadequate resources. Indeed, agroforestry is rapidly recognized as a land use system, capable of yielding both wood and food, while at the same time conserving and rehabilitating ecosystems.

Geographically, Myanmar is located in the tropics. Myanmar falls into two major ecological regions, namely humid lowlands and highlands. Agroforestry has been a traditional land-use practice for the rural communities in Myanmar for centuries. A case in point is the *taungya* system which is a forerunner to agroforestry originated in Myanmar. *Taungya* has been a sole mode of establishing forest plantations in Myanmar since 1856. Different agroforestry systems under three categories: agrisilvicultural; silvopastoral; and agrosilvopastoral are found across the country.

Chapter 7. NATIONAL ACTION PROGRAMME TO COMBAT DESERTIFICATION

7.1 Action Programme for Key Issue, 6.1, i.e., Policies and Policy Conflicts

7.1.1 Short-term

- To carry out appropriate follow-up actions in each forest management unit (FMU), i.e., district, with specific objectives in order to fulfil the principal objectives of the said unit. Wildlife sanctuaries and national parks which are constituted for biodiversity conservation and protected areas for watershed conservation should not be disturbed by timber extraction for economic benefits;

7.1.2 Medium-term

- To closely interact with other economic sectors in order to achieve long-term sustainable forestry development since forests are often degraded due to development activities/projects carried out in other economic sectors such as mining and agricultural sectors;

7.1.3 Long-term

- To establish a Forest Policy Advisory Board within the Ministry of Forestry with dual functions to review the implementation of the current forest policy and coordinate the forestry sector with other sectors including harmonization at policy interfaces;

7.2 Action Programme for Key Issue 6.2, i.e., Information and Planning

7.2.1 Short-term

- To strengthen the Planning and Statistics Division of the Forest Department to carry out the forest inventory annually and more efficiently in order to provide reliable and up-to-date information on forest resources;
- To establish a forest database management system which can provide on-line information on forest and land resources;
- To improve the inventory design to be in line with the current forestry role on environmental, social, economic and recreational development;
- To allocate sufficient budget for intensive forest inventory with appropriate sampling intensity in order to provide the data with acceptable errors;

7.2.2 Medium-term

- To conduct ecological survey, socioeconomic survey, and consumption survey in order to have ecological and socioeconomic data relating to land degradation process;

7.2.3 Long-term

- To establish an information management system to provide quantitative and qualitative facts and figures relating to forest resources, together with

socioeconomic situation in order to facilitate the identification of policy options, integrated planning and decision making;

7.3 Action Programme for Key Issue 6.3, i.e., Institutional Framework

7.3.1 Short-term

- To strengthen the professional staff of FD in terms of quantity as well as quality in order to effectively implement the measures to combat the challenges leading to land degradation and desert-like formation;
- To speed up the extension of reserved forests, protective public forests and protective areas system so that 35% of the total land area of the country can be effectively managed under permanent forest estate covering all closed forests which are about 37% of the country's total area at present;
- To accelerate rehabilitation of degraded forests which is at present about 15% of the country's land area by means of natural regeneration as well as artificial regeneration methods as deemed appropriate;
- To strengthen restoration of mangroves ecological system to prevent salination and acidulation by means of reforestation and effective protection from exploitation of fuelwood and charcoal, encroachment of agricultural crops, resettlement of villages and other improper land utilization;
- To effectively enforce Forest Law, Rules and Regulations to prevent encroachment for agricultural extension, grazing, mining, poaching and other improper land-use and illegal exploitation of timber, posts and poles and woodfuel for commercial purposes in PFE as well as in other forested areas;

7.3.2 Medium-term

- To investigate forestry man power requirements and to prepare a Man Power Development Plan for Myanmar including career planning, incentive structure and accountability;
- To conduct refresher courses and in-service trainings in the specialized fields of forest economy, environmental, ecological, social, wildlife and biological management in order to upgrade the capabilities of staff in respective fields;
- To increase the capacity and quality of institutions providing technical and vocational trainings in order to meet the increasing manpower needs of the forestry sector;

7.3.3 Long-term

- To develop training curricula and improve the existing facilities for education in forestry at all levels in order to keep abreast with the advanced technology and new development among international forestry communities;
- To establish a human resource development unit within the Ministry of Forestry in order to design, innovate and monitor all aspects of human resource development required for sustainable forest Management;

- To strengthen the capability of the Forest Research Institute and prepare a forestry research development plan with identification of research priorities while taking note of user needs in research programme areas relating to forest management, ecological and environmental management, nature conservation, community forestry, forest-based industry, wood and non-wood technologies, etc;

- To establish a mechanism for collaboration and promotion of forestry research through joint research or research contracts with universities, non-governmental organizations, research associations and client participation at national and international levels;

7.4 Action Programme for Key Issue 6.4, i.e., Budgetary Resources

7.4.1 Short-term

- To allocate sufficient budgets to effective implementation of the forestry development activities and also to enhance budgetary resources to accelerate such activities in shorter time;

- To increase investment in forest conservation and rehabilitation of the degraded forest land through cost-sharing with other sectors which benefit from forestry such as agriculture, irrigation, mining, tourism, energy sectors etc;

7.4.2 Medium-term

- To increase funding for development activities to combat land degradation and desert-like formation with cooperation and assistance of government and non-governmental organizations of foreign countries, UN and other donor agencies;

7.4.3 Long-term

- To provide continuous financial support to strategic priorities identified in National Forest Policy and in long-term master plans and integrated plans of the departments concerned;

7.5 Action Programme for key issue 6.5, i.e., Adhocism in Land Use

7.5.1 Short-term

- To establish a land-use advisory board with responsibilities to oversee and coordinate overall land utilization;

- To identify appropriate land use patterns for the country giving priority to the regions affected by land degradation;

- To prepare detailed land-use maps based on land-use capability classification;

7.5.2 Medium-term

- To promote proper land utilizations based on the aforementioned land-use capability classification;

7.5.3 Long-term

- To prevent further land degradation through proper land-use practices;

7.6 Action Programme for Key Issue 6.6, i.e., Shifting Cultivation

7.6.1 Short-term

- To actively and effectively rehabilitate degraded forests and lands affected by shifting cultivation by means of reforestation, introduction of agroforestry and proper agricultural practices, since shifting cultivation is common in watershed areas of the main river systems, causing erosions, landslides and heavy siltation.

7.6.2 Medium-term

- To inventory shifting cultivation and encroachment areas within the Permanent Forest Estate and also in other forested areas in order to prepare in-situ development programmes to rehabilitate areas affected by shifting cultivation and by encroachments in various forms.

7.6.3 Long-term

- To carry out preventive measures at the community level by providing understandable extension and practicable, educative training to eventually eliminate shifting cultivation practices and substitute proper and more productive agricultural methods.

7.7 Action Programme for Key Issue 6.7, i.e., Wood Processing and Utilization of Forest Resource

7.7.1 Short-term

- To promote existing wood-based industries in order to develop capacity to produce not only lumber but also semi-finished, finished or value added products qualified for both domestic and export markets;

- To enhance the utilization of lesser used timber species with proper treatments in their respective usages according to their specific properties;

- To create opportunities to utilize all parts of the whole tree of valuable species down to as smallest diameter as possible in order to reduce the timber waste in the forest.

7.7.2 Medium-term

- To increase the export of value added wood-based products by decreasing the export of round logs in order to supply more raw materials required for the installed capacity of the domestic wood-based industries.

7.7.3 Long-term

- To transform the present status of wood-based industry into more larger resource-based industry for effective utilization of the forest resources.

7.8 Action Programme for Key issue 6.8, i.e., Livelihood Strategies of Local People Living near the Forests

7.8.1 Short-term

- To expand the formation of community forests and communal or cooperative forest plantations in order to provide the direct benefit of those forests to the local population and indirect benefit to the surrounding areas to some extent;

- To provide sufficient energy sources by forming village supply fuelwood plantation and community forests, by free distribution of seedlings for self-help planting in their own compounds, by substituting alternative energy and producing efficient improved cooking stoves;

- To provide more financial support, technical assistance and training programmes in implementing community forestry;

- To promote the greenery of the environment with full participation of the local people in order to achieve indirect benefit for their present and future generation;

- Promote income generating opportunities in forestry and forest-related sectors for rural people in order to reduce over-utilization of raw material of forest resources.

7.8.2 Medium-term

- To establish pasture/livestock development farms by introducing silvo-pastoral system in order to improve livestock breeding for the people as well as to reduce the damage to the soil and vegetation of the environs;

- To improve the soil fertility of the degraded land by means of agroforestry and proper agricultural methods in order to increase the production of crops and consequently seasonal income;

- To promote surface and ground water resources in drought-prone areas by using every possible means for multiple use.

7.8.3 Long-term

- To ensure food security and increase the income of ethnic minorities based on sustainable resource management in forestry and agricultural sectors;

- To upgrade the capabilities of forestry personnel in extension, social forestry and participatory forestry.

7.9 Integrated Management of Land Resources in Myanmar

Land resources are useful in many ways. Competition for land use necessitates an integrated approach to the planning and management of land resources. In Myanmar, about 10 million hectares or 15% of the total land area is under cultivation. Since a total of about 18 million hectares is estimated suitable for the agricultural purposes, some 9 million hectares of more new land can be brought under crop cultivation and livestock farming. Land is currently owned by the State and the farmer has the right to till on it. The system is under revision to be in line with the prevailing market economy.

The Government laid down a policy to encourage area expansion in agriculture by reclaiming culturable, fallow and waste lands. A Central Committee for the Management of Culturable Land, Fallow Land and Waste Land has been formed.

Dry Zone farming and soil conservation techniques are largely demonstrated by the Ministry of Agriculture and Irrigation in Central Myanmar, where wind and water erosion is common due to its prevailing characteristics combined with incorrect cultivation practices. Contour ploughing, mixed cropping, suitable crop rotation, mulching, irrigation and hedge row and wind break plantings are advised and demonstrated. Wind breaks and contour bunds are largely demonstrated by the Land Use Division of Myanmar Agriculture Service since 1991. Farmers though reluctant to practice in the beginning, have realized the benefits and have started adopting these measures for soil conservation. "Agricultural developing and environmental rehabilitation in the Dry Zone" was implemented.

Hill side farming techniques are largely demonstrated in hilly areas especially in border regions where shifting cultivation continues to be practised. Measures were taken to transform these areas into regular terraces since 1963-64. More than 26,000 hectares have since been terraced.

The integrated management of land resources has improved housing, agriculture and other economic activities as well as forestry and biodiversity.

PROGRAMME AREAS

The programme areas are identified in the context of integrated management of land resources in the Myanmar Agenda 21.

(a) Strengthen policy, planning and management systems
(b) Prevent land degradation and desertification
(c) Promote integrated mountain development

(a) Strengthen policy, planning and management systems

Objectives

(i) Improve and strengthen the existing planning and management systems within the framework of the integrated system by reviewing present policies, rules and regulations and undertake human resources development to implement the policies.

(ii) Create mechanisms to facilitate the active participation of all parties concerned in the decision making process on the use of land resources.

(iii) Undertake capacity building efforts at all levels; viz. village, township, districts, regional and national levels for staff, community, NGOs and interested parties.

Activities

(1) Form and strengthen the National Land Use Commission
(2) Develop legal framework land use planning and planning institution
(3) Promote data collection system, research and development
(4) Prevent land degradation and desertification

(b) Prevent land degradation and desertification

Objectives

(i) Conduct an assessment of land degradation and desertification and study its causes and consequences and take effective measures on the conservation of the eroded soils.

(ii) Identify salinity, alkalinity and acidity problems and eliminate these problems effectively.

(iii) Generate information to facilitate proper methods of soil conservation and transfer the technology to farmers.

Activities

(1) Prepare soil maps
(2) Encourage soil conservation programme
(3) Promote soil reclamation
(4) Promote application of organic and biological fertilizers
(5) Undertake planning and management of watershed
(6) Develop and implement national action programme to combat desertification
(7) Promote integrated mountain development

(c) Promote integrated mountain development

Objectives

(i) Develop sustainable mountain farming systems by increasing farm-level productivity without degrading the natural resources and watersheds.

(ii) Develop alternative income and employment opportunities for mountain dwellers.

(iii) Control land and watershed degradation from soil erosion, desertification, deforestation and overgrazing and protect the biodiversity of mountain areas.

Activities

(1) Identify sustainable mountain farming systems
(2) Develop national schemes for natural resources management
(3) Promote regional collaboration

7.10 Integration of Environment and Development into Decision-making

Achieving sustainable development requires the integration of environmental considerations into decision-making at all levels. Political commitment and the support of the Government and administration are best reflected through this integration of environment and development. Private actors also make decisions that affect the environment. It is therefore imperative that industry and individuals also integrate environmental concerns in their decision-making process.

Since the adoption of the market-oriented economic system in Myanmar in 1988, foreign direct investments have been encouraged and promoted and the result is a substantial rise in economic activity in the country. It is therefore critical that environmental issues are

incorporated and integrated into future development plans so that they are economically and technically sound and viable, and environmentally sustainable.

Thus far in Myanmar, environmental factors have not been given explicit attention in the development process. However, the Government has recently implemented changes to reflect its growing commitment to the environment. In 1990, the National Commission for Environmental Affairs (NCEA) was established as the national focal point and coordinating agency for environmental matters. In December 1994, the National Environment Policy was adopted. Its objectives were to establish sound environmental policies and to integrate environmental concerns into the national planning process.

Apart from implementation of the specific programme areas and activities of Myanmar Agenda 21, the integration of environment and development should be undertaken through an effective legal and regulatory framework, effective use of economic instruments and market and other incentives, and the establishment of systems for integrated environmental and economic accounting.

The process of environmental impact assessment (EIA) is an important mechanism for the integration of environment and development. The establishment of a transparent and participatory process of environmental impact assessment will bring about optimal integration of environment and development. The process of integration of environment and development in decision-making also requires the support of comprehensive and up-to date information and data on the social economic and environmental status of the country. Sustainable development is an ongoing process, and it is essential that information is available and easily accessible to provide feedback for making necessary policies and programmes adjustments.

The following programme areas are proposed in Myanmar Agenda 21.

(a) Integrate environment and development in the national development and planning process.
(b) Strengthen institutional and legal structures, and participation in international programmes.

PROGRAMME AREAS

(a) Integrate environment and development in the national development and planning process

Objectives

(i) Integrate environment and sustainable development concerns in national and sectoral development policies and planning and management process.
(ii) Establish a national mechanism and framework for environmental impact assessment and build necessary capacities for implementation.

Activities

(1) Changes in the policy formulation and decision-making process
(2) National review of existing policies, plans and programmes
(3) Establishing a national framework for environmental impact assessment

(b) Strengthen institutional and legal structures, and participation in international programmes.

Objectives

(i) Develop and strengthen legal and institutional mechanisms for environmental protection and sustainable development.
(ii) Develop and strengthen financial mechanisms for environmental management and sustainable development.
(iii) Increase participation in international and regional programmes and implement obligations under international and regional environmental conventions, treaties and protocols.

Activities

(1) Strengthening the NCEA
(2) Strengthening institutional mechanisms
(3) Preparation of a framework legislation
(4) Building the institutional capacity to implement and enforce EIA
(5) Developing financial and other mechanisms
(6) Strengthening participation in international and regional environmental agreements and programmes

Chapter 8. MAJOR INPUTS ESSENTAIL FOR SUCCESSFUL IMPLEMENTATION OF NAP

8.1 Political Commitment and Support

NAP to combat desertification needs sufficient political support to ensure successful implementation. Even well-formulated NAPs could fail if political leaders have not been adequately involved in their formulation. The best way to guarantee strong political support is to ensure that political leaders are aware of and support the process by which NAPs are developed and implemented. The thrust should be to get a broad coalition of political leaders to "buy into" a NAP - making process and to commit to subsequent support for the implementation of all action plans deriving from this process.
Land degradation is generally characterized by loss of biological or economic productivity and complexity in croplands, pastures and wood lands. Primary causes in addition to climatic factors are over-cultivation, over-grazing, deforestation, poor irrigation practices and poverty among others. All are related to utilization of land resources in different ways. As a result, competition of land use necessitates an integrated approach to the planning and management of land resources.

Since improper land-use practices are the initial steps in the process of desertification, a high-level body like "National Land Use Commission" should be formed under the guidance of the State. The commission should adopt a framework for utilization of all lands for the purpose for which they are best suited and for the interest of the entire people of the country in the long run. A well-defined land-use policy is therefore essential in order to resolve the conflicts between forestry, agriculture, fisheries, mining, industries and local communities.
Since desertification affects the sustainable development of many sectors, integrated approach is a must and hence the Government should provide an "enabling environment" to coordinate the active participation of all departments concerned in NAP implementation.

The successful implementation of NAP fully depends on the interest of the local authorities concerned. Without their cooperation and coordination, some activities cannot be carried out as planned especially at the implementation stage. The Government's pressure on NAP is of prime importance to all local authorities at different levels.

Political commitment and support plays a critical role to realize the following objectives.

- To implement the National Action Programme to Combat Desertification as an integral part of broader, national sustainable development of the community;
- To provide an enabling conditions to facilitate the implementation of the NAP in integrated approach;
- To promote international cooperation in combating desertification;
- To encourage implementation of joint projects and research activities in relation to environmental and sustainable development; and
- To form a land-use advisory board with responsibilities to oversee and coordinate overall land utilization in the country in order to prevent any possible improper practices leading to the process of land degradation and desertification.

8.2 People's Participation

Land degradation and desert-like formation in Myanmar are mainly due to human activities. Deforestation is primarily caused by over-exploitation of forest products and encroachment on forested lands for agricultural extension and shifting cultivation where the lands are degraded by over-cultivation and/or improper agricultural practices. These activities are mostly done by the local people from nearby villages. This is one of the reasons why local people should take part in implementing NAP. Another reason is that they have extensive experiences and valuable knowledge about the main causes and impacts of deforestation and land degradation of their own environs and hence their participation will be very helpful in the preparation and implementation of NAP.

As a matter of fact, they are the people who had the benefits from over-utilization of the forest, agricultural and grazing lands, and also they are the people who are experiencing adverse impacts of land degradation. Besides they are the same people who will have a greater stake than anyone else in improving agricultural productivity while ensuring the long-term ecological balance of their fragile lands. Hence, local people should be involved at all stages of NAP from the very beginning, i.e., planning to implementation and in the decision-making process. To ensure effective and efficient participation, capacity building of local communities is essential.

8.3 Multi-Disciplinary Approach

Land degradation which is the initial step of desertification is generally caused by human activities including over-exploitation of forest products, over-cultivation of agricultural crops, application of improper cultivation methods, construction of dams and reservoirs, construction of highways, utilization of mineral resources, exploitation of natural energy reserves, and so on. The development activities of one sector, i.e., agriculture, irrigation, forestry, construction, mining, or energy, sometimes cause adverse environmental impacts affecting the development of another sector.

Under land use practices such as shifting cultivation and other improper land management practices, vegetation cover is lost and soil erosion becomes serious especially in watershed areas, resulting in adverse effects on the water resources such as the Inle Lake in Shan State. In mining sector, the annual outputs of oil, gas and various kinds of minerals have to be increased by systematically exploring the potential mineral areas including border areas using modern exploration technology such as satellite images and airborne geophysical technology. On the other hand, as the development of mineral resources has great impact on environmental quality, the Myanmar Mines Law, 1994, has some provisions for environmental protection. Rehabilitation of degraded areas from mining and mineral processing operation is important for promoting environment and minimizing wastage of land resources. The authority should promote the application of Polluter Pays Principal (PPP) under which the project proponent should be responsible for the rehabilitation of degraded areas and pay for it.

Achieving sustainable development requires the integration of environmental considerations into decision-making at all levels in order to have a balance between environment and development. NCEA was established as the national focal point and coordinating agency for environmental matters at the national level. The 1994 National Environment Policy underlines the Government's commitment to establish sound policies regarding the utilization

of water, land, forests, mineral, marine resources and other natural resources in order to conserve the environment and prevent its degradation.

Environmental impact assessment (EIA), as it provides identification of potential environmental problems, is a vital and useful tool for planning and decision–making in development process. The information gathered in the EIA process and its analysis is essential to allow an equitable balance to be struck between environment and development. As EIA is a vital means of integrating environment and development, NCEA should coordinate and manage its progress.

During the past decade, i.e., 1990-2000, the country achieved considerable progress especially in its social and economic aspects, however also resulting in new pressures on the environment and new requirements for development on the other hand. Consequently, a strong national level coordination committee needs to be established in order to solve their complicated problem in multi-disciplinary approach, including representatives from Ministry of Foreign Affairs, Ministry of National Planning, Ministry of Finance, Ministry of Agriculture and Irrigation, Ministry of Forestry, Ministry of Health, Ministry of Education, Ministry of Industry, Ministry of Livestock breeding and Fisheries, Ministry of Energy, among others.

The following action programmes should be implemented through the multi-disciplinary approach.

- To effectively implement the rural development programmes including heath care, education, income generation and job opportunities for poverty alleviation, giving priority to the regions seriously affected by desert-like formation, land degradation and drought;
- To establish mechanism including departmental personnel from various Ministries concerned and the people from local communities for regular monitoring and evaluation on the implementation of NAP and its degree of success; and
- To encourage the involvement of all possible stakeholders and promote private sector involvement in sustainable management practices of natural resources and NAP implementation.

8.4 Workable Budget

The rehabilitation activities to combat land degradation are not an easy task to implement especially in the Dry Zone where the soil and climatic conditions are unfavourable and the socioeconomic status of the local people is relatively low. Formation of forest plantations in the Dry Zone needs more inputs than in other areas since the soils of the Dry Zone are mostly infertile, low in humus content, extreme in p^H value, shallow in soil layer and so forth. Forest plantations need effective protection especially in the early stages where they are more vulnerable to the destructive causes such as grazing, fire, and encroachment.

Natural forests in the Dry Zone have been degraded due to repeated cutting of trees for firewood, poles and posts for domestic use. To restore these natural forests requires special protective measures as well as proper silvicultural treatments. These remedial measures cannot be successfully implemented without provision of sufficient budget. Some remedial measures may need to be accelerated so that the desertification process can be timely prevented. During the implementation of NAP, the annual target of prioritized activities may

also need to be increased and consequently the sufficient and workable annual budget will be certainly required.

In Myanmar, about 15% of the country's total land area are degrade forests which need to be rehabilitated either by natural or artificial means or both. The current budgetary allocation for the forestry sector accounts for only 10% to 15% of the revenue generated by the sector at current price. It means the present budgetary allocation severely limits forest management and also efforts towards conservation of the resource base.

There should be a proper mechanism to transfer sufficient or workable budget for the activities and projects to combat desertification. Currently, the relevant institutions and departments are implementing the activities to combat the process of desertification using their own limited funds. Given that desertification is the imminent threat to some areas in Myanmar, particularly the Central Dry Zone, the State should consider allocating a special funds to combat desertification. The significant role of the international donor agencies such as UNEP, UNCCD, UNDP, and international and national NGOs shouldn't be forgotten and their technical and financial cooperation should be sought.

8.5 Modern and Efficient Technologies

Modern and efficient technologies are also important inputs required to produce qualified outputs to fulfil the objectives of the NAP implementation. Technical and professional staff in each specific sector are required in both quantity and quality.

The Government should provide environmental training programme to equip the local authorities with required technologies in order to effectively undertake their responsibilities and functions of NAP. People participation in NAP implementation should also be encouraged through adequate educational training on sustainable development of natural resources. Information on appropriate modern and efficient technologies of agriculture, livestock breeding, agro-forestry, and also resource conservation of land, water and energy should be distributed among the local people.

Some development activities need advanced technology and modern materials and equipments which can be transferred through the joint projects implemented in co-operation with UN agencies and other countries. The Government should also provide more opportunities of foreign training for the core staff in order to be fully acquainted with the new and efficient technologies which are invaluable to NAP implementation.

8.6 Regional and International Cooperation

During the last two decades, many development projects were implemented in various sectors with the financial and technical assistance of UN agencies and donor countries. Most of the projects were relevant and helpful to combat land degradation and poverty alleviation. But the majority was carried out on pilot or small scales and hence the outputs, outcomes and impacts were not as prominent as expected for the targeted beneficiaries and their environments. However, the experiences gained, the lessons learnt, new efficient technologies applied and the modern materials and equipment used are the invaluable inputs for the future similar development programmes.

For the current NAP, more relevant projects should be promoted, preferably on a large scale, with the assistance of regional and international co-operation in the following fields:

- Environmental and sustainable forestry projects;
- Soil and water conservation projects;
- Agriculture and water resource development projects;
- Energy efficiency projects (to reduce pressure on woodfuel);
- Forest-based cottage industry development projects;
- Food security and poverty alleviation projects; and
- Environmental impact assessment (EIA) projects.

8.7 Adequate Institution Building

The institutional capacity of relevant departments and ministries needs to be further strengthened in terms of both quantity and quality. Currently, NCEA is the focal point with respect to environmental conservation and DZGD is mainly responsible for greening the Central Dry Zone of Myanmar. A specific division under NCEA or DZGD or a new department under a relevant ministry should be formed with qualified staff and mandated to perform special duties to combat desertification in Myanmar. The proposed institution should monitor and evaluate the process of land degradation and take required actions and measures to combat desertification on a continuous basis. With competitive salaries, incentives, and sufficient investment in human resource development, training and research, the quality of the staff of the concerned institutions and departments need to be enhanced to be more effective and efficient in combating desertification.

8.8 Effective Monitoring and Evaluation System

There is a need to develop a system to monitor and evaluate the implementation of the NAP. Monitoring is the continuous assessment of programme or project implementation and performance whereas evaluation is the periodic assessment of the relevance, success, cost-effectiveness, and sustainability of a programme or project. The overall objective of the currently formulated NAP is to combat desertification and to mitigate draught in the country as a whole and in the arid regions in particular. The NAP to combat desertification is to be implemented by a number of projects/programme areas. As such, inputs, activities, outputs, outcomes, short-, medium-, and long-term impacts are to be identified for each project/programme area at all levels. A set of impacts and their corresponding verifiable indicators have to be identified and monitored over time to determine the degree of attainment of the objectives of the NAP. Impact indicators may be quantitatively, qualitatively or behaviorally measurable.

The kind of information to be monitored. In defining the set of information to be monitored, a good starting point is the input-output view of the sector-programme-project-activity hierarchy. From the input side, the manpower, materials, and other inputs to the activities can be aggregated into the project inputs for a given period of time. The project inputs can be aggregated into the programme inputs, which can then be aggregated into the sector inputs. Budgeting for the government resources needed to provide the inputs moves in the opposition direction, i.e. sector-programme-project-activitiy. Outputs of activities add up to form the project impacts, which then affect the programme impacts, which are finally manifested in the attainment of the NAP objectives. Data requirements and data collection methodologies for monitoring are generally much more basic than those for evaluation. Monitoring provides an important source of information for evaluation.

Method and frequency. The monitoring and evaluation system must indicate how, the indicators are to be monitored and how often. Periodic reporting systems should incorporate the monitoring of a defined set of indicators. The monitoring officers generally take measures or collect already measured data and enter the required information in pre-set formats. The reliability of the information generated by the reporting systems would have to be checked independently, for example, by making use of the services of universities or NGOs.

Management information systems and databases. Management Information Systems (MIS), with their associated databases, should be incorporated as a part of the monitoring and evaluation system. In some institutions, the MIS itself includes monitoring and evaluation as a system.

Monitoring staff. Staff who are assigned the monitoring functions must be well acquainted with the various types of information and how they serve the purpose of evaluating the effects or impacts of the projects and national actions programmes. The staff must be provided with training, particularly on the specific monitoring methods that they will use in their work.

Chapter 9. CONCLUSION

The National Action Programme to Combat Desertification in Myanmar has been prepared based on the imperative guidelines of the 1995 Myanmar Forest Policy and within the framework and principles laid down by the UNCCD. The suggestions and recommendations proposed at the two UNCCD Workshops held in Myanmar were also taken into account in the preparation of the current NAP. The facts and figures from the latest publications of the various departments concerned were used in assessing and evaluating the prevailing status of the country.

The National Action Programme places emphasis primarily on the forestry and agricultural sectors due to the following reasons:

(i) about 88% of the total land area of the country are still either forested or agricultural lands; both are closely interrelated and depending on each other;

(ii) about 75% of the total population of the country are living in rural areas depending mainly on agriculture and forest resources for their livelihoods;

(iii) about 60% of the total labour force of the country are engaged in agriculture, forestry and fishery sectors; and

(iv) primary causes to land degradation are mainly due to agricultural expansion, overgrazing, shifting cultivation, deforestation, poor irrigation practices, illicit logging and excessive use of woodfuel and poverty among others in addition to climatic and natural factors.

As the biophysical characteristics, main causes and effects of the land degradation of a country are significantly different from other countries, prioritized remedial measures laid down and approaches adopted in the national action programme of the countries are also different. Poverty, rapid environmental degradation, lack of alternative income and employment opportunities and stagnant agriculture represent the major components of an integrated problem. To solve these problems, an integrated approach is essentially needed. A well-formulated NAP should consist of effective measures and activities that are relevant to the prevailing circumstances and needs of the country for which it is drawn up.

In Myanmar, desertification is not well known among the people as there is no actual desert in the country although some patches of desert-like formation area can already be seen in the Central Dry Zone. Land degradation and degraded/denuded forests are the main problems for the people living in the Central Dry Zone, Ayeyarwady delta and some hilly regions. As such, the remedial measures mentioned in this Action Programme have to be taken seriously and immediately to mitigate the initial steps in the process of desertification. Some remedial measures, as aimed to stop desertification process, must be implemented with all our might and capability within a short-term. Preventive measures are also very important and essential for those lands that are not yet degraded or only slightly affected.

The implementation of the National Action Programme mainly depends on the availability of financial and human resources and hence it should be fully integrated into national sustainable development plans, long-term programmes and strategies. As it is necessary to adopt an integrated approach addressing the physical, biological and socioeconomic aspects

of the process of desertification and drought, the Government should provide "enabling conditions" for successful NAP implementation.

As desertification is primarily a common problem detrimental to sustainable development of every sector, and since it is mostly related to the socioeconomic status of the local people, a participatory approach is of utmost importance in NAP implementation. Local communities have valuable experiences and a special understanding of their own environment. In addition, these local people have a greater stake than anyone else in sustainable agricultural productivity and long-term ecological balance on their fragile lands. The professionals from the various sectors need to be engaged in various stages of NAP implementation together with local people including farmers, pastoralists, land users, local leaders, representatives of community groups, local authorities, NGOs, voluntary associations etc., who will play a major role in the implementation of most activities.

In Myanmar, all possible preventive and remedial measures against land degradation have been taken until now but on a small scale due to financial and institutional constraints. Similarly, only a few environmental and sustainable utilization projects have been implemented with the financial and technical assistance of UN aid agencies, other international institutions and countries on a limited scale. Now the time has come to implement the formulated NAP for Myanmar with full strength and on a sufficiently large scale in order to successfully combat desertification.

Effective monitoring and evaluation system is essential for every sustainable development programme. The main objective should be focused on smooth implementation of every activity from the beginning up to the end of the project. It should not be regarded as purely a fault-finding mechanism. Monitoring should be carried out either daily, weekly or monthly depending upon the nature of the activity and its important role. For example, in the case of transplanting operation in the Dry Zone, the suitable planting period is only a few days according to local climatic nature, and hence it is very important to monitor daily progress until the operation is finished.

Monitoring generally focuses on the following:

- Timely provision of the various kinds of inputs such as budget, staff, material and equipment in required amount;
- Timely implementation of all activities in proper ways;
- Timely production of outputs in both quantity and quality as specified in the plan; and
- By applying the monitoring system, unexpected problems and difficulties could be learnt in time so that they could be solved and improved not to adversely affect the final outputs or results.

Evaluation is a process to assess the final outputs or products as targeted in the plan to fulfil the objectives laid down for the project. In order to ensure the production of targeted outputs, it is necessary to evaluate in the mid-term of the improved to complete the project in good success. Evaluation is not only essential for the implementing project but also very helpful for the preparation of future similar development plans.

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