UNION OF MYANMAR

MINISTRY OF FORESTRY

THIRD NATIONAL REPORT TO THE UNCCD

July 2006

Table of Contents

LIST OF ABBREVIATIONS AND ACRONYMS

1.	ARDC	Agriculture and Rural Development Corporation
2.	ASEAN	Association of Southeast Asian Nations
3.	CFIs	Community Forestry Instructions
4.	CITES	Convention on International Trade in Endangered Species
5.	DZGD	Dry Zone Greening Department
6.	ESCAP	Economic and Social Commission for Asia Pacific
7.	FD	Forest Department
8.	MOAI	Ministry of Agriculture and Irrigation
9.	MTE	Myanma Timber Enterprise
10.	NAP	National Action Programme
11.	NCEA	National Commission for Environmental Affairs
12.	NFMP	National Forest Master Plan
13.	NGOs	Non-Governmental Organization
14.	PAS	Protected Areas System
15.	PFE	Permanent Forest Estate
16.	RS & GIS	Remote Sensing and Geographic Information System
17.	SEE	State-Owned Economic Enterprise
18.	SFM	Sustainable Forest Management
19.	UNCCD	United Nations Convention to Combat Desertification
20.	UNCED	United Nations Conference on Environment and Development

EXECUTIVE SUMMARY

1. The main purpose of this report is to inform the parties to the Convention of the situation in Myanmar with regard to measures taken in the implementation of the United Nations Convention to Combating Desertification (UNCCD) at the national level. The present report is the outcome of collaborative efforts by all institutions/organizations and individuals who are actively involved in the efforts to combat desertification in the country.

2. 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 UNCCD to resolve environmental and desertification problems at a global scale, Myanmar acceded to the UNCCD in January 1997.

3. 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 55.4 million with an annual growth rate of 2.02% in 2006. More than 70% of the population are living in rural areas, and 65% of the total labour force are engaged in the agricultural sector. Main objectives of the agriculture sector are (i) surplus in paddy, (ii) sufficiency in edible oils, (iii) increased production and export of pulses and industrial crops. Five improved strategies are (i) exploitation and expansion of agricultural land resources, (ii) sufficient provision of irrigation water, (iii) increased use of agricultural machinery, (iv) improved technology, and (v) production and use of improved crop varieties and quality seeds (MOAI 2005).

4. Myanmar is rich in natural resources, particularly forest resources and biodiversity. About 50% of the country's total area is still covered with forests, out of which about 37% are closed forests, and the remaining 14% being degraded forests. Some forested areas have been constituted as permanent forest estate (PFE) under the 1995 Myanmar Forest Law; its total area reaching as much as 23.23% of the country's land surface, exclusive of protected areas system at the end of 2005. 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").

5. Due to the rapid develpment 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 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 DZGD undertakes establishment of forest plantations; protection of remaining natural forests; introducing and promotion of wood fuel substitutes; and management and development of water resources. 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.

6. Extension of agricultural land, construction of dams and reservoirs, and increase in livestock breeding area has contributed to the socioeconomic development of local people. A total of 187 dams was constructed during the period from 1988-89 to end-July, 2006 throughout the country. However, much of the forest areas have been clear-felled for other land use purposes, diminishing biodiversity and environmental stability to a considerable extent.

7. 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, others but less desirable alternative fuels such as agro-residues, forest-waste and coal briquettes are being used.

8. During the period between 1997-1998 and 2005-2006, the DZGD, as a principal institution to combat desertification in the Central Dry Zone, planted trees on a total of 117,414 ha comprising village forests, watershed plantations and mountain greening in Sagaing, Mandalay and Magway divisions. The department maintained and protected about 486,415 ha of the existing natural forests during the same period. A total of 0.4 million of fuel-efficient stoves and 67.8 million of fuel briquettes were distributed by the DZGD in the three divisions during the same fiscal year. A total of 1,420 small ponds and 86 artesian wells constructed to supply much-needed water resource, 1249 small dams for water harvesting and 0.2 million tons of agricultural waste used as alternative fuel.

9. The 1995 Myanmar Forest Policy identifies six imperatives in accordance with the forest principles adopted at the United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, which suggest a holistic and balanced approach in the formulation of forest policy and programme within the overall context of the environment and development, taking into consideration the multiple functions and uses of forests as well as the potential for development that sustainable forest management (SFM) can offer. 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 practised with emphasis on the participation of local community in managing forests to meet their basic needs without detriment to environmental conservation.

10. The Dry Zone of Central Myanmar is the most problematic region in terms of land degradation 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.

11. Currently, there are 140 important dams constructed in the Dry Zone with watershed areas of about 4.5 million hectares, of which 50% are degraded and 25% 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.

12. In Myanmar, fuelwood is a vital energy source for cooking, lighting and for some cottage industry. Fuelwood consumption contributes about 84% of the total energy consumption of the country. 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 has 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.

13. The FD of the Ministry of Forestry has been taking measures, namely effective conservation and preservation of the forests, systematic enforcement for the protection of wildlife and wild plants, extension of reserved forests and protected public forests areas and natural and artificial regenerations throughout the country. Moreover, to ensure protection of wild life and wild plants and conservation of natural areas, the State has established 13 nature and wildlife sanctuaries with an area of 2.0 million acres and seven national parks with an area of 1.6 million acres. 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 seedlings increasing year after year especially in the Dry Zone. About 17 million seedlings were planted by the public in 2005 under the supervision of the Regional Forest Conservation Committees. The FD is intensifying efforts to keep such a good momentum of tree planting in future.

14. 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. Accordingly, 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 30-year rural road development plan from 2001-2002 to 2030-2031 is being implemented.

15. 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 (from 2001-02 to 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 have been put into action. During the last decade, the FD implemented various kinds of special projects related to biodiversity and environmental conservation in cooperation with several international organizations and national as well as international NGOs.

16. 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 both endangered 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.

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

(i) 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

18. Today, Myanmar has successfully formulated its National Action Programme (NAP) to combat desertification. The Myanmar NAP consists of nine chapters in which short-, medium-, and long-term action programmes are proposed in order to

address the above-mentioned key issues. The NAP for Combating Desertification in Myanmar is the collective efforts of many institutions and individuals. The representatives from the different ministries, institutions, NGOs and all stakeholders are involved in the process. 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

19. In Myanmar desertification is not well known among the people, as there is no desert in the country although there are some patches of desert-like formation in the Central Dry Zone. Land degradation and degradation of the forests are the major issues in the region. In fact, they are the first steps in the process of desertification. Remedial measures are essential to stop the process of desertification and so are preventive measures for the lands that are not yet degraded or slightly degraded. The National Action Programme should be fully integrated with national sustainable development programme, long-term perspective plans and strategies. An integrated approach addressing physical, biological and socioeconomic aspects of the process of desertification and drought should be adopted. In fact, desertification is the common problem for all the sectors in achieving the sustainable development. Both remedial and preventive measures have been carried out in prioritized areas only on small scales due to financial and institutional constraints. The Ministry of Forestry as a key player in combating desertification is implementing all possible measures based on its limited financial and institutional resources with the active participation of other line ministries such as Ministry of Agriculture and Irrigation, Ministry of Livestock and Fisheries, Ministry of Energy, Ministry of Mining and national and international organizations and NGOs.

2. BACKGROUND

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 up 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 core area (around Nyaung U area) of the Dry Zone of Central Myanmar. The Dry Zone encompasses three divisions, namely Lower Sagaing, Mandalay and Magway Divisions. The Dry Zone is the hottest place in the country. The potential evapotransporation (PET) is great throughout the year with slight decrease in the winter months. The PET is about 2-3 mm per day in cool months and 6-7 mm per day in hot months. The annual PET is about twice the annual rainfall. During the summer months, i.e. March and April, the maximum temperature in the Central Myanmar is above 39° C while it is about 26° C in Northern Myanmar and 29°C on Shan Plateau in the east and the minimum temperature in the Central Myanmar in cool months, i.e. December and January, is about 15°C. The Dry Zone of Myanmar is demarcated by 1,016 mm Isohyet line. All areas within this zone have a semi-arid climate. The region lies entirely within the tropics. Since the Dry Zone is a low region between the two highlands, it does not enjoy the cooling effect. The most striking characteristics of the Dry Zone is the double maxima or bimodal rainfall pattern. The dry spell lasts for about 30 days. Although the rainy season lasts from May to October, the number of rainy days is meager, about 50 rainy days in a year. Summarized land uses of the Dry Zone are given in Table 1. Agriculture is predominant type of land use in the region. Since shifting cultivation is permanent in nature, 68.5% of the total area of the Dry Zone falls under agricultural land use. About 2% of water bodies indicate the scarcity of above-ground water resource. Erosion susceptibility data generated based on the FAO procedures are given in Table 2.

Table 1. Summarized land uses of Central Dry Zone

Sr.	Land use type	Area (km^2)	% of total
1.	Closed forest	17,214.9	19.7
2.	Degraded forest	7,354.2	8.4
3.	Shifting cultivation	11,356.9	13.0
4.	Agriculture	48,447.7	55.5
5.	Other land uses	1,710.2	2.0
6.	Water bodies	1,223.8	1.4
	Total	87,307.7	100.0

Source: Forest Department, Myanmar, 2006

Table 2. Erosion susceptibility in Dry Zone

Sr.	Division	Slight	Moderate	Critical	Total
1.	Sagaing Division	21434.05	916.77	13.91	22364.73
2.	Magway Division	31750.43	9144.30	1152.86	42047.59
3.	Mandalay Division	20123.95	2250.24	521.20	22895.39
	Total	73308.43 (84%)	12311.31 (14%)	1687.97 (2%)	87307.71 (100%)

Source: Forest Department, Myanmar, 2006

National Commission for Environmental Affairs (NCEA) was established in 1990 with a specific mandate 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. 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, even before Myanmar's accession to the UNCCD, measures relating to combating

desertification had already been taken both at the local and national levels in Myanmar. However, accession to the 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 the NCEA and the Forest Department of Myanmar organized the regional follow up meeting on the UNCCD in Yangon, Myanmar. 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, Myanmar, in October 1996.

Myanmar had sent her delegations to all Conferences of Parties except COP 6 and as a requirement, the National Reports on UNCCD implementation were submitted on a regular basis. At the national level, countries of the South and Southeast Asian region has already started the process of drafting their own national action programs. "The National Workshop on Preparation of the United Nations Convention to Combat Desertification National Action Programme" was held from 20-21 December 2001 in Yangon as the first step to draft the national action programme for Myanmar. The Workshop 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 and fall into two broad classifications, namely severely affected area and moderately affected areas. The central part of Myanmar is being severely affected by the process of desertification. The second NAP Workshop was held from 9-10 June 2004 in Yangon to review the draft National Action Programme. The Workshop was attended by the representatives from the different ministries, institutions and NGOs who provided invaluable suggestions and shared their knowledge and experiences. Based on the feedback from the Workshop, the draft NAP was revised. The preparation of NAP of Myanmar came to a successful completion in December 2004. The Cabinet has approved the "National Action Programme of Myanmar to Combat Desertification in the context of UNCCD" in September 2005. The Myanmar NAP consists of nine chapters together with the proposed projects.

3. MEASURES TAKEN TO COMBAT DESERTIFICATION IN MYANMAR

3.1 Greening the Central Dry Zone

The Dry Greening Department plays a lead role in combating desertification since its formation on the 22nd July 1997 with a specific mandate to realize the following objectives.

(a) To green the Central Dry Zone of Myanmar;
(b) To protect and conserve the environment as a whole and land and water resources in particular;
(c) To provide the basic needs of rural people for forest products;
(d) To enhance the socioeconomic development of rural people on a sustainable basis;
(e) To raise the awareness about the values and beneficial effects of forests and trees among local people;
(f) To enhance knowledge and promote participation of the public in environmental conservation and sustainable development;
(g) To improve microclimate conditions of the environment so as to support sustainable productivity of agriculture; and
(h) To prevent desertification.

In order to implement the above-mentioned objectives, the following four main tasks are laid down:

(a) Establishment of forest plantations;
(b) Protection and rehabilitation of remaining natural forests;
(c) Promotion of fuelwood substitute utilization; and
(d) Development of water resources.

3.1.1 Establishment of forest plantations

Forest plantations have been established in deforested and degraded areas in Sagaing, Mandalay, and Magway Divisions to restore the forest cover and rehabilitate the environment. The total area planted between the period from 1994-1995 to 2005-2006 has reached 117,414 ha as shown in Table 3. There are three

types of forest plantations established in the Dry Zone, namely Village Supply Plantation, Watershed Plantation and Plantation for greening the hills.

Table 3. Plantation establishment in the Central Dry Zone (1994-95 to 2005-06)

(ha)

Sr.	Year	Sagaing Div.	Mandalay Div.	Magway Div.	Total
1.	1994-95	931	2,388	3096	6,415
2.	1995-96	1,477	2,489	3,359	7,325
3.	1996-97	1,295	2,550	3,735	7,580
4.	1997-98	1,439	1,748	4,717	7,904
5.	1998-99	3,086	4,881	6,313	14,280
6.	1999-00	2,966	5,144	6,070	14,180
7.	2000-01	2,964	5,130	6,333	14,427
8.	2001-02	2,023	2,914	5,913	10,850
9.	2002-03	1,862	3,318	4,856	10,036
10.	2003-04	1,416	2,804	4,399	8,619
11.	2004-05	1,214	1,827	4,654	7,695
12.	2005-06	1,133	2,516	4,452	8,101
	Total	21,807	37,709	57,898	117,414

Source: DZGD - Four Main Tasks (1994-95 to 2005-2006)

3.1.2 Protection and rehabilitation of remaining natural forests

One of the four main tasks of the DZGD is to protect and rehabilitate the remaining natural forests. Protection against human, cattle, and fire has been effective in rehabilitating the degraded forests. The following benefits are achieved through protection.

(a) Existing natural forests are well protected from further degradation;
(b) Extensive areas can be rehabilitated at low cost and within a short period;
(c) Revitalization of degraded natural forests is well adaptable to microclimate and edaphic conditions in the harsh environment.

Protection and rehabilitation of remaining natural forests in the Central Dry Zone between the period from 1997-98 to 2005-2006 is shown in Table 4.

Table 4. Protection and rehabilitation of natural forests (1997-98 to 2005-06)

(ha)

Sr.	Year	Sagaing Div.	Mandalay Div.	Magway Div.	Total
1.	1997-98	5,666	8,499	24,282	38,447
2.	1998-99	7,689	9,713	25,873	43,275
3.	1999-00	7,689	12,546	20,235	40,470
4.	2000-01	7,689	12,546	20,235	40,470
5.	2001-02	24,282	24,282	32,376	80,940
6.	2002-03	24,282	24,282	32,376	80,940
7.	2003-04	20,235	8,094	32,376	60,705
8.	2004-05	20,235	8,094	32,376	60,705
9.	2005-06	16,188	809	23,472	40,469
	Total	133,954	108,863	243,598	486,415

Source: DZGD - Four Main Tasks (1994-95 to 2005-2006)

3.1.3 Promotion of utilization of fuelwood substitutes

The following activities have been carried out in support of protection and conservation of the forests in the Central Dry Zone of Myanmar.

3.1.3.1 Distribution of improved cooking stoves

Improved cooking stoves with low fuelwood consumption were distributed during the period from 1997-98 to 2005-06 in the Central Dry Zone (See Table 5).

Table 5. Distribution of improved cooking stoves (1997-98 to 2005-06)

(number)

Sr.	Year	Sagaing Div.	Mandalay Div.	Magway Div.	Total
1.	1997-98	625	2,695	12,841	16,161
2.	1998-99	18,720	16,564	60,044	95,328
3.	1999-00	12,835	13,778	22,048	48,661
4.	2000-01	17,167	19,112	32,164	68,443
5.	2001-02	9,905	9,637	25,826	45,368
6.	2002-03	9,000	10,062	13,591	32,653
7.	2003-04	9,000	9,053	11,694	29,747
8.	2004-05	9,000	9,259	12,055	30,314
9.	2005-06	9,000	9,300	13,418	31,718
	Total	95,252	99,460	203,681	398,393

Source: DZGD-Four Main Tasks (1994-95 to 2005-2006)

3.1.3.2 Promotion of production and utilization of fuel briquettes

Fuel briquette producing factories were set up in Sagaing and Pyinmana areas. The fuel briquettes were distributed as fuelwood substitutes during the period from 1997-98 to 2005-06 in three divisions in the Central Dry Zone (Table 6).

Table 6. Distribution of fuel briquettes (1997-98 to 2005-06)

(number)

Sr.	Year	Sagaing Div.	Mandalay Div.	Magway Div.	Total
1.	1997-98	-	1,044,796	653,036	1,697,832
2.	1998-99	691,000	1,623,000	5,963,893	8,277,893
3.	1999-00	1,410,000	3,500,000	4,117,891	9,027,891
4.	2000-01	1,953,960	4,263,483	5,840,549	12,057,992
5.	2001-02	1,158,850	3,832,939	5,716,597	10,708,386
6.	2002-03	1,000,000	2,699,196	4,750,615	8,449,811
7.	2003-04	1,000,000	2,027,189	4,524,750	7,551,939
8.	2004-05	1,000,000	1,603,705	2,377,848	4,981,553
9.	2005-06	1,000,000	1,672,580	2,381,989	5,054,569
	Total	9,213,810	22,266,888	36,327,168	67,807,866

Source: DZGD - Four Main Tasks (1994-95 to 2005-2006)

3.1.3.3 Utilization of agricultural residues

In Myanmar, fuelwood is a vital energy source for cooking, lighting and for some cottage industry. Fuelwood consumption contributes about 84% of the total energy consumption of the country. Over cutting of trees for fuelwood significantly contributes to the deforestation in Myanmar. Due to the shortage of fuelwood, others but less desirable alternative fuels such as agro-residues, forest-waste and coal briquettes are being used. Utilization of residues of agricultural crops such as stalks of sesame, pigeon pea, cotton, and peanut husks as fuelwood substitutes has been encouraged to reduce the consumption of fuelwood. The amount of agricultural residues utilized in the three divisions during the period from 1997-98 to 2005-2006 in the Central Dry Zone is shown in Table 7.

Table 7. Utilization of agricultural residues (1997-98 to 2005-06)

(ton)

Sr.	Year	Sagaing Div.	Mandalay Div.	Magway Div.	Total
1.	1997-98	-	400	50	450
2.	1998-99	2,153	2,525	28,743	33,421
3.	1999-00	2,315	2,697	20,944	25,956
4.	2000-01	2,489	4,271	13,630	20,390
5.	2001-02	3,056	5,249	15,617	23,922
6.	2002-03	2,780	3,575	15,810	22,165
7.	2003-04	2,977	3,004	13,432	19,413
8.	2004-05	2,850	3,016	12,410	18,276
9.	2005-06	2,792	2,863	10,066	15,721
	Total	21,412	27,600	130,702	179,714

Source: DZGD-Four Main Tasks (1994-95 to 2005-2006)

3.1.4 Development of water resources

Sufficient water supply was a serious problem in the Dry Zone in the past. The Government of Myanmar has been taking intensive measures to supply sufficient water to the community in the region from all available water resources. Soil and water conservation are of utmost importance to reduce the pressure on scarce land resource, 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 Central 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. The DZGD has constructed about 1,420

ponds and 1,249 small dams, and dug more than 86 artisan wells during the eight years period since its establishment.

Regarding water resource management, the 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.

Tables 8, 9, and 10 show the completed activities during the period from 1997-98 to 2005-2006 with regard to the development of water resources.

Table 8. Construction of ponds (1997-98 to 2005-06)

(Number)

Sr.	Year	Sagaing Div.	Mandalay Div.	Magway Div.	Total
1.	1997-98	20	-	13	33
2.	1998-99	26	78	68	172
3.	1999-00	54	45	71	170
4.	2000-01	51	48	71	170
5.	2001-02	50	49	76	175
6.	2002-03	50	49	76	175
7.	2003-04	50	49	76	175
8.	2004-05	50	49	76	175
9.	2005-06	50	49	76	175
	Total	401	416	603	1,420

Source: DZGD - Four Main Tasks (1994-95 to 2005-2006)

Table 9. Digging of artisan wells (1997-98 to 2005-06)

(number)

Sr.	Year	Sagaing Div.	Mandalay Div.	Magway Div.	Total
1.	1997-98	-	1	-	1
2.	1998-99	1	7	4	12
3.	1999-00	2	1	4	7
4.	2000-01	1	3	3	7
5.	2001-02	3	3	4	10
6.	2002-03	3	3	4	10
7.	2003-04	3	3	4	10
8.	2004-05	3	3	4	10
9.	2005-06	12	3	4	19
	Total	28	27	31	86

Source: DZGD - Four Main Tasks (1994-95 to 2005-2006)

Table 10. Construction of small dams (1997-98 to 2005-06)

(number)

Sr.	Year	Sagaing Div.	Mandalay Div.	Magway Div.	Total
1.	1997-98	-	-	-	-
2.	1998-99	-	-	-	-
3.	1999-00	54	45	72	171
4.	2000-01	51	136	36	223
5.	2001-02	40	80	50	170
6.	2002-03	40	80	50	170
7.	2003-04	40	80	50	170
8.	2004-05	40	80	50	170
9.	2005-06	40	85	50	175
	Total	305	586	358	1,249

Source: DZGD - Four Main Tasks (1994-95 to 2005-2006)

3.2 Provision of Water for Crop Production

The Ministry of Agriculture and Irrigation (MOAI) 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 Department till early 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 in 1995 for closer cooperation and more efficient utilization of water resources.

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.

3.2.1 Pumping water from rivers and streams

Completed and on-going river pumping irrigation projects are presented in Tables 11 and 12 respectively.

Table 11. River pumping irrigation projects (completed at end-2005)

Division	Electric Pumping		Diesel Pumping		Total	
	Qty	Beneficiaries (acres)	Qty	Beneficiaries (acres)	Qty	Beneficiaries (acres)
Sagaing	13	53,020	41	36,658	54	89,678
Magway	19	72,086	26	8,515	46	80,601
Mandalay	24	75,965	51	25,421	68	101,386
Total	56	201,071	118	70,594	162	271,665

Source: Water Resources Utilization Department, MOAI, 2006

Table 12. River pumping irrigation projects (ongoing)

Division	Qty.	Beneficiaries (acres)
Sagaing	5	111,500
Magway	4	16,900
Mandalay	4	48,000
Total	13	176,400

Source: Water Resources Utilization Department, MOAI, 2006

3.2.2 Ground water

Activities completed and planned with respect to ground water availability are shown in Tables 13 and 14 respectively.

Table 13. Groundwater irrigation facilities (completed)

Division	Groundwater		
	Tube Wells	Cluster Wells	Beneficiaries (acres)
Sagaing	2,772	1,830	2,150,475
Magway	2,602	1,877	2,042,718
Mandalay	3,246	1,105	2,307,905
Total	8,620	4,812	6,501,098

Source: Water Resources Utilization Department, MOAI, 2006.

Table 14. Future plan for groundwater irrigation (As per Thirty-Year Master Plan)

Division	2001-2010		2011-2020		2021-2030	
	Qty	Acres	Qty	Acres	Qty	Acres
Sagaing	1,320	10,560	920	18,500	835	20,840
Magway	503	18,500	1,902	52,300	1,886	59,760
Mandalay	400	10,000	502	30,550	470	35,610
Total	2,223	39,060	3,324	101,350	3,191	116,210

Source: Water Resources Utilization Department, MOAI, 2001

3.3 Environmental Education in Formal Education Sector

The growing environmental awareness across the country has also spread into the formal education sector. Formal education in Myanmar consists of two levels, namely Basic Education and Higher Education levels. At the basic level, primary

and secondary students learn about the environment such as forests and deforestation, forest conservation; land degradation and land conservation; biodiversity loss and biodiversity conservation; atmosphere and climate. Chapters relating to these topics are included in the science text books. Moreover, in order to raise environmental awareness among young generations, there are extra curricula activities such as tree planting, greening and clean-up activities. School children also participate in the literary and art competitions held every year on the World Environment Day. Training is also given to the primary school teachers to improve their environment-related skills.

At the higher level, i.e. at universities and colleges topics relating to environment are now included in the curricula of a number of arts and science degree courses such as Law, International Relations, Economics, Geography, Philosophy, Botany, Zoology, Chemistry, Agriculture, Forestry, Marine Biology, and Engineering. A degree course on Environmental Studies has been introduced since October 2001. Remote Sensing and Geographic Information System (GIS) course is also conducted for some degree courses at the universities. A course on environmental education is also incorporated in the B.Ed degree courses. Environmental research work is also progressing with many Master's and PhD students doing thesis on the environment.

3.4 Environmental NGOs and Media

In recent years, environmental NGOs in Myanmar play an important role in promoting environmental knowledge and awareness. Local NGOs such as Forest Resource Environment and Development Association (FREDA), World Conservation Society (Myanmar programme), Biodiversity and Nature Conservation Association (BANCA), Mangrove Service Network (MSN), Birdlife International (Myanmar Branch), CARE (Myanmar) are doing environmental projects, helping local community in environmental conservation activities and imparting environmental knowledge.

Working Group on Environment formed under the Myanmar Women's Affairs Federation (MWAF) has also been active in disseminating environmental education and promoting environmental awareness among women and girls. Environmental

conservation activities and environmental sanitation works are also being promoted under the aegis of the Working Group on Environment.

Media also play an important role in promoting environmental education and awareness. There are regular programmes on local television to raise public environmental awareness. Those programmes cover a broad range of topics such as forest conservation, alternative source of energy, fuelwood substitutes, fuel-efficient stove, pesticide handling, pest management, soil conservation, solid waste disposal, personnel hygiene and sanitation. Recently promotion of biofuel through planting of physics nuts receives extensive coverage in TV, radio and newspapers. (Lay 2006)

3.5 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. 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 State and Division Development Affairs Committees have been building roads linking villages and towns; and 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. Table 15 shows the status of completion of rural roads between 1988 and 2003.

Table 15. Rural Roads

Type of road	1988 (km)	2003 (km)
Tarred	452.21	1,146.12
Gravel	1,099.43	5,063.25
Lateriate	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

The five methods, namely 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 in Table 16.

Table 16. 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	1,091	768
Total	2,331	1,469

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

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 8042 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.

4. MAIN CAUSES AND IMPACTS OF LAND DEGRADATION

4.1 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.

4.1.1 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 degraded 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.

4.1.2 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.

4.1.3 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.

4.1.4 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 being 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 is estimated and presented in Table 17.

Table 17. 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

4.1.5 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 are degraded to the extent that some of them cannot thrive any longer and have 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.

4.2 Impacts of Land Degradation

4.2.1 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.

4.2.2 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/UNESCO, 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.

4.2.3 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.

4.2.4 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. KEY ISSUES IN COMBATING DESERTIFICATION

5.1 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.

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 activities for economic gains 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.

5.2 Information and Planning

Forestry today, unlike the earlier decades, 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.

5.3 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.

5.4 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.

5.5 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.

5.6 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 bears 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 forests 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.

5.7 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 is about US$

300 million annually at present. Export earnings of the forestry sector from the wood and wood-based products (public sector) in 2004-05 was about US$ 305 million with about 75% 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 owners and others partners to upgrade processing in 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 Association of Southeast Asian Nations (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.

5.8 Livelihood Strategies of Local People Living Near Forests

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.

6. MEASURES PLANNED TO BE IMPLEMENTED

6.1 Measures Planned to be Implemented According to Integrated Master Plan (2001-2002 to 2030-2031)

A 30-year Comprehensive Master Plan (2001-2002 to 2030-2031) has been formulated in order to implement the four main tasks of the DZGD systematically. At the end of the integrated Master Plan, the following will have been accomplished in the Central Dr Zone of Myanmar.

- ❖ 1.05 million acres (0.42 million ha) of land will have been planted under three categories of forest plantations, namely village supply, watershed protection and research and other plantations;

- 1.8 million acres (0.73 million ha) of remaining degraded natural forests will have been conserved and rehabilitated by natural means;
- A total of 1,500,000 energy stoves, about 400 million briquettes, and 210 tons of agricultural residues as substitutes for woodfuel will have been distributed;
- A total for 6,400 ponds/dams will have been constructed, 150 artisan wells dug and 150 water pumping stations established for water resources development.

6.2 Projects Planned to be Implemented According to NAP

Five projects are proposed in the NAP of Myanmar to be implemented in order to combat desertification in Myanmar, particularly in the Central Dry Zone. The project proposals are mentioned in detail in the NAP of Myanmar. The profiles of the proposed projects are given below.

6.2.1 Project 1

Title: Mitigation of Land Degradation Project
Development objective: To combat desertification in Myanmar
Immediate objective: To prevent or reduce land degradation in Central Dry Zone
Project period: Three (3) years
Estimated cost: US $ 30,000

6.2.2 Project 2

Title: Drought Mitigation Project
Development objective: To develop a system to mitigate drought in Myanmar
Immediate objective: To prevent or reduce effects of drought in Central Dry Zone
Project period: Three (3) years
Estimated cost: US $ 60,000

6.2.3 Project 3

Title: Capacity Building Project
Development objective: To promote human resource development
Immediate objective: To strengthen national and local capacities

Project period: Two (2) years
Estimated cost: US $ 20,000

6.2.4 Project 4

Title: Rural Development Project
Development objective: To alleviate poverty
Immediate objective: To improve socioeconomic status of rural communities in Central Dry Zone
Project period: Three (3) years
Estimated cost: US $ 60,000

6.2.5 Project 5

Title: Land Use Planning Project
Development objective: To establish a well-defined national land use policy
Immediate objective: To strengthen a framework for development of a national land use policy
Project period: Two (2) years
Estimated cost: US $ 50,000

7. FINANCIAL ALLOCATION FOR DESERTIFICATION CONTROL

Myanmar still needs to develop specific mechanisms to ensure financing for combating desertification. The DZGD of the Ministry of Forestry has the annual budget allocation for greening activities in the Central Dry Zone of Myanmar (See Table 18). Although the other line ministries have their own responsibilities and commitments for management of natural resources, they do not have specific funds for measures to prevent desertification. Other sources of financing are:

- UNDP/FAO;
- International NGOs;
- National NGOs;
- Joint-venture companies and private enterprises; and
- Local communities.

Table 18. Budget Allocation for the Dry Zone Greening Department (2001-2002 to 2005-2006)

(Kyat in million)

Year	Capital	Current	Total
2001 – 2002	214.860	330.000	544.860
2002 – 2003	216.564	329.400	545.964
2003 – 2004	236.053	380.000	616.053
2004 – 2005	256.487	489.742	746.229
2005 – 2006	235.000	597.484	832.484

Annual budget allocation for the DZGD has increased year by year during the last five years. This indicates that the Government of Myanmar has placed greater emphasis on the programmes to combat desertification in the country.

8. MONITORING AND EVALUATION

Currently the NCEA under the guidance of the Ministry of Forestry is responsible for observation and monitoring the environment and the methodology for the elaboration of environmental impact indicators. The line ministries have their own internal mechanisms for observing and monitoring the activities at the national, division, district and township levels. The capacity at the national level will be enhanced with the formation of a National Environmental Protection Committee and the establishment of a separate Ministry responsible for the environment which is envisaged in future.

The FD and DZGD have developed their own sets of criteria and indicators for monitoring and evaluation. The FD has the perfect capability to monitor the land use changes throughout the country including the Central Dry Zone through the integrated use of Remote Sensing (RS) and Geographic Information System (GIS).
The forest cover of Myanmar was assessed four times (1955, 1975, 1989 and 1997) in order to determine the total forest cover area, to evaluate the dynamic status of forests and to analyze forest-related changes. The first appraisal of forest cover assessment was conducted in the early 1960s solely based on the visual interpretation of aerial photographs taken between 1951 and 1963. In 1980, the Forest Department carried out the second appraisal using the landsat imagery data

with the assistance of the UNDP/FAO project. Third and fourth appraisals were conducted based on the satellite data using both visual interpretation and computer classification methods. Table 19 shows the status of forest cover in Myanmar at different periods.

Table 19. Forest cover at different periods

Year of appraisal	Forest covered area		Percent of country 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, FD, 2003

Deforestation rates in Myanmar were worked out during the assessments of forest cover changes (Table 20). The overall deforestation rate between 1955 and 1997 was about 3,160 square kilometres per year (about 780,000 acres per year) indicating that the actual forest area annually decreased at a rate of 0.5% of the total land area. Out of the 14 States and Divisions in Myanmar, 4 States, namely Kachin, Chin, Rakhine and Shan and 3 Divisions, namely Bago, Magway, and Mandalay were more seriously affected by deforestation during a period of 14 years from 1975 and 1989.

Table 20. Deforestation Rates 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
Loss 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 and 1997 (42years)	←	3,160 sq. km/year (0.5% of total land area)		→

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

The forest cover of Myanmar has been continuously monitored in order to keep 35% of the total land area of the country under permanent forests as stipulated in the 1995 Myanmar Forest Policy.

Out of the total land area of 676,577 km^2, 472,940 km^2 are covered with different categories of forests. The breakdown of forest land use at the end of 2005 is shown in Table 21.

Table 21. Forest cover (2005)

Sr. No.	Forest Land Use	Area (km^2)	% of total land area
1.	Closed Forest	247,042	36.51
2.	Degraded Forest	92,624	13.69
3.	Forest Affected by Shifting Cultivation	119,193	17.6
	Total	458,859	67.8

Source: Forest Resource Assessment (2005), Forest Department, Myanmar

Extent of Permanent Forest Estate

Three categories of forest land, namely Reserved Forests, Protected Public Forests, and Protected Areas System legally constitute permanent forest estate (PFE). The extent of PFE at the beginning of 2006 is presented in Table 22.

Table 22. Permanent Forest Estate in Myanmar

Sr.	Legal Classification	Area (,000 ha)	% of total land area
1	Reserved forest	12,191	18.02
2	Protected public forest	3,525	5.21
3	Protected areas system	3,195	4.72*

Source: Planning and Statistics Division, Forest Department, 2005

PFE now covers 17.4 million hectares constituting 25.68% of the total land area

*Note: Some areas of protected areas system are overlapping with the areas of reserved forests.

9. RECOMMENDATIONS OF THE NATIONAL REPORT VALIDATION WORKSHOP

Organized by the United Nations Convention to Combat Desertification (UNCCD) and Ministry of Forestry, the National Report Validation Workshop was held at the Forest Research Institute of the Forest Department in Nay Pyi Taw on 25-26 July 2006. The Workshop was opened with an address by H.E. Minister for Forestry Brig-Gen Thein Aung. At the workshop, eight papers were presented. Also present on the ceremony were directors-general of the Ministry of Forestry and other line ministries, deputy directors-general, representatives of 11 ministries, representatives of 12 districts in three Divisions of the Central Dry Zone and responsible persons.

The Workshop made the following recommendations:

(a) To build the capacity of the government and non-governmental organizations in combating desertification;
(b) To educate the people to know more about the process of desertification and its impacts through different extension media;
(c) To incorporate the matters relating to the environment in the curriculums of the basic and high school education levels;
(d) To provide adequate funds and incentives to attract the cooperation of the people in combating desertification;
(e) To secure funds from international and national non-governmental organizations; and
(f) To monitor and evaluate the process of desertification using the space technology;

10. CONCLUSIONS

In Myanmar desertification is not well known among the people, as there is no desert in the country although there are some patches of desert-like formation in the Central Dry Zone. Land degradation and degradation of the forests are the major issues in the region. In fact, they are the first steps in the process of desertification. Remedial measures are essential to stop the process of desertification and so are preventive measures for the lands that are not yet degraded or slightly degraded. The National

Action Programme should be fully integrated with national sustainable development programme, long-term perspective plans and strategies. An integrated approach addressing physical, biological and socioeconomic aspects of the process of desertification and drought should be adopted. In fact, desertification is the common problem for all the sectors in achieving the sustainable development. Both remedial and preventive measures have been carried out in prioritized areas only on small scales due to financial and institutional constraints. The Ministry of Forestry as a key player in combating desertification is implementing all possible measures based on its limited financial and institutional resources with the active participation of other line ministries and national and international organizations and NGOs.

References:

CIFOR/Government of Indonesia/UNESCO. 1999. *World heritage forests: the World Heritage Convention as a mechanism for conserving tropical forest biodiversity.* Bogor, Indonesia, CIFOR.

CIFOR/Government of Indonesia/UNESCO. 1999. *World heritage forests*: *the World Heritage Convention as a mechanism for conserving tropical forest biodiversity*. Bogor, Indonesia, CIFOR.

Dyson, F.J. 1977. Can we control the carbon dioxide in the atmosphere? *Energy*, 2:287-291.

FAO. 2001. S*tate of the World's Forests 2001*. Rome

Kaimowitz, D. and Angelsen, A. 1998. *Economic model of tropical deforestation*: a review. Bogor, Indonesia, CIFOR.

Lay, Yin Yin. 2006. Environmental awareness and education in Myanmar. Yangon, Myanmar, 2006.

MOAI, Myanmar. 2005. Myanmar Agriculture at a Glance. Department of Agricultural Planning.

MOF, Myanmar. 1995. Myanmar Forest Policy, 1995.

MOF, Myanmar. 1992. Myanmar Forest Law, 1992.

MOF, Myanmar. 1994. Protection of Wildlife, Wild Plants and Conservation of Natural Areas Law, 1994.

MOF, Myanmar. 1995. Community Forestry Instructions, 1995.

MOF, Myanmar. 1999. Dry Zone Integrated Plan (2001/02 – 2030/31).

MOF, Myanmar. 2001. National Forest Master Plan (2001/02 – 2030/31).

MOF, Myanmar. 2002. Proceedings of the National Workshop on Preparation of the UNCCD National Action Programme, December, 2001, Myanmar

Ministry of Information, Myanmar. 2003 Development of Myanmar (1988 – 2003)

Ministry of Information, Myanmar. 2002. Myanmar Facts and Figures, 2002

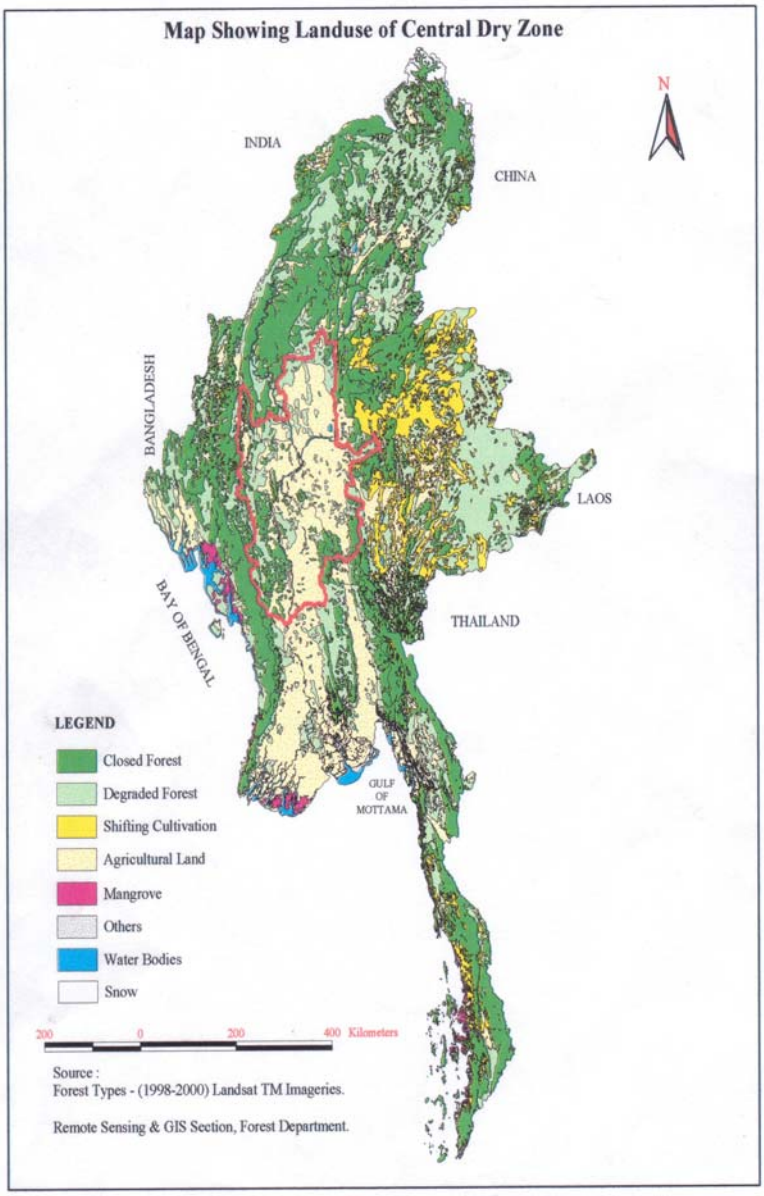
NCEA, Yangon. 1997. Myanmar Agenda 21.

Than, M.M. 2002. Review of landuse and land degradation status in Myanmar, desertification, land degradation, deforestation, drought and their environmental and socioeconomic impacts. Proceedings of the National Workshop on Preparation of the UNCCD National Action Programme, 20-21 December 2001 Yangon, Myanmar.

Tint, K. 2002. Review of forestry and related legislation, policies, and practices and their impacts/implications on sustainable forest management (SFM) and on the model forest approach to SFM in Myanmar. Yangon, Myanmar.

United Nations. 1996. *Implementation of forest–related decisions of the United Nations Conference on Environment and Development at the national and international levels, including an examination of sectoral and cross-sectoral linkages. Programme element I.2: Underlying causes of deforestation and forest degradation*. Report of the Secretary General. E/CN. 17/IPF/1996/2. New York.


Location Map of Myanmar
N
Russia
Kazakhstan
Mongolia
Uzbekistan
Kyrgyzstan
Turkmenistan
Tajikistan
China
Korea D P Rp
Korea Rep
Japan
Iran
Afghanistan
Pakistan
Nepal
Bhutan
India
Bangladesh
Myanmar
Vietnam
Laos
Thailand
Cambodia
Taiwan
Philippines
Oman
ARABIAN SEA
BAY OF BENGAL
Sri Lanka
Malaysia
INDIAN OCEAN

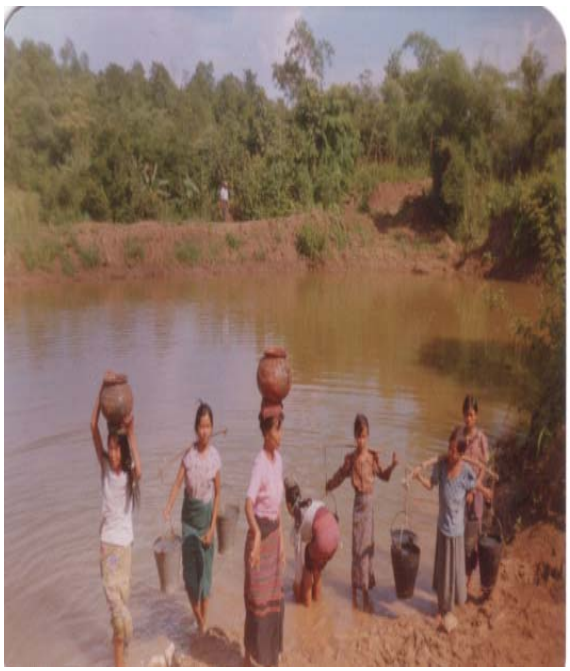

Map Showing Landuse of Central Dry Zone
N
INDIA
CHINA
BANGLADESH
LAOS
THAILAND
BAY OF BENGAL
GULF OF MOTTAMA
LEGEND
Closed Forest
Degraded Forest
Shifting Cultivation
Agricultural Land
Mangrove
Others
Water Bodies
Snow
200 0 200 400 Kilometers
Source :
Forest Types - (1998-2000) Landsat TM Imageries.
Remote Sensing & GIS Section, Forest Department.

Map Showing Location of Dry Zone Greening Area

Establishment of Forest Plantation

Protection of Natural Forest

Promotion of Fire wood - substitute fuel Utilization



Water Resources Development

C. UNCCD country profile

Country name: Union of Myanmar

This UNCCD profile has been provided by: Ministry of Forestry

Name of focal institution/ministry/office: Ministry of Forestry

Date: 08-08-2006

Mailing address: Forest Department, Ministry of Forestry, Nay Pyi Taw, Union of Myanmar

Telephone: 95-067-405384 Telefax:

E-mail: DG.FD@mptmail.net.mm

Biophysical indicators relating to desertification and drought

1. Climax

1.1. Index of aridity[1] -

1.2. Normal rainfall -

1.3. Rainfall standard deviation -

Sub-national areas	mm
1. Monywa	828
2. Mandalay	811
3. Magway	729

2. Vegetation and land use

2.1. NDVI (normalized difference vegetation index) -

2.2. Vegetation cover (% of total land area) - 50.2

2.3. Land use (percent of total land) -

[1] The index of aridity is the ratio P/PET; P=precipitation, PET=potential evapotranspiration. Climatic zone maps to be annexed if available in a scale of 1/million.

(000' ha)

Land use		1990-1999	2000-2005
Arable crop land		8,858	10,064
	Irrigated	1,818	2,557
	Rainfed	7,040	7,507
Current fallows		1,305	601
Culturable waste other than fallows		7,938	6,741
Reserved forests		10,689	14,088
Other woodlands		21,781	19,128
Others		17,088	17,038

Source: Statistical Year Book by CSO and Agriculture in Brief published by DAP

2.4. Surface albedo[2] -

3. Water resources

3.1. Fresh water availability (million m^3) 1,082,000

3.2. Fresh water resources per capita (m^3) 19,926

3.3. Agricultural water use (million m^3) 41,500

3.4. Industrial water use (million m^3) 400

Source: Irrigation Department, 2006

4. Energy

Consumption

4.1. Energy use per capita

Year	Per capita consumption (Kg oil equivalent)
2001 – 2002	200
2002 – 2003	210
2003 – 2004	210

4.2. Agriculture sector consumption

Year	Agricultural sector consumption thousand ton (Kg oil equivalent)
2001 – 2002	157
2002 – 2003	123
2003 – 2004	142

[2] Surface albedo map to be annexed if available.

Production

4.3. Energy from renewables including combustible renewables and waste (% of total supply)

Year	Hydro (thousand ton oil equivalent) (Mini + Micro Hydro Power)
2001 – 2002	772
2002 – 2003	743
2003 – 2004	788

Year	Biomass (thousand ton oil equivalent)
2001 – 2002	8,036
2002 – 2003	8,249
2003 – 2004	8,615

Renewables –Consumption by sector

4.4. Industry (% of total renewable consumption) 1

4.5. Residential (% of total renewable consumption) 8

4.6. Agriculture (% of total renewable consumption) 91

Source: Irrigation Department, 2006

5. Types of land degradation

Type of degradation	1990-1999		2000-2005	
	Million ha	Percent of total area	Million ha	Percent of total area
Forest degradation	0.22	0.3	0.46	0.7

6. Rehabilitation

Lands under rehabilitation	1990-1999	2000-2005
Rehabilitation of degraded crop land (km^2)	-	-
Rehabilitation of degraded rangeland (km^2)	-	-
Rehabilitation of degraded forest (km^2)	6,651	8,536

Socio-economic indicators related to desertification and draught

7. **People and economy**

7.1. Population (total)	52.17 million (2002 – 03)
Population: urban (percent of total)	-
Population: rural (percent of total)	-
7.2. Population growth (annual %)	2.02 % (2002 – 03)
7.3. Life expectancy (years)	61.8 (male); 66.01 (female)
7.4. Infant mortality rate (per 1,000 live births)	48.4 (urban); 50.7 (rural)
7.5. GDP (Kyat in million) 2004/2005 (End of March)	9,078,928.5
7.6. GDP per capita (Kyat) 2004/2005 (End of March)	167,202.0
7.7. National poverty rate (% of population)	-
7.8. Crop production (metric tons)	35,227,010.8
7.9. Livestock production (metric tons)	598,676

8. **Human development**

8.1. Primary education completion rate (% age group)	-
8.2. Number of women in rural development (total number)	-
8.3. Unemployment (% of total)	4.02 (2003 – 04)
8.4. Youth employment rate (age 15-24)	-
8.5. Illiteracy total (% age 15 and above)	-
8.6. Illiteracy male (% age 15 and above)	-
8.7. Illiteracy female (% age 15 and above)	-

9. **Science and technology**

9.1. Number of scientific institutions engaged in	-
desertification-related work (total number)	-

10. Please specify the data sources

CSO, DOH, DSW, DAP, DLF, DOP, SLRC

Abbreviations

CSO = Central Statistical Organization

DAP = Department of Agricultural Planning

DOP = Department of Population

DLF = Department of Livestock and Fisheries

DSW = Department of Social Welfare

DOP = Department of Health