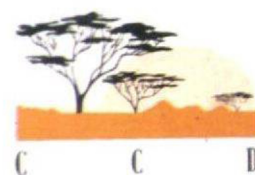




National Action Programme (NAP)
For
Combating Land Degradation
in Sri Lanka
2002



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National Action Programme for Combating Land Degradation in Sri Lanka

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NATIONAL ACTION PROGRAMME FOR COMBATING LAND DEGRADATION IN SRI LANKA

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ABBREVIATIONS AND ACRONYMS

CARP	Council for Agricultural Research Policy
CBOO	Community Based Organizations
CEA	Central Environmental Authority
CEPOM	Committee on Environment Policy and Management
CHPB	Centre for Housing Planning and Building
CIEDP	Committee on Integrating Environment and Development
DAD	Department of Agrarian Development
DAPH	Department of Animal Production and Health
DCS	Department of Census and Statistics
DOA	Department of Agriculture
DOI	Department of Irrigation
DOM	Department of Meteorology
DS	Divisional Secretaries
DSS	Department of Social Services
DWLC	Department of Wild Life Conservation
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
FD	Forest Department
GLASOD	Global Assessment of Soil Degradation
GNP	Gross National Product
GSMB	Geological Survey and Mines Bureau
LC	Land Commissioners Department
LUP	Land Use policy
LUPPD	Land Use Policy Planning Division
MASL	Mahaweli Authority of Sri Lanka
MOAL	Ministry of Agriculture and Livestock
MOE	Ministry of Environment
MOF	Ministry of Finance
MOIND	Ministry of Industries
MOI	Ministry of Irrigation
MOL	Ministry of Lands
MOS	Ministry of Samurdhi
MSS	Ministry of Social Services
NDMC	National Disaster Management Centre
NEAP	National Environmental Action Plan
NGOO	Non Government Organizations
NPPD	National Physical Planning Department
NRMC	Natural Resources Management Centre of the DOA
PC	Provincial Councils
PDA	Provincial Department of Agriculture
PDAPH	Provincial Dept. of Animal Production & Health
PGRC	Plant Genetic Resources Centre of the DOA
PLC	Plantation Companies
SALT	Sloping Agricultural Land Technology
SD	Survey Department
UDA	Urban Development Authority
UNCCD	United Nations Convention to Combat Desertification

UNIV
WMP
WRA
WRB

Universities
Watershed Management Policy
Water Resources Authority
Water Resources Board

INTRODUCTION

The United Nations Convention to Combat Desertification (UNCCD), defines land degradation as the reduction or loss of the biological or economic productivity and complexity of rain fed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or a combination of processes, including processes arising from human activities and habitation patterns such as soil erosion, deterioration of the physical, chemical and biological or economic properties of soil and long term loss of natural vegetation.

Land Degradation has emerged as a serious problem in Sri Lanka. The population has been expanding rapidly and this has led to an increased demand for land for economic purposes and social services. The demands from various users such as agriculture, industry, transport and settlements have set up pressures on the land, and these in turn have inevitably resulted in the misuse and degradation of land in many areas. Evidence of this degradation can be seen in heavy soil losses; high sediment yields; decline in soil fertility, salinization and the marginalization of agricultural land.

The government has been keen to address this problem and several measures have been adopted over the past few decades to control land degradation. However these have only had a limited impact and this is reflected in the spread of settlements into environmentally fragile areas; eroded uplands; low and unreliable crop yields, and other offsite effects of soil erosion such as sedimentation of reservoirs and floods. These trends need to be reversed early; if not there could be serious economic and social consequences.

The Convention to combat Desertification is being implemented through national action programmes. As a party to the convention Sri Lanka is expected to prepare and implement a National Action

Programme (NAP) to identify the factors contributing to land degradation and practical measures necessary to combat land degradation. This document has been prepared to fulfill this need. It is divided into two parts. Part I present the country background; significant environmental issues, the state of land degradation and its causes and consequences; and measures adopted up to date to combat land degradation and to mitigate the effects of drought. Part II presents the National Action Programme for implementation. It is hoped that the implementation of the National Action Programme will lead to the prevention and reversal of land degradation.

2.0 COUNTRY BACKGROUND

Sri Lanka covering an area of about 65,610 square kilometers is located between 6 and 10°N latitude and between 80 and 82 °E longitude. The island has a maximum length of about 435 km and a maximum width of about 240km.

Sri Lanka has a coastline of about 1600km, a continental shelf estimated at 31,250 km and holds sovereign rights with respect to the natural resources both living and non - living of the waters superjacent to the sea bed and of the sea bed and subsoil in the Exclusive Economic Zone (EEZ) of Sri Lanka extending to a distance of 200 nautical miles from the mean sea level.

2.1 PHYSIOGRAPHY

Physiographically, the island comprises a mountainous area situated in the south - centre and a surrounding intermediate zone of upland ridges and valleys at a lower elevation (Fig. 1).

RELIEF AND DRAINAGE

DAY OF BENGAL

9.30

9.00

8.30

8.00

7.30

7.00

6.30

6.00

INDIAN OCEAN

80.00

80.30

81.00

81.30

LEGEND

Peak

River

Wewa, Kulam, Tank, Reservoir

Bathymetric Contours (in metres)

TOPOGRAPHICAL REGIONS

ALTITUDE IN METRES

2500

2000

1500

1000

500

0

SCALE 1:1,666,000

3

Next to the intermediate zone lies gently sloping lowlands. The central hill country rising to an elevation of approximately 2500 meters above sea level, is the source of the major rivers of the country.

2.2 CLIMATE

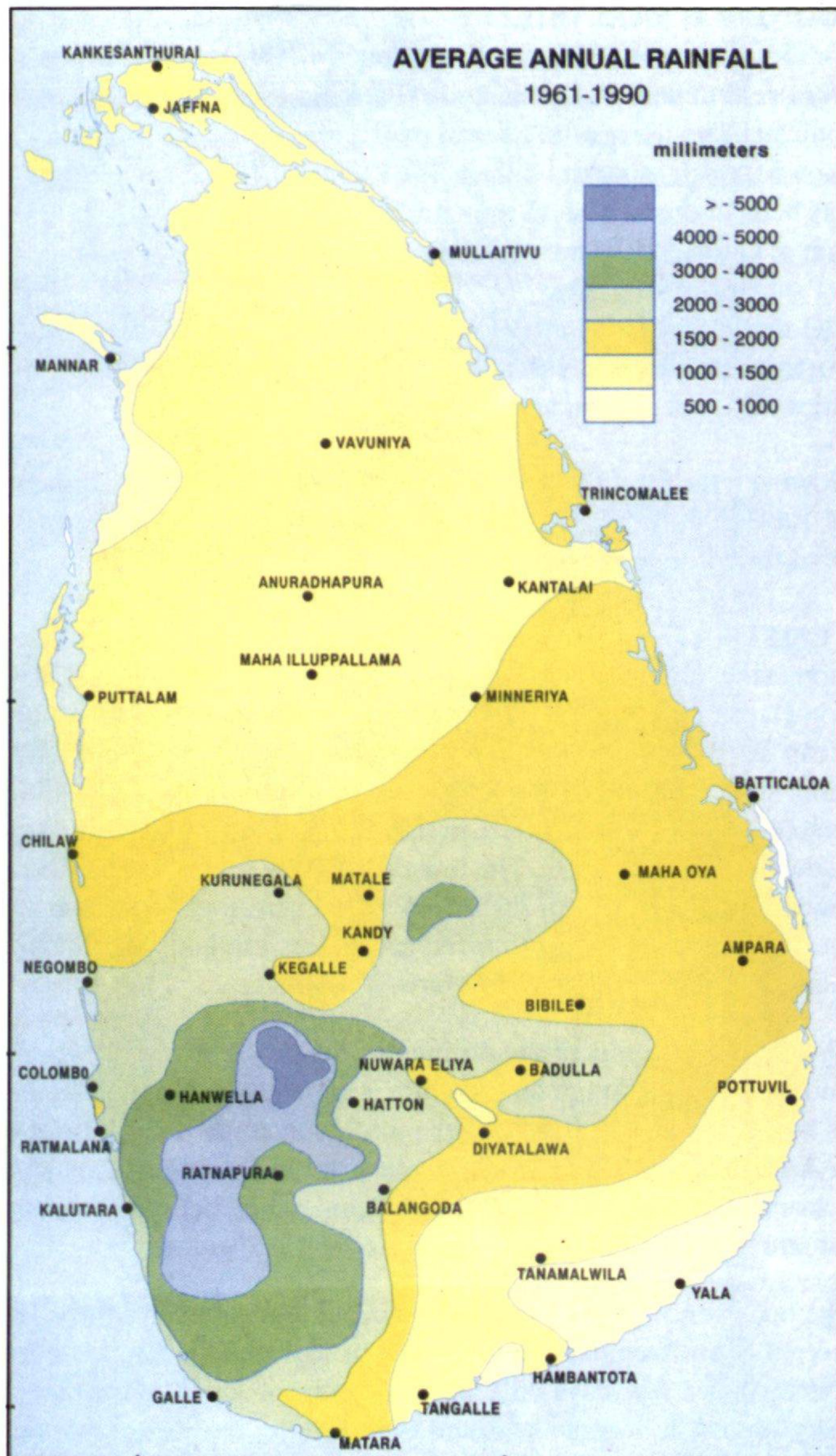
Sri Lanka has a hot and humid climate with warm and humid conditions being found over most parts of the island throughout the year.

There are four rainfall seasons i.e. First Inter monsoon (March - April); South-West monsoon (May-September); Second Inter - monsoon (October to November); and the North-East Monsoon (December - February). The dependability of the rainfall varies with seasons with the South-West monsoon rainfall being comparatively more reliable than the rainfall in the other three seasons. The least reliable are the North- East monsoon rains.

The rainfall in the country is unevenly distributed varying from less than 1000mm over a small region in the semi - arid parts of the North-West and South-East of the island to over 5000mm on the windward slopes of the hill country (Fig 2). The seasonal distribution is also very uneven. The Wet Zone experiences a fairly well distributed rainfall throughout the year with short dry spells from February to March and August to September while the Dry Zone experiences a distinct bi-modal rainfall pattern with two dry periods from February to March and July to September.

Most of the districts in Sri Lanka are affected by droughts (Fig3). However droughts are more common (a) in the dry and intermediate

Fig. 2



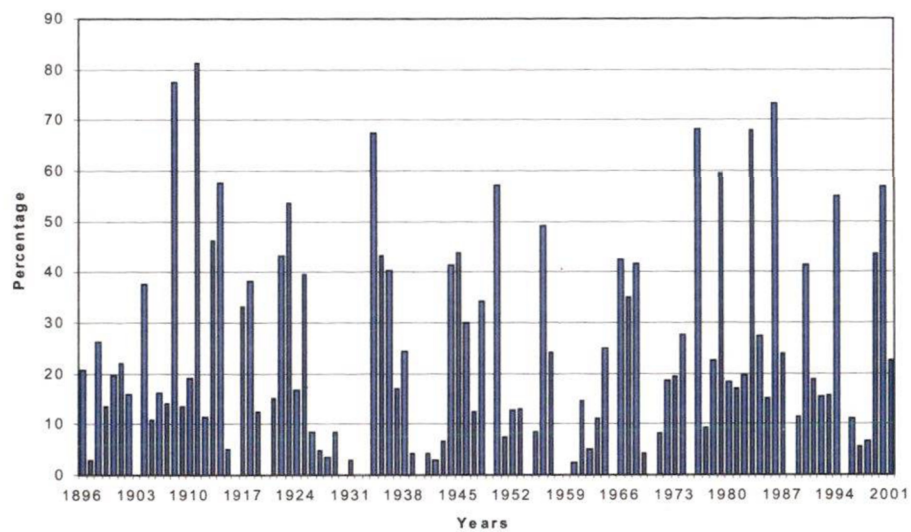


Fig. Percentage of Land Area Affected by Drought During the YALA SEASON

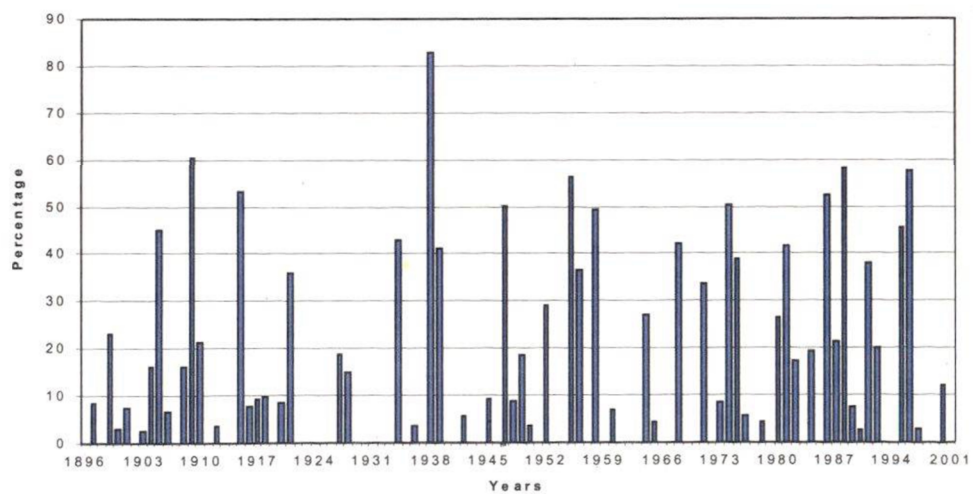


Fig. Percentage of Land Area Affected by Drought During the MAHA SEASON

zones than in the Wet Zone and (b) in the Yala season than in the Maha season.

The seasonal variation in temperature in Sri Lanka is minimal. In the coastal areas below 180 m in elevation, the mean annual temperature varies from 26.0°C to 28.0°C and in the hill country above 1500m. it varies from 15.0°C to 19.0°C. Higher temperatures are generally experienced in the northern, north central and eastern regions of the country and vary on the average between 33 °c and 34°C.

2.3 NATURAL RESOURCES

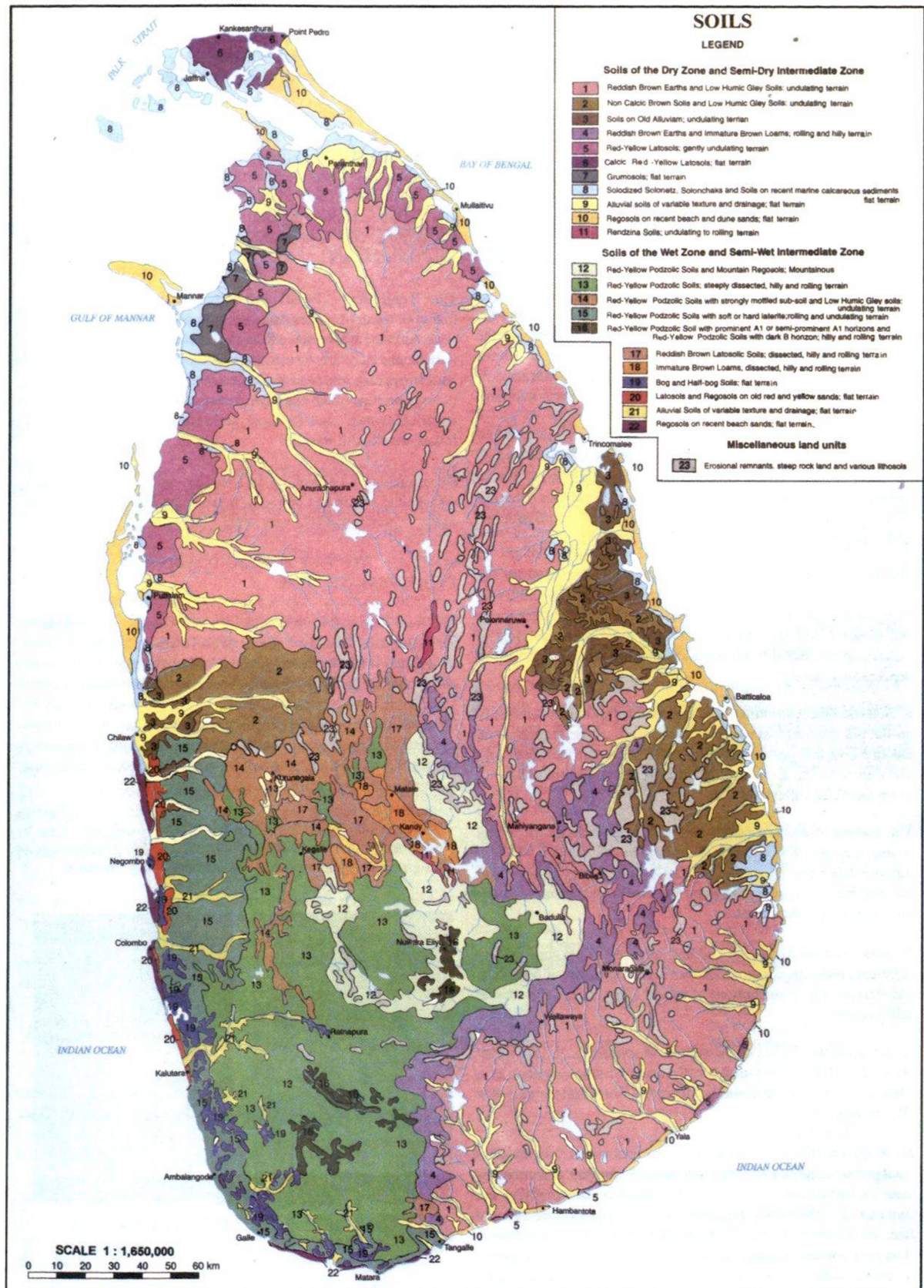
2.3.1 Land Resources

Sri Lanka has a total area of about 6.5 million hectares of which 96 percent comprise land and the balance 4 percent water. Nearly 80 percent of this area comes under some form of state control. A rough "land balance sheet" prepared in 1995 indicated that a little over 40 percent of the land area was used, while another 11 percent remain sparsely used or unutilized. Forest and catchment areas covered 31 percent and streams and their reservations, reservoirs and infrastructure facilities covered another 9 percent. The balance 9 percent comprised steep lands, barren lands, lands over 1500m, marshes and mangroves.

2.3.2 Soil Resources

Sri Lanka has a wide variety of soils falling into 14 Great Soil Groups (Fig.4). These permit the cultivation of a number of crops including cereals, pulses, vegetables, fruit crops, cotton, tobacco, tea, rubber, coconut coffee, cocoa, cinnamon, pepper, and cloves. Although a wide variety of crops can be grown, most of the soils have to be carefully

Fig. 4



managed. They are highly erodible and special conservation measures are needed for sustained production.

2.3.3 Water Resources

Sri Lanka's water resources comprise both surface water and ground water. Surface water is primarily determined by the Central Massif, which intercepts the moisture laden monsoon winds. Surface water from the upper watersheds are transported by 103 natural river basins covering 90 percent of the island (Fig. 5). Rivers originating in the wetter parts of the hill country are perennial while the majority of those in the Dry Zone are seasonal.

The ground water resources in the country also vary considerably from region to region. Ground water potential is highest in the northern and north - western parts of the country, which contain highly productive aquifers. In other areas the ground water potential is modest. Regional aquifers underlie 1-2 percent of the land in areas underlain by quartzites or crystalline limestone bands; elsewhere ground water is to be found in fissures and cracks and weathered material which are re-charged from rainfall infiltration.

2.3.4 Forest Resources

The climate of Sri Lanka favors forest growth and at one time the country was rich in tropical forests. Over the years, a part of this forest cover has been lost due to the spread of agriculture and settlements (both legally and illegally) and hence the forest cover today amounts to approximately 2.1 million ha representing 32 percent of the land area (Fig.6). Of this extent 2.04 million ha are natural forests and 0.72 million ha, forest plantations. Approximately 85 percent of the natural forests are concentrated in the Dry and Intermediate Zones.

Fig. 5

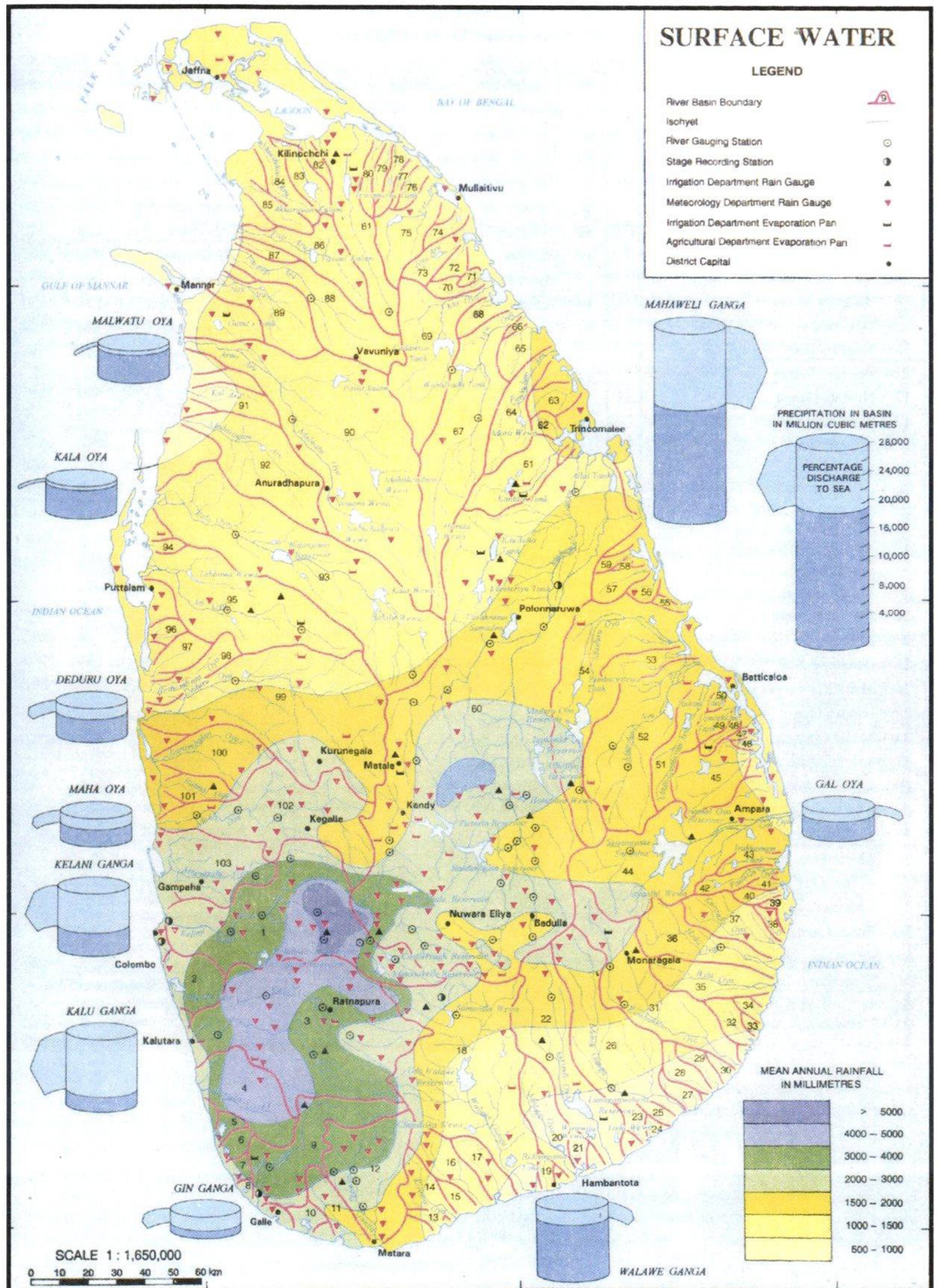
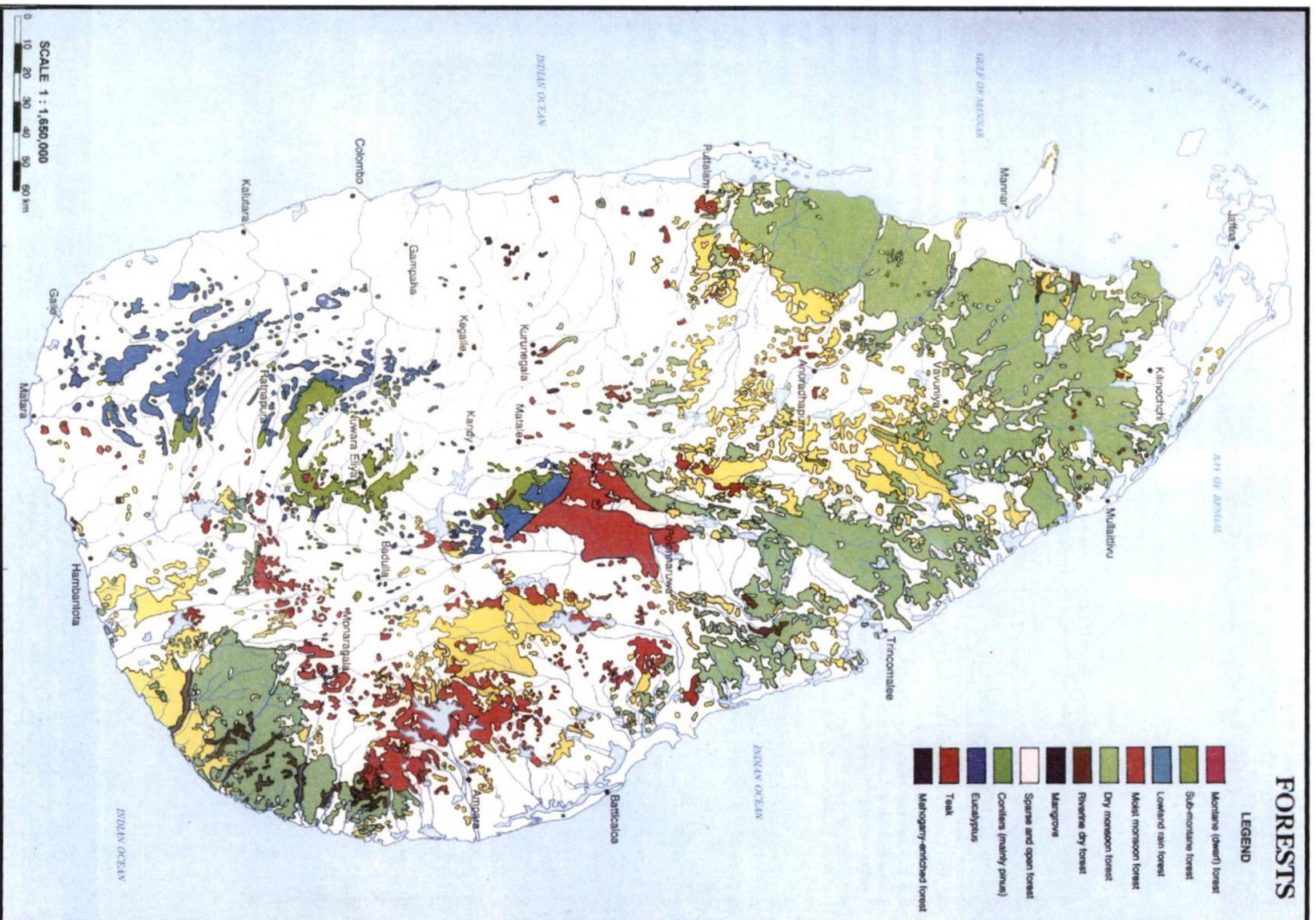


Fig. 6



Source : Arjuna's Atlas

Sri Lanka still has a variety of forest types. The montane forests, sub-montane forests and the lowland rainforests represent the major natural forest types in the Wet Zone while the dry and intermediate zones have most of the dry and monsoon forest, riverine dry forests, mangroves and sparse forests. Large - scale felling and chena cultivation has degraded the forest cover in the Dry Zone and hence a substantial portion of what remains today comprise scrub or low jungle.

2.3.5 Wildlife Resources

Sri Lanka has a wide variety of mammals, birds and amphibians some of whom are endemic and others non - endemic. Most of the endemic species are confined to the Wet Zone.

A greater part of the wildlife in the country is to be found in protected areas covering an extent of approximately 8,500 ha. These include Strict Nature Reserves, Nature Reserves, National Parks and Sanctuaries. Some of these areas are strictly protected while a limited amount of human activities are permitted in others. Most of the wildlife reserves are confined to the Dry Zone and amongst the reserves National Parks are the most important as they carry a greater part of wildlife in the country.

2.3.6 Bio Diversity

Sri Lanka with its rich biological diversity is considered to be one of the bio diversity "hotspots" in the world.

Despite its small size the island has a rich ecosystem diversity because of its varied topography and climate. Among the terrestrial ecosystems are forests varying from wet evergreen forest (both lowland and montane) to dry thorn forests; grasslands; and a complex network of

rivers, wetlands and freshwater bodies. These, along with the coastal and marine ecosystems such as sea - grass beds, coral reefs, estuaries and lagoons, and associated mangrove swamps, constitute the natural ecosystems in the country. In addition, there are also numerous man - made ecosystems related to agriculture and irrigation. The range of ecosystems found in the country are grouped into four basic habitat classes: forest, inland wetlands, agricultural lands, and coastal and marine systems. The ecosystem diversity has resulted in high species diversity particularly in respect of mammals, birds, reptiles, amphibians, freshwater fishes and several groups of invertebrate fauna. A similar high diversity is to be found among flowering plants, ferns and fern allies, mosses, liverworts, lichens, algae and fungi.

The island also has a very high endemism among its fauna and flora. Among the different vertebrate groups the highest proportion of endemic species has been recorded among amphibians (65 percent), reptiles (52 percent), and fresh water fishes (41 percent), while among the invertebrate groups the highest proportion of endemics has been recorded among crabs (100 percent) and land molluscs (76 percent). Among the flora 28 percent of the flowering plant species and about 17 percent of the fern species are endemic to Sri Lanka.

The island's biodiversity is being increasingly threatened through the increase in population and human activities. Pressures are being exerted through the destruction of habitats due to sedimentation arising from soil erosion and filling of land for development, selective exploitation of commercially important species, unsustainable collection of biological resources for subsistence needs, and the introduction of alien invasive species either intentionally or accidentally.

2.4 AGRICULTURE

Agriculture plays a dominant role in the Sri Lankan economy. In 2001, the agricultural sector contributed 16 percent to the Gross National Product (GNP) and accounted for 19 percent of the total merchandise exports. It also employs directly more than one third of the labour force; provides inputs for the agricultural processing industry and supplies a large share of domestic food requirements.

The agricultural sector has traditionally been viewed in terms of two sub-sectors, the plantation sector with tea, rubber and coconuts as the major crops and the food crop sector with paddy as the dominant crop. The plantation sector generates most of the export earnings from agriculture while the non-plantation sector generates most of the food needed by the local population.

Outside the areas coming under plantations and food crops there are other tree crops such as cocoa, coffee, spices and cashew. The food crop sector or the domestic agricultural sector provides the chief means of sustenance to the majority of the rural population. Within this sector, paddy, other field crops including grain legumes, coarse grains, oil seeds and condiments and fruits and vegetables are the main commodities produced. Of these paddy is the most important.

Paddy is the chief crop within the domestic agricultural sector. In 2001 it contributed 2.3 percent towards the GNP and accounted for nearly 15 percent of the contribution made by the agricultural sector towards the GNP. It also provides employment to about 10 percent of the total population and accounts for 45 percent and 40 percent of the per capita calories and proteins respectively in the Sri Lankan diet. Paddy is cultivated throughout the island, but is relatively more important in the Dry Zone than in the other areas. It is grown both

under irrigation and rain fed conditions. Nearly 70 percent of the area that has been brought under paddy cultivation.

Tea which is the major export crop is grown on approximately 200,000 ha of land representing 3 percent of the total land area. In 2001 it contributed 1.25 percent of the GNP and accounted for nearly 8 percent of the contribution made by the agricultural sector to the GNP. In the same year it also accounted for 14 percent of the country's total export earnings and 74 percent the export earnings from agriculture. This made tea the second largest earner of foreign exchange in the country behind textiles and garments. Tea is found at elevations ranging from 100 meters above sea level to well over 2,000 meters above sea level. Cultivation takes place both on large estates and smallholdings.

Rubber, another of the major export crops is grown on approximately 171,000 ha representing 2.5 percent of the land area. In 2001 it contributed nearly 0.4 percent to the GNP and accounted for 2.3 percent of the contribution made by the agricultural sector towards the GNP. In the same year it also accounted for approximately 0.5 percent of the total export earnings and 2.5 percent of the export earnings from agriculture. Rubber is grown in the Wet and Intermediate Zones on land varying from flat to very steep elevations ranging from sea level to 300 meters above sea level. Production takes place both on smallholdings and estates.

Coconut, the third major export crop is grown on approximately 440,000 ha representing nearly 7.0 percent of the total land area. In 2001 it contributed almost 1.1 percent towards the GNP and accounted for a little over 6.5 percent of the contribution made by the agricultural sector towards the GNP. In the same year coconut products contributed nearly 9 percent towards the country's export earnings from agriculture. Coconut is grown in all of the districts, but

the (bulk 64 percent) is to be found in the districts of Gampaha, Kurunegala and Puttalam constituting what is commonly referred to as the "Coconut Triangle". A little over 10 percent of the area under coconut, comprises scattered trees; the balance is grown systematically both on smallholdings and estates.

Export agricultural crops consist mainly of beverage crops such as coffee and cocoa, spices such as cinammon, pepper, cardamoms, cloves and nutmeg and other agricultural products such as cashew. The extent under cultivation is relatively small and amounted to only 117, 664 ha in 1999 representing 1.8 percent of the land area. Yet, in the same year, they contributed 7 percent towards the value of agricultural exports from the country and 43 percent towards the value of other agricultural exports.

The other field crop sector includes legumes such as green gram, black gram, cow pea and soya beans; cereals such as kurakkan and maize; tubers such as potatoes; and condiments such as, chillies and onions. Legumes and cereals are generally cultivated under rainfed conditions in home gardens and unirrigated uplands while the high value crops are usually grown under irrigation partly in paddy fields and partly on uplands.

Vegetables have traditionally been divided into two broad categories, i.e. low country vegetables and up country vegetables. The former are grown in the low- country and the mid- country as seasonal crops both during the Maha and Yala seasons. Up country vegetables are generally grown in the mid- country and the hill -country. Some up country varieties however are grown on a limited scale in the low country.

2.5 ENERGY

Sri Lanka depends on three primary energy sources i.e. hydro - electricity, petroleum and biomass. In 1996, hydro - electricity accounted for 780 thousand tonnes of Oil Equivalent (TOE); (11.4 percent) petroleum and crude oil products for 2169 thousand TOE (31.5 percent); and biomass for 3930 thousand TOE (57.1 percent). The use of renewable energy sources such as wind power and solar electricity for commercial purposes is very limited and almost negligible.

Hydro -electricity is generated by several hydro stations whose number has increased over the past few decades through the commissioning of new hydro power stations. Yet of the total demand of electricity of 6481 million units in 1999 only about 3500 million units were supplied by hydro - power stations. The balance had to be provided by thermal power stations.

Petroleum oil products are supplied either through the local refinery or through the direct imports of refined products. The major use of petroleum products is the transport sector (59 percent). This is followed by the industrial sector (22 percent); the electricity sector (15 percent); and household, commercial and other sector's (4 percent).

The demand for biomass which is the most widely used source of primary energy in Sri Lanka is shared by the domestic, commercial and industrial sectors. The domestic sector depends primarily on fuel wood, coconut residues, paddy husk and saw dust while small manufacturing industries such as bakeries and tile and brick making and the commercial sector depend mainly on fuel wood.

A large extent of forest land in the Dry Zone is degraded and has to be re-forested in order to prevent further degradation. It has been suggested that some of these areas be provided with "cover" by introducing energy plantations. Estimates indicate that fuel wood plantations on approximately one - third of the degraded area amounting to 0.5 million ha could provide 10 million tonnes of fuel wood per year which is equivalent to 3.8 million tonnes of oil. Apparently this quantity of fuel wood could generate more energy than what is being supplied by oil at present.

2.6 POPULATIONS AND POVERTY

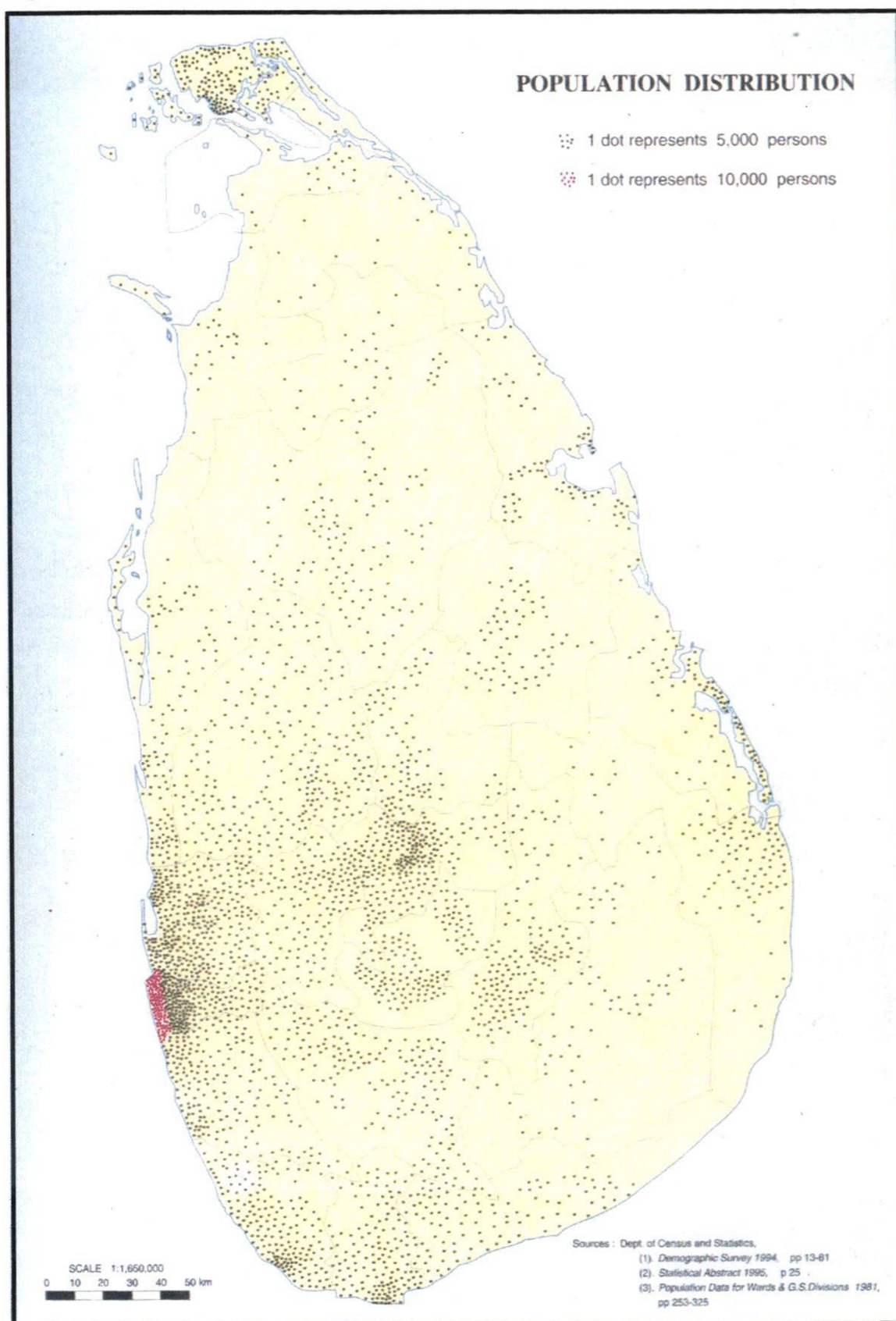
2.6.1 Population

According to the Census of Population and Housing taken in 2001 the enumerated population in Sri Lanka other than in the Northern and Eastern Provinces amounted to approximately 16.9 million. The projected population for the whole island was 18.7 million persons. The average annual growth rate of population for the 20 year period from 1981 – 2001 was 1.2 percent. According to the standard projection the population is expected to increase up to 22.4 million in 2020.

The population is unevenly distributed across the country, with nearly 60 percent being concentrated in the Wet Zone (Fig. 7). Within the Wet Zone nearly 50 percent of the population is concentrated in the Western Province comprising the districts of Colombo, Gampaha and Kalutara.

Sri Lanka is one of the most densely-populated countries in the South Asian Region. With an average density of approximately 300 persons per square kilometer, the country ranks behind Bangladesh and Maldives. Regional variations however are quite marked with the Wet Zone having higher densities than the Dry Zone. The densities vary

Fig. 7



from approximately 3550 persons per square kilometer in the Colombo District in the Wet Zone to 41 persons per square kilometer in the Vavuniya District in the Dry Zone.

A large part of the country's population live in rural areas and a part in urban areas. According to the Census of 2001, the rural population in the enumerated areas amounted to 85 percent and the urban to 14.6 percent. These figures however may not present the correct picture because the Census defined the urban population as those persons living within Municipal Council areas and Urban Council areas. The proportion of urban population should be higher because urbanization has spread to the peripheries of municipal and urban council areas. Furthermore there are a large number of small urban centres scattered throughout the country, which according to the Census definition falls within the rural sector. A study undertaken by the National Physical Planning Department (NPPD) to ascertain the urban population in the country taking into consideration all areas that has become urbanized estimated the urban population to be 44.5 percent in 2001. According to the same study the urban population in the country is expected to increase to 65 percent by the year 2030.

2.6.2 Poverty

The incidence of poverty in Sri Lanka is high. In 1996, the population was estimated at 17.5 million. Of this number one-fifth to one-third was considered to be poor depending on the use of a lower poverty line of Rs. 860/= per person per month or a upper poverty line of Rs. 1032/= per person per month to measure consumption poverty. It is likely that the majority of those living below the lower poverty line suffer from chronic (or long term) poverty while those falling within the lower and the higher poverty lines are vulnerable to transitory (or short term) poverty. The survey on Household Income and Expenditure conducted by the Department of Census and Statistics (DCS) in 1995 /

96 seems to suggest that at any given time around 25 percent of the population is affected by long-term poverty, while around 40 percent is affected by combined chronic and transitory poverty.

The majority of the poor households are to be found in the rural sector. The DCS survey indicates that 88 percent of those falling below the poverty line reside in rural areas as against 8 percent in urban areas and 4 percent in estate areas. From a sectoral point of view the highest levels of poverty are to be found in mining and quarrying (59 percent) and agriculture (51 percent). From occupational point of view farmers have the highest incidence of poverty (52 percent).

From a regional point of view the incidence of poverty is lowest in the Western Province where the proportion below the lower poverty line and the higher poverty line is 14 percent and 23 percent respectively. The proportions are highest in the Uva Province where 37 percent are below the lower poverty line and 55 percent below the higher poverty line.

3.0 ENVIRONMENT

3.1 SIGNIFICANT ENVIRONMENTAL ISSUES

Although Sri Lanka's environment is presently considered to be comparatively healthy, nevertheless it is being severely threatened because of the demands being placed by a rapidly increasing population. The country faces a number of environmental problems and of these five have been identified in the State of the Environment Report of Sri Lanka, 2001 as the key environmental issues viz. land degradation by soil erosion, waste disposal, pollution of inland waters, loss of bio diversity and depletion of coastal resources. The other

issues include air pollution by industrial and vehicular emissions, industrial pollution, depletion of forest cover, flooding and landslides.

(a) Land Degradation by Soil Erosion.

It has been estimated that nearly one - third of the land in the country is subjected to soil erosion, the proportion eroded ranging from less than 10 percent in some districts to over 50 percent in others. Much of the erosion has been taking place in the hill country, the problem being particularly severe in the mid country where sloping lands have been given over to the cultivation of highly erosive temporary crops such as vegetables, potatoes and tobacco, seedling tea and chena cultivation (Fig. 8). Soil erosion however is not confined to the hill country. It is also considered a threat to agricultural production in the Dry Zone.

(b) Waste Disposal

Management of liquid and soil waste has emerged as a critical problem in the larger urban areas and around industrial sites. Changing life styles and consumption patterns has led to an increase in waste generation and it is estimated that this would continue to increase at a growth rate of 1.2 percent per annum. The rapid economic changes that have been taking place in recent years however have not been matched by investments in urban infrastructure facilities, especially in the areas of urban solid waste management. Much of the waste is disposed by open dumping in low - lying areas and this has led to adverse impacts such as the reduction in flood detention areas, pollution of wetland habitats, pollution of surface and ground water and the creation of environments that promote insect and mosquito breeding (Fig. 9).

Fig. 8 Typical Site of Soil Erosion in the Hill Country



Fig. 9 Stream Polluted with Waste



(c) Pollution of Inland Waters

Pollution of inland waters take place primarily through agricultural practices, industrialization and urbanization. In agricultural areas the widespread and enhanced use of agro - chemicals and fertilizers has led to the discharge of domestic waste into waterways. In industrial areas major effluent generating industries such as textile dyeing and bleaching, food processing leather tanning and metal finishing, release industrial effluents into surface and stagnant waters. The pressures created by these three sources have led to eutrophication and blooming in stagnant water bodies; nitrate pollution in ground water; spread of disease due to organic pollution; reduction of land values near water ways and general economic losses to the country. The estimated clean - up costs of the pollution are considered to be substantial.

(d) Loss of Biodiversity

Pressures are being placed on Sri Lanka's rich biodiversity by the increasing demand for land for urban cultural and industrial development and the consequent reduction of extents under natural forest ecosystems, removal of materials/species from the wild, competition between invasive exotic/domestic species and indigenous species, lack of understanding of scientific management, pollution, undervaluation of biodiversity, the lack of awareness and the absence of inter - institutional coordination with regard to biodiversity. These pressures have led to the loss and degradation of natural ecosystems, loss of species and loss of genetic material (Fig. 10). Over 30 species of ferns and over 50 species of flowering plants, including 13 species of orchids are suspected of being extinct, while extinct animals include Gaur and Comb Duck and 13 species of snakes. Furthermore over 480 flowering plant species and 90 fern species have been assigned threatened status and among animals about 75 percent of

Fig. 10 Sri Lanka's Eco Systems



Vertebrate groups and about 50- 100 percent invertebrate groups are considered to be under threat.

(e) Depletion of Coastal Resources

Sri Lanka has a coastline of 1585 km and the coastal zone is defined as a 2km wide band of ocean and an adjoining strip of land extending 300 meters inland. Within this zone ecological processes of both land and maritime environments are interlinked and are influenced by human activities. The zone contains 32 percent of the total population, 90 percent of the industrial units and 80 percent of tourist infrastructure. The pressures created by the expanding population and human activities have led to the degradation and destruction of mangrove and coral reef ecosystems; expansion of non - living resource exploitation such as expressive sand mining, reduction in the fish stock; erosion of coastal areas salinization of paddy land and water pollution (Fig. 11).

3.2 LAND DEGRADATION, FOREST DEGRADATION AND DROUGHTS

3.2.1 Land Degradation

3.2.1.1 Types of Land Degradation

In Sri Lanka, major contributors to land degradation are soil erosion and soil fertility degradation. Over exploitation of ground water, salinization, water logging and water pollution are also becoming important contributors to land degradation. According to the Global Assessment of Soil Degradation (GLASOD), about 50 percent of land in Sri Lanka is degraded. The area affected by soil fertility decline is 61 percent of the total agricultural land.

Fig. 11 Coastal Erosion



(a) Soil Erosion

Soil erosion is a common problem in the entire country but it is more pronounced in the upper watershed areas of the hill country. According to recent estimates, the area affected by soil erosion in Sri Lanka is nearly 33 percent. A district wise break down, shows a vast difference in the extent of land affected by soil erosion, with the Colombo district reporting the lowest area of 2.3 percent and the Nuwara-Eliya district reporting the highest area of 58 percent. The most vulnerable districts are those in which a high proportion of land is used for cultivation of tea, tobacco, market gardens, and annual crops. Soil erosion is also severe in the rainfed highlands in the Dry Zone where *chena* cultivation is predominant.

Human activities such as cultivation of steep slopes, deforestation, burning of natural vegetation, construction of roads and buildings have been responsible for the major share of soil erosion. Reservoir sedimentation has already reduced reservoir capacity of some of our major reservoirs. High sediment yield from poorly managed market gardens is the main source of sediment.

(b) Soil Fertility Decline

Nearly 1.6 million ha of agricultural land in Sri Lanka is affected by soil fertility decline. Soil fertility decline is caused by soil erosion and excessive up take of nutrients by crops. Declining crop yields have been reported during the last two decades due to soil fertility degradation. Studies have shown that in the case of tea, the loss of 1 cm of topsoil cover is associated with a decline in yield of 44 kg/ha/yr, while in the case of rubber the decline in yield could be nearly 174 kg/ha/yr.

Though the soil fertility decline due to excessive uptake of nutrients by crops can be corrected to some extent by application of extra fertilizer the soil fertility decline due to loss of surface soil cannot be renewed easily. It is usually costly and will require considerable time and effort.

(c) Salinization and Water Logging

According to GLASOD estimates, the land degradation due to salinity is in the region of 2 percent (47,000 ha) of the total agricultural land area in Sri Lanka compared to 15 percent in Pakistan and 55 percent in Iran. A major proportion of the area is affected by coastal salinity (seawater intrusion). The area affected by inland salinity is quite insignificant. It is often associated with use of poor quality irrigation water, poor drainage and water logging. Inland salinity is more pronounced in Hambantota District especially when rivers flow at low discharge level.

Although salinity was expected to emerge as a serious problem in major irrigation projects, this has not happened, apparently because of the sloping topography and high intensity seasonal rainfall, which tend to flush out salts accumulated in the topsoil.

Salinity occurs in coastal areas mainly due to seawater intrusion. Seawater intrusion into inland areas through river outlets has increased over the past few decades due to the lowering of river water levels. The lowering of water levels occurs either due to reduced rainfall or storage of water by major reservoirs in the upstream areas.

(d) Excessive Ground Water Extraction

There are a few important ground water sources in Sri Lanka. The Karstic ground water resource found in the lime stone belt in the

Jaffna Peninsula has been exploited for agriculture for over 100 years. In this aquifer, a shallow lens of fresh water is found to float over the saline water. Therefore, pumping has to be done at a sustainable rate to prevent saline water entering into the well. However, due to over pumping some wells have developed high salinity rates in the past. It is also reported that there is widespread contamination of ground water due to agro chemical leaching and contamination of water by pit latrines.

Another source of ground water is in the North Western Province sandy coastal belt, where fresh water is found a few meters below the surface in the sandy aquifer. As the fresh rainwater is stored in the form of thin lens, side by side with seawater its exploitation has to be done very carefully. The intensive agriculture developed in the area over the last few decades has caused several problems due to over exploitation of ground water and over use of agro chemicals.

Ground water in the sap rock area in the North Central and Southern Provinces have been exposed to indiscriminate use over the past two decades. According to the estimates made by researchers, only 25 percent of total available ground water in the sap rock zone are available for abstraction. Fifty percent of the total storage needs to be kept as a buffer reserve to minimize environmental hazards. Depending on the availability of ground water, the average farm size per agro-well would be about 0.4 ha with 50 percent of water application efficiency. Hence for sustainable extraction, there can only be one well per 16 ha in potential ground water areas. However, the number of wells constructed in certain areas has surpassed the above threshold level threatening the sustainability of use of this important natural resource.

(e) Water Pollution

Leaching of excess agro-chemicals into streams and water bodies has increased the level of chemical substances in water. In intensively cultivated areas such as Kalpitiya and Nuwara Eliya, nitrate levels in ground water and spring water are in excess of World Health Organization (WHO) standards. Dumping of garbage into water bodies and disposal of household affluent into streams are also major contributory factors for water pollution.

Only 32 percent of the population is provided with pipe-borne water supply in Sri Lanka. The rest depends on surface water or ground water for their domestic water supply. The quality of water used through such sources is often subjected to high pollution due to unfavorable human interventions. In urban areas there is high organic pollution of water due to disposal of household affluent and in industrial areas there is pollution of surface and ground water due to industrial affluent. In major agricultural areas water is contaminated because of the high use of fertilizers and pesticides. In some of the intensively cultivated areas farmers use very high quantities of fertilizer very often in excess of the dosage recommended by the Department of Agriculture (DOA). In order to overcome this situation farmers are being advised to apply fertilizer based on a soil test of their cropland. Furthermore, Integrated Pest Management (IPM) is promoted in agricultural areas to reduce the consumption of agrochemicals.

3.2.1.2 Causes of Land Degradation

Causes of land degradation can be divided into two categories i.e; underlying causes and direct causes.

(a) Underlying Causes

(1) Lack of awareness on land degradation

Although the nature of the problem is well understood, the poverty stricken- resource poor farmers who cultivate fragile soils on the hill slopes and exploit ground water in the plains do not properly recognize its hazardous effects.

(2) High demand for agricultural land

Due to the lack of alternative income generating opportunities in other sectors in rural areas people tend to exploit marginal land for agriculture. Creation of opportunities in off- farm employment could probably reduce the pressure on land.

(3) Insecurity of tenure

Large numbers of people who use land without a proper title often do not take any interest in protecting the soil due to the uncertainty of the ownership. At the same time many land parcels are too small to make an investment on soil conservation. Despite this, land fragmentation is continuing due to increasing population in rural areas. The tenurial constraints have to be removed by providing permanent title to those lands, which are suitable for cultivation. People living on fragile lands have to be provided with alternate land or suitable off- farm employment.

(4) Drought and uncertainty of rainfall

Poverty stricken farmers in rain fed areas often do not have financial or other material resources to face droughts and uncertain rainfall.

Lack of resources has led to increased poverty and malnutrition and further land degradation.

(5) Policy failures

Various types of land users have misused the land, as there is no Land Use Policy. For example the cultivation of tobacco and potatoes on steep slopes has led to rapid land degradation. Hence land rights, crop insurance, rural credit, and the protection of critical areas needs urgent attention of the policy makers and related government organizations dealing with these subjects.

(6) Insufficient government commitment to mitigate land degradation

There is limited government commitment to conserve and improve the productivity of land. Implementation of land conservation activities is generally confined to a few small donor funded projects. Often, the process initiated by the projects could not be extended to other areas after the project period due to the non-availability of funds and the discontinuation of incentives offered to the extension staff and the farmers.

(7) Lack of a government mechanism to provide incentives

The resource poor farmers need to be compensated for additional labour and investment that has to be incurred in soil conservation. Perhaps the conservation measures that the up stream farmers implement also benefit the down stream beneficiaries who make use of irrigation water and hydropower. Hence, it is necessary to provide some incentives to encourage land users to undertake soil conservation measures. The down stream users should also bear part of this cost. Therefore, it is necessary to establish the proposed Environmental

Fund and the Soil Conservation Fund to provide necessary assistance to the land users.

(8) Inadequate capacity of government organizations to implement a systematic programme on conservation

The government organizations entrusted with the responsibility of managing land do not have adequate capacity to implement a national programme or enforce the laws to combat land degradation due to a shortage of physical and human resources. Therefore, institutional capacity building has emerged as a priority area.

(b) Direct Causes

In addition to underlying causes there are direct causes of land degradation. The more important of the direct causes are outlined below.

(1) Loss of forest cover

Over the last century, the country has lost most of its valuable forest cover. At present the area under the forest cover is less than 22 percent. Loss of forest cover exposes the soil to direct impact of rain, wind and sunshine. Soils on steep slopes as well as soils with poor soil structure are most vulnerable to erosion due to the removal of forest cover.

(2) Chena cultivation

Chena or shifting cultivation, which covers nearly 1.2 million ha of land throughout the country, produce about 80 percent of the rainfed grains. Chena cultivation is known for its devastating effects on the environment and loss of agricultural productivity, because

removal of forest cover without conservation efforts leads to soil erosion and soil fertility degradation (Fig. 12). As nearly 0.25 million families depend on chena cultivation for their livelihood, greater attention needs to be paid to develop suitable forms of rain fed farming.

(3) Cultivation of steep slopes without proper soil conservation measures

Land over 60 percent slope is generally considered unsuitable for agricultural purposes. However, a large extent of land exceeding this limit has been utilized by people for cultivation of crops such as tea, tobacco, vegetable, and potato in the hill country. Soil erosion on these steep slopes is very high particularly in areas with fragile soils and high rainfall erosivity (Fig. 13). Only level bench terraces could be recommended for such land but these are very expensive to construct. Such land should be ideally left for forestry and recreation.

(4) Land slides

According to the National Building Research Organization (NBRO), about 125,000 ha of land in the hill country are vulnerable to landslides (Fig. 14). Although landslides occur due to various reasons, soil erosion is one of the main reasons for the occurrence of landslides in the hill country. Landslides frequently occur during the rainy season in areas with steep slopes and high rainfall. Human activities such as deforestation and poor land uses have contributed to the increased incidence of landslides. There has been a marked increase in the occurrence of landslides in recent years. It was reported that there were only 34 cases of landslides prior to 1980; between 1980 and 1991 the number increased to 171.

Fig. 12 Abandoned "Chena" Land



Fig. 13 Soil Erosion on Steep Slopes



Fig. 14 Landslides



(5) Exposure of building sites and road cuttings

Exposure of soil in construction sites such as roads and buildings has been a major cause for silt transport and sedimentation. In some areas sediment load from construction sites has been much higher than the sediment load coming from agricultural areas.

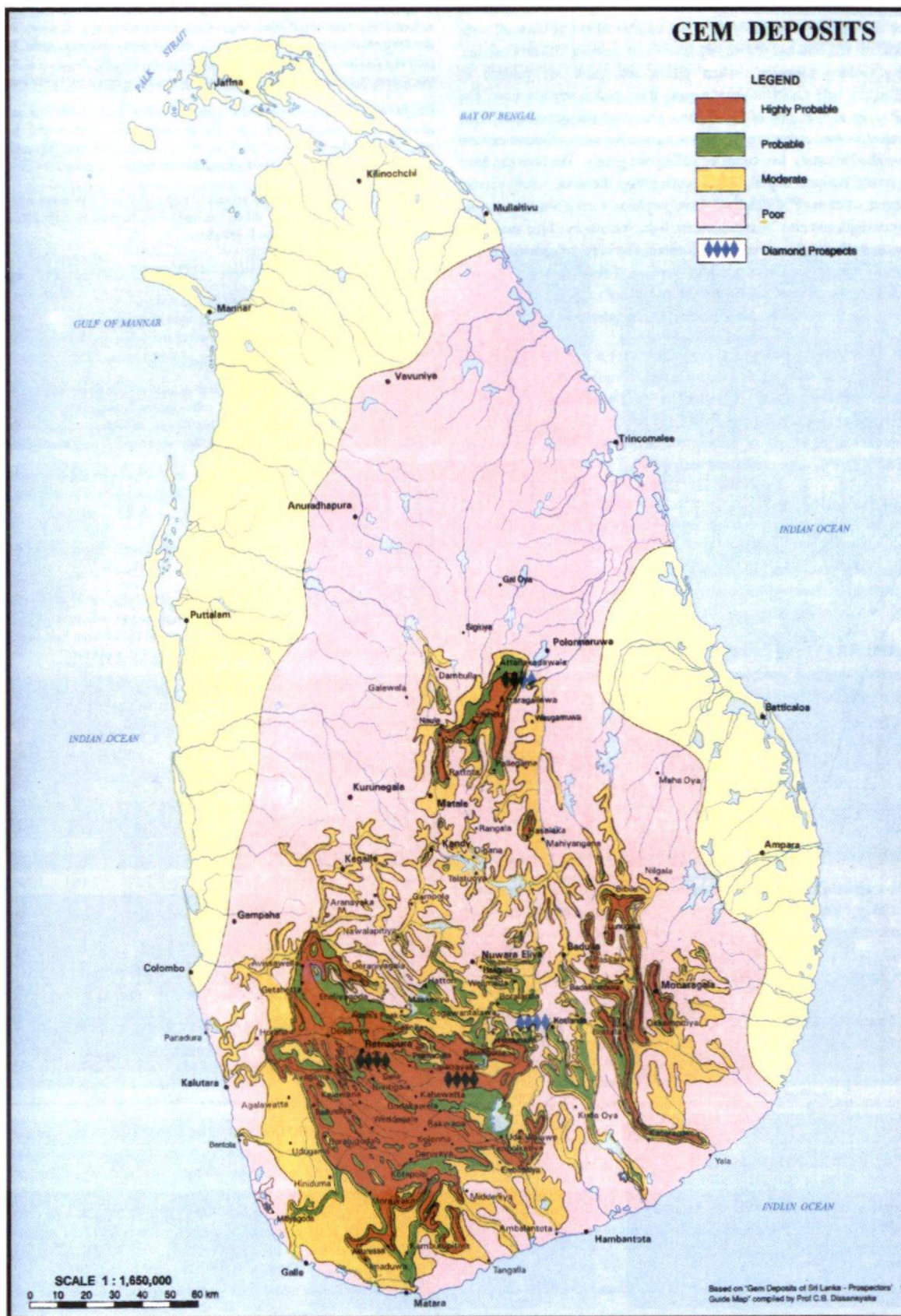
(6) Gem mining/ Clay mining

Gem mines and borrow pits constructed in the process of brick making have become a serious environment problem in the Wet Zone (Fig.15). These have become breeding grounds for mosquitoes. Though there are laws to control this menace they are not implemented properly. Gem miners are compelled by law to fill back the gem pits when they are not in use, but there is no legislation to control borrow pits constructed for brick making. It is worth examining whether some of these borrow pits could be converted to fishponds.

3.2.2 Deforestation and Degradation of Forests

The natural forest cover in the country which stood at 80 percent of the land area until the turn of the century had dwindled to less than 22.4 percent by 1999. The average annual rate of deforestation between 1956 and 1992 has been over 36,000ha. A part of the forest has been cleared legally for agricultural and land settlement schemes and other development projects and a part illegally for chena cultivation and for agriculture and settlement by encroachers. Despite efforts made by the government to safeguard the remaining natural forests, deforestation and degradation continue to be threats. The depletion has been taking place in different ways:

Fig. 15



Encroachments on Forest Reserves and Proposed Reserves administered by the Forest Department (FD):

According to the Conservator of Forests (CF), there have been nearly 6000 cases of encroachments on forest lands between 1995 and 1999. The extents taken over by these encroachers amounted to almost 2000 ha.

(1) Encroachments on the Other State Forests:

Acute land hunger and the availability of state owned land drive people to encroach on Other State Forests. According to the Land Commissioners' Department (LCD) approximately 13,000 encroachments have been regularized in different parts of the country between 1994 and 1998.

(2) Illicit felling of trees in forests :

Although a permit is required to obtain timber from forests, illicit felling of trees apparently takes place all the time. According to the CF nearly 7000 cases of illicit felling of trees was reported between 1995 and 1999.

(3) Utilization of forest lands for public development programmes:

The demand for land for different government programmes such as housing schemes, industrial parks and estates and agricultural settlement schemes have been met by excising lands from forests. The continuing deforestation despite the efforts being made to control the problem has severe implications for the environment, the welfare of the rural sector and the economy of the country.

In 1994, 7 percent of the land area in the country was covered with sparse forests, which comprised open forest and scrubs, regenerating chena and savannas. Nearly 95 percent of these forests were in the Dry

and Intermediate Zones. Within this area almost 85 percent of the extent under sparse forests was considered to be degraded largely because of chena cultivation, illicit cutting of trees and clearing of land illegally for settlement purposes.

3.2.3 Drought

Systematic and long- term monitoring of the meteorological parameters form an essential element in understanding the problem and status of droughts. In Sri Lanka recording of meteorological parameters in an organized manner was started in 1860s. The observations thus collected are available with the Department of Meteorology (DOM), which is responsible for providing meteorological services in the country. The present observation network comprises 22 Meteorological Surface Observation Stations (which conduct three-hourly observations on rainfall, temperature, pressure, wind etc,) 36 Agro-meteorological Stations, 4 Upper Air Stations, one Satellite Picture Receiving Station and one Cyclone Detection Radar Station. Apart from these there are nearly 400 rain gauges scattered throughout the country.

Trends and conditions of drought in Sri Lanka can be well understood by analyzing the long records of data (extending to over 100 years) available with the DOM. According to a rainfall analysis carried out under World Meteorological Organization/ United Nation Development Programme WMO/UNDP project in 1970s to cover the period 1876 to 1971 and later extended by the DOM to cover the period 1876 to 2001, it has been found that during this period at least one district was affected by drought in the "Yala" (April to August) during 90 seasons. During the same period the "Maha" (September to March) was affected by drought during 59 seasons. Further it has been found that except for Galle, Matara and Matale districts where probability of drought in "Yala" and "Maha" are equal (once in 5-10 years), all the other

districts are more likely to be affected by drought in "Yala" than in "Maha".

During the "Yala" season some of the districts in the Dry Zone (Mannar, Jaffna, Polonnaruwa) experience droughts on an average of once in 2-3 years. Districts such as Puttalam, Kilinochchi, Mullaitivu, Vavuniya, Anuradhapura, Trincomalee, Batticaloa and Hambantota are prone to drought during "Yala" on an average of once in 3-4 years. The Badulla, Ampara, Kurunegala and Monaragala districts are likely to be affected by "Yala" drought on an average of once in 4-5 years. In the case of "Maha" season, the frequency of droughts in districts which are most susceptible (Jaffna, Kilinochchi, Mullaitivu, Vavuniya, Batticaloa and Hambantota) is only once in 4-5 years.

The main cause for the non-occurrence of the seasonal rainfall is the anomalous changes in the global circulation pattern due to various changes that take place in the region or outside the region. El Nino Southern Oscillation which occurs once in few years is one such situation which disturb the general circulation pattern and in most cases resulting in less rainfall in Sri Lanka

4.0 MEASURES TO COMBAT LAND DEGRADATION AND MITIGATE THE EFFECTS OF DROUGHT

4.1 POLICY, STRATEGY AND LEGISLATIVE PROVISIONS

The government's concern towards environmental issues in general and particularly on land degradation has led to various policy initiatives, strategies, and legislation being developed to deal with issues pertaining to land management. On the whole there are a large number of policies, strategies and laws to provide the basis for implementing

the policy initiatives on land management. However, land degradation continues on a large scale, despite these initiatives.

4.1.1 Constitutional Obligations and Provisions

The firm commitment of the state for environmental conservation is shown in the 1978 Constitution of the Democratic Socialist Republic of Sri Lanka, through Article 27 (14), which decrees; "the state shall protect, preserve and improve the environment for the benefit of the community." Article 28f also states, "the exercise and engagement of rights and freedom is inseparable from the performance of duties and obligations, and accordingly, it is the duty of every person in Sri Lanka to protect nature and conserve its riches". These provisions however, are not stated in the chapter on fundamental rights, and are not legally binding.

The role of the State in meeting the objectives is spelt out in Section 8 of the National Environmental Act (NEA) of 1980 and the agenda for sustainable development is clearly outlined in the National Environmental Action Plan (NEAP) prepared every five years.

The 13th Amendment to the Constitution of Sri Lanka in 1987 introduced the Provincial Councils as a new level of governance between the Central Government and local level. Since then, the Government policy has been to decentralize and devolve many functions held by the Central Government to the Provinces. The Provincial Councils have been empowered with legislative powers over several areas including the environment, and for handling intra-provincial projects in areas such as irrigation, land development and agriculture.

4.1.2 Policies and Strategies Formulated

The land policy of the country has been examined by successive, Land Commissions established in 1927, 1955, and 1985. However, one of the very first to discuss land related issues and propose action for resolving them is the National Conservation Strategy of 1988. The strategy recommended that a separate national organization be established for land use planning, the adoption of remedial measures to control soil erosion and the replacement of the Soil Conservation Act by a "Land use, soil and water conservation Act". The National Agriculture, Food and Nutrition Strategy of 1984, National Policy Framework- Ministry of Agriculture, Lands and Forestry of 1995, National Forestry Policy of 1995, National Wildlife Conservation Policy of 2000, and the National Physical Planning Policy of 2002 are also important, as they provide direction and recommend measures towards restoring degraded land and the means for increasing land productivity through efficient utilization of land resources. The National Agricultural Policy and Strategy Framework, 2001- 2005 though not directly linked to land degradation, intends to set the agenda and strategic direction, for the development of the food and agriculture sector for a five-year period.

In addition to these initiatives, there are many draft policies relating to environment and land use that would assist in combating land degradation issues in the country. Among these policies the draft National Environmental Policy (NEP) of 2002 the draft Land Use Policy (LUP) of 2002 and the draft Watershed Management Policy of 2001 are considered important in the context of resolving land degradation issues in the country.

The draft NEP intends to provide direction and guidance for environment and natural resources management in the country. It recognizes the importance of land as a means of sustaining other

natural resources and the people. The policy statement on land states that "land resources will be managed to maintain and enhance their quality, productivity and life supporting capacity to protect their ability to support a variety of land use options".

Despite many initiatives, the absence of a coherent Land Use Policy has been cited as a major obstacle to effective land management. A draft policy is now in place, which declares that land belongs to the people and that the role of the state will be that of a facilitator. The policy emphasizes the need for an integrated approach to land management. The policy is quite comprehensive and when implemented would have a great impact on land resources management and in resolving land degradation problems in the country.

A draft Watershed Management Policy (2002), which addresses among other aspects soil erosion in hilly areas, advocates the rehabilitation of already degraded land in the upper watersheds through conservation farming and the adoption of appropriate soil conservation measures with people's participation.

The policies and strategies were intended to deal with issues relating to land degradation, some directly and others indirectly. However, one common weakness in many of these initiatives was the delay in implementing them. By the time they were implemented the envisaged results were only partly effective. Furthermore some of these policies were not implemented at all due to various reasons, such as the non-availability of legal instruments, resources etc. Most of these policies also lacked some essential elements specifically required for combating land degradation. Some economic policies have also had detrimental effects. For example the incentives for conservation of private lands are meager, and there are pervasive subsidies (e.g. fertilizer subsidies) that promote land exploitation and pollution.

In addition, the policy followed by successive governments in respect of encroachment has also had a negative impact on land management in the country. Although encroachment is an offence and the encroacher has to be evicted, regularization of encroachments has taken place from time to time. This policy has only encouraged more encroachments on environmentally sensitive land, contributing to increased land degradation in the country. There is a need for a clear political commitment to address the issue, in line with other policies and laws on land management.

4.1.3 Legislative Framework

At present there is no one single statute pertaining to the management of land in the country. Legal provisions pertaining to the protection and sustainable utilization of land resources are contained in about 13 major enactments and these are enforced by a number of agencies.

The problem of soil erosion has been addressed partly by incorporating environmental safeguards in legislative enactment pertaining to land and water resources management and partly by introducing legislation directed towards the prevention or mitigation of soil erosion. The management, administration and alienation of land that come under the control of the State are mainly governed by the Land Development Ordinance of 1935, the State Lands Ordinance of 1947 and the Land Grants (special Provisions) Act of 1979. All these enactments contain provisions to address soil erosion issues. These Acts also contain provision for the protection of environmentally sensitive areas such as disposition of land over 1500 meters, protection of conservation areas, preservation of reservoirs, and the prevention of encroachments on State land.

The major legal provision to combat land degradation was introduced by the Soil Conservation Act (SCA) of 1951, which was designed to

"make provision for the conservation of soil resources, for the prevention or mitigation of soil erosion and for the protection of land against damage by floods and drought". However, due to institutional and functional deficiencies the Act could not be effectively implemented and after fifty years it was amended in 1996 with provision for the establishment of a Soil Conservation Board and a Soil Conservation Fund. This Board is expected to coordinate activities; research and programmes to prevent soil erosion on both agricultural and non-agricultural lands and to rehabilitate already degraded lands. However, the Board lacks representation from the private and the plantation sectors and this is considered a deficiency in the effective functioning of the Board. The regulations to implement the amendments have now being drafted.

In addition to the above Acts, the Water Resources Board Act of 1964, the Agrarian Services Act of 1979, and the Mahaweli Authority of Sri Lanka Act of 1979, can also be considered as important pieces of legislation to assist in the prevention of land degradation in the country.

Environmental management on public lands has generally been weak. However, Environmental Impact Assessment (EIA) introduced by the government covers some aspects of public land management. EIA's are required for the removal of forest cover for conversion to other land uses on extents of land of over 1 hectares, clearing of land areas over 50 hectares, conversion of wetlands of more than 4 hectares; and the extraction of timber on lands over 5 hectares. In addition, any projects not listed under the EIA regulations, but located within 100 meters of any forest reserve, or wildlife sanctuary requires approval under the NEA and is subject to an EIA. EIA's also cover other environmental issues such as soil erosion and water pollution. Although these regulations do not address the issue as a whole, they nevertheless contribute towards minimizing land degradation.

The protection of forests and ensuring an adequate tree cover are important aspects in the prevention of land degradation. The Forest Ordinance of 1907, the Fauna and Flora Protection Ordinance of 1937, and the National Heritage Wilderness Act of 1988 have been enacted to meet these purposes. Although the forest cover has been diminishing with the increase of population, Sri Lanka has nonetheless been able to slow down the depletion of forest in recent years.

Despite the many laws to prevent land degradation, agricultural land is being increasingly degraded due in part to the inability to effectively implement the laws as envisaged. There is no shared responsibility to implement these laws and the lack of co-ordination among the different agencies is often cited as one main factor hindering proper land management in the country. The lack of capacity and resources for implementation are also major contributory factors.

It is well understood that laws alone cannot resolve the problems. It is important that all parties concerned are educated and awareness is created, so that they can effectively contribute in dealing with the issues concerned. The command and control approach adopted in these laws are outdated and not applicable in the present day context. In fact this approach has not been very successful. What is required for successful implementation is active stakeholder participation.

4.2 TECHNOLOGIES

4.2.1 Technologies for Controlling Land Degradation

4.2.1.1 Traditional Technologies

(a) Water harvesting by village tank systems in the dry zone

The village tank system in the dry zone of Sri Lanka is a unique system of water harvesting and soil conservation. Village tanks are a series of small reservoirs built by making embankments across rivulets, which are either perennial or non-perennial streams. This is commonly referred to as the minor tank cascade system. Due to their geographical location the system has the capacity to catch spill water from upstream reservoirs in addition to the run-off collected from its watershed area. The ancient rulers made it mandatory by law for each farmer to give his labour free to de-silt the tank bed and use the silt to mend the tank bund. The cascade tank system also enriched the ground water levels in the vicinity of the tank where the village is located and this became a sustainable source of water for the villagers. The watershed was composed of protected forests, where people were allowed to harvest only firewood. This part of the watershed was reserved for soil and water conservation.

(b) Cultivation of tree species in river and stream banks

Several species of trees such as Arecanut (*Areca catechu*), Kitul (*Caryota urens*), Bamboo (*Bambusa vulgaris*), Kumbuk (*Terminalia arjuna*) have been grown along the stream banks to conserve the stream banks. These trees produced timber and firewood required by the villagers. Systematic harvesting of these tree species also provided sustainable protection to the land and yielded some useful products.

These tree species were also used as hedges to protect steep slopes from soil erosion.

(c) Stone bunds and log barriers

Stone bunds and log barriers have been traditionally used by people to protect highland crop areas from soil erosion.

(d) Hedgerows

Pawatta (*Pometia indica*), and Pila (*Tephrosia purpurea*) have been used intensively in Jaffna Peninsula to protect the home gardens against wind erosion. In the wet zone these tree species are used in fences for soil conservation and for protection from wild animals.

Savandara (*Vetivaria zizanioides*) and, sera (*Cymbopogon citratus*) are grown as hedgerows to protect soil from sheet erosion.

(e) Kandyan Home Gardens

These are also called Kandyan Forest Gardens. In these home gardens a variety of trees including fruit trees, jak, coffee, arecanut, Kitul, nutmeg, pepper, cocoa, banana, root crops of different heights (canopy layers) are allowed to grow under natural competition for sunlight. Due to natural competition for light the trees eventually form a canopy structure that maximizes the utilization of sunlight and land and minimizes soil erosion. The Jak (*Artocarpus integrifolia*), Kitul (*Caryota urens*), Arecanut, and other tall trees form the upper canopy, the nutmeg, pepper, coffee, banana form the middle canopy and the shrubs, and root crops form the lower canopy.

(f) Use of Palmyra leaf fences

Palmyra leaves are used for fencing of home gardens in Jaffna to provide protection from wind.

(g) Terraced paddy fields

Level terraces constructed on steep hill slopes is a mechanical soil conservation measure adopted in Sri Lanka for a long period, with the terraced paddy fields in the hill country area going back to the period before 161 B.C. The contour canals taking off from adjoining streams provided irrigation water for these level paddy fields. The water diverted not only met the water requirement of crops but also ensured the perennial flow of streams and rivers. Terraced paddy fields also trap the sediment carried with the surface flow thereby improving the soil fertility.

(h) Use of Bio fertilizer

Use of bio-fertilizer has been a traditional practice followed by many rural farmers to increase the soil fertility, soil aggregate stability, water infiltration and soil water holding capacity. This is probably the most environmental friendly, cost- effective and low cost system that can be adopted by local communities.

4.2.1.2 New Technologies

(a) Mechanical Measures

Mechanical measures act as barriers to overland flow of water and reduce the velocity of the flow to a non-erosive level. This allows much of the water to infiltrate into the soil. Mechanical measures such

as contour platforms level bench terraces, stone terraces, contour drains and contour bunds have been successfully practiced in tea, and rubber plantations for the past four decades. The mechanical measures adapted in the Low Country Dry Zone areas consists of contour earth bunds, graded or level bench terraces and lock and spill drains. In the Low Country Wet Zone, stone terraces and lock and spill drains perform well. In the hill country (Wet and Inter-mediate Zones), contour stone terraces, and contour drains are performing well.

(1) Terracing

Terracing is probably the oldest system of soil conservation adopted in Sri Lanka. On hilly slopes where an abundant supply of water is available from springs and streams people have leveled land into narrow strips along the contour to facilitate irrigation water application. These are referred to as contour terraces. The width of the terrace depends on the steepness of the slope and the depth of the soil. Such leveled terraces have been utilized to grow irrigated rice. In recent times terracing has been adopted even for the cultivation of highland crops and tree crops.

(2) Stone walls

Where stone is found in abundance, erection of narrow strips of stone walls across the slope has served as a good soil conservation measure. The stone walls generally have a width of 50 cm and a height of about 45 cm above the ground on the upper side of the wall. The wall is constructed on a foundation, which is at least 15 cm deep. The distance between two stone walls is dependent on the slope of the land. On the average they are constructed at a spacing of about 5-10 meters.

(3) Lock and spill drains

Lock and spill drains are so named because there is a block of earth retained every 4-5 meters within the drain to create a pool of water in the drain. Water starts to flow from one section to another only when that section is full. These drains are constructed either on the contour or slightly off the contour with a mild gradient. The drain is about 50 cm wide and 60 cm deep. The blocks are about 45 cm long and few centimeters lower than the depth of the drain. The major advantage of a lock and spill drain is its capacity to allow more water intake into the soil.

The lock and spill drains have generally been constructed on sloping land where stone is not available on site for the construction of stone walls. However even in places where stones are abundantly available lock and spill drains are better suited as they allow more water into the soil. This system is not used in areas prone to land slides, and on land with high stoniness. It is more popular on gently sloping land with deep soils.

(b) Biological Measures

Biological measures include systems such as avenue cropping (alley cropping), and Sloping Agricultural Land Technology (SALT). These measures have been adopted to mitigate soil erosion and to improve soil fertility. Selection of appropriate methods has been based on crop, soil, agro-ecological conditions and economic viability. The spacing is similar to mechanical measures.

(1) Avenue Cropping

Traditionally people have used hedgerows along the boundaries of land to serve two purposes. Firstly, to serve as a boundary demarcation and secondly to protect the land from erosion. They have generally used tree species such as *Gliricidia* and *Pawatta* (*Agal adara*) for these purposes. The name *Agal adara* means the tree that protects the precipice. The scientific application of hedgerow system was initiated in the early 1950s, as a conservation farming system at Mahailuppallama Agricultural Research Station, and later the technology was adopted successfully in farmers fields. The system has been identified as Avenue Cropping or Alley Cropping where crops were planted between leguminous trees planted on the contour.

(2) Sloping Agricultural Land Technology (SALT) System

Sloping Agricultural Land Technology (SALT) was introduced to Sri Lanka in the late eighties. It is a system similar to Avenue Cropping that has been recommended especially for sloping agricultural lands. Hedgerows of tree species (usually legumes) are established on the contour in place of stone walls or lock and spill drains. The spacing is similar to mechanical measures, with hedgerows being established as single rows or as closely spaced double rows. The tree species used are *Gliriceedia*, *Pawatta*, Wild Sun Flower, *Desmodium*, *Flamingia*, *Erabadu* etc. The legumes are usually preferred as they have the capacity to enrich soil by fixation of atmospheric nitrogen and to produce more organic matter.

The system needs regular maintenance for it to be successful. Cost is much less than mechanical soil conservation measures.

(c) Agronomic Measures

Agronomic practices provide effective conservation of soil nutrients and moisture when adopted in conjunction with other mechanical and biological soil conservation measures. Most of the agronomic measures are practiced along with normal cultivation practices, as they need only little additional labour for their successful implementation. Furthermore the technology is very simple and easily practiced by any farmer

(1) Mulching

Mulching is a practice where either live or dead plant material is applied as a soil cover in between crops. The mulch so placed has the capacity to protect soil surface from raindrop splash and retard the velocity of surface run-off. It also reduces the evaporation from the soil surface and conserve moisture. Later the plant material decomposes and adds organic matter and other soil nutrients to the soil.

(2) Strip Cropping

Under this system alternate strips of crops are established on the contour. Tall and short crops are established in alternate strips. As the tall crops with lesser canopy has the tendency to expose soil for high erosion the short canopy crops have the capacity to protect the soil from splash erosion. Much of the soil that is eroded from the high canopy crop strip is retained in the short canopy crop strip. This system does not demand too much of additional labour from the farmer.

(3) Contour Planting

Contour planting has been widely adopted for plantation crops such as tea, rubber and coconut. The system was not adopted on tea plantations in the early days, but has become a common practice now. Planting of annual crops on the contour has become more popular with the introduction of agricultural machinery for land preparation and other agricultural operations.

(4) Bio-technology/ Bio-fertilizer

Chemical fertilizer is generally expensive to the farmer. However the use of bio-fertilizers which are natural fertilizers, with microbial inoculates, such as, bacteria, algae and fungi individually or in combination are being promoted for the cultivation of rice and other field crops.

4.2.2 Technologies for Restoring Degraded Forests

A number of strategies have been adopted over the years by the FD to recover vegetation on degraded forest lands. The strategies fall into three broad categories i.e. Natural regeneration, restoration and replacement.

(a) Natural Regeneration

Under this system the FD encourages the establishment of hermitage forests. This is done by issuing permits for small extents of natural forest at a nominal fee to Buddhist monks to be developed as centres of meditation.

(b) Restoration

Several silvicultural systems have been adopted to restore degraded forests. These include:

(1) Selection system:

Under this system there is selective removal of some of the products such as wood, wildlife and fruit in order to allow some type of natural or induced tree regeneration to occur without further manipulation or enrichment.

(2) Line planting:

The method was initially practiced in the Wet Zone degraded forests using Mahogany and was later extended to the Dry Zone for the restoration of abandoned chena lands using local species.

(3) Enrichment planting:

Desirable species are planted in the logged forests and in the gaps provided by falling trees, logging tracks etc. to promote the development of a self-sustained multi species forest.

(4) Establishment of Forest Gardens:

These are established by issuing permits to those who have encroached on forested land and developed home gardens. The occupants are given secure title to the land and permitted to cultivate their lands subjected to certain land use restrictions.

(c) Replacement

The replacement approach, which is the most popular, is the conversion of species rich forests into species poor ecosystems mainly through forest plantations. Under the "Taungya" system, native or exotic tree species are planted along with annual crops. The field is abandoned after 2 or 3 years and the planted trees protected and the plot allowed developing into a forest plantation. The most popular species planted are teak, *Eucalyptus grandis*, Pine and Mahogany.

In the Wet Zone under planting is also done in rainforest areas. The forest is planted twice. During the initial phase a nurse crop is introduced and after a prescribed period other recommended species are introduced depending on site conditions.

4.2.3 Technologies for Mitigating the Effects of Drought

Technologies adopted for mitigating the effects of droughts fall into three broad categories:

(a) Agronomic measures

(1) The measures to mitigate the effects of droughts are taken depending on whether the deficit of rainfall occurs during the early, middle or latter part of the normal rainy season. In the case of early season drought, the measures adopted to mitigate the effects include transplantation, changing to drought tolerant crops and selection of short-term varieties. The mid-season drought is generally met by reducing the leaf area or by adopting measures like mulching and

keeping the field free of weeds. To manage late season drought priority is given to the flowering and grain filling stage crops when issuing limited available water.

(2) Incorporation of organic matter and green manure in the soil.

This is practiced to increase the water holding capacity of the soil.

(b) Engineering measures

(1) Rotational issue of irrigation water

This is done according to a pre- determined plan by which water is issued to selected blocks of land on a rotational basis.

(2) Drip and sprinkler irrigation

These systems which have high water application efficiency, are generally used in situations where irrigation water is scarce.

(3) Dry land preparation

This is usually undertaken when farmers expect in a delay in filling of small tanks leading to a delay in the issuing of water. The procedure is to plough the land with the first rain (in September) so that the sowing can be done with subsequent (October) rains.

(4) Rainwater harvesting

Rainwater harvesting practices are predominantly in existence in the Dry Zone where the other water supply options are very limited. People in the drought prone areas adopt number of different traditional practices for rain water harvesting.

(i) Collection of rainwater falling on the roofs.

The rain water falling on the roof is directed to a tank or dug well through a conveyance system such as roof gutters and down pipes. Depending on the capacity of the tanks some manage to preserve and use the water thus collected even up to 6 months. During dry period the water is preserved for cooking and other basic hygienic requirements, but during the rainy seasons the system is extended to bathing and washing.

In the case where water is diverted to dug wells the depth of the wells are limited to 2 - 3 m, to ensure the bottom of the well is above the shallow ground water table to avoid salinity intrusion into the wells. With increased storage this type of storage system can provide required water for a considerable length of time.

(ii) Collection of rain water directly into containers kept on a platform

In fishing villages in the North - Western coastal region of the country, platforms are used for the drying of fish. During rainy seasons containers are kept on these platforms to collect rain water for daily

use. Compared to water collected from roofs, the quality of water collected through this system is far better.

(iii) Collection of rain water through a cloth

This is a basic indigenous system where in an open area, a fairly large piece of cloth is attached to four poles and provision made for rain water to drain into a container kept underneath. The quality of the water so collected is good.

Steps have been taken through the intervention of government agencies and non-government organization to improve and popularize rain water harvesting at domestic level in villages in the Dry and Intermediate Zones. One such project was implemented through the Community Water Supply and Sanitation Project (CWSSP) in Badulla district in a village called Dematawelihinna. In this case financial assistance is provided for the villagers to construct storage tanks and to improve the roof water conveyance system. This model project was very successful and within few years it was extended to other districts and more than 5000 such units has been constructed and are in use (Table 1). Since this programme is proven to be very successful it is planned to expand this programme as an UNCCD activity.

Table 1: Number of rain water storage tanks constructed in each district by different agencies..

District	No. of storage tanks	Financing agency
Kandy	85	NWSDB
Badulla	3500	CWSSP
Matara	50	CWSSP
Hambantota	600	SDA
Puttalam	04	LRWHF
Monaragala	400	SDA
Kurunegala	500	GTZ

(NWSDB-National Water Supplies and Drainage Board. CWSSP- Community Water Supplies and Sanitation Project. SDA-Southern Development Authority. LRWHF- Lanka Rain Water Harvesting Forum. GTZ- German Technical Cooperation)

(c) Early warnings

Though long-range weather forecast are still not possible due to complexity of the parameters involved in the behaviour of the seasonal circulation pattern and the rainmaking processes, short range (24-48hours) and medium range (3-10days) forecasts with reasonable accuracy are issued by the DOM. Steps need to be taken to improve the monitoring and data processing facilities and the long range forecasting capabilities of the DOM.

4.3. PLANNING, INSTITUTIONAL FRAMEWORK AND PROGRAMMES

4.3.1 Planning

The responses of the state in dealing with land degradation issues in the country are reflected in the plans developed to cover areas such as environment, forestry, biodiversity, coastal, water, agriculture and disaster management. These planning exercises have translated into

action the various policies pertaining to land management and have addressed land degradation issues in detail. The Forestry Sector Master Plan of 1995 emphasizes on forest management, soil and water conservation, conservation of environmentally sensitive areas and peoples participation in forestry development activities. The Coastal Zone Management Plan of 1997 outlines interventions to reduce coastal erosion, minimize depletion and degradation of coastal habitats. The Biodiversity Conservation Action Plan of 1998 outlines the principles in biodiversity conservation, and includes proposed action in areas such as forests, wetlands, coastal and marine areas and agricultural systems. The National Disaster Management Action Plan of 1999 provides for effective disaster management, which includes preparedness, response, and recovery.

The first comprehensive plan to address all environmental concerns was the NEAP which was first prepared in 1992 and has been updated twice since then. The current update, which will cover the period 2001-2006, gives priority among others towards resolving land degradation issues in the country. It recommends legislative and institutional support, and provincial level interventions in resolving land degradation.

A National Agricultural Research Plan was prepared in 1988 with the intention of promoting agricultural sustainability and increasing efficiency in food production. This was followed by a second plan, which covered the period 2000-2008. This plan has proposed many research initiatives that would promote sustainable agriculture in the country. In addition a National Physical Planning Policy has been prepared and is awaiting government approval.

A major deficiency in the planning exercises carried out so far, is that they have not adopted an integrated approach. All natural resources sectors have strong biological as well as socio-economic links, which need to be considered in land management. The recent ADB assisted

Technical Assistance Programme on Sustainable Natural Resources Management and Development, emphasizes the need to follow an integrated approach in land resources management, has highlighted this aspect as a priority area

4.3.2 Institutional Framework

4.3.2.1. National Level

(a) Institutions

There are a host of state agencies involved in the management of state lands. Primary responsibility for state land is vested with the Land Commissioner, who exercises powers, vested in him under the State Lands Ordinance, the Land Development Ordinance, and the Land Settlement Ordinance. The powers of the functions of the Land Commissioner are exercised through delegation, to the Divisional Secretaries and District Secretaries.

The task of land management is shared by a number of state institutions and non-state institutions including the private sector and non-governmental agencies. The main institutions dealing with land are the Land Commissioners Department, the Land Settlement Department and the Land Reform Commission. In addition, there are about nine Ministries dealing with matters related to land, water, forestry and agriculture. Of these three Ministries deal with the subject of water. At the provincial level several agencies deal with land related subjects while these subjects are handled by the Pradeshia Sabhas at the local level.

Other key national level institutions that deal with land related issues are the Department of Agriculture(DOA), Forest Department(FD), Department of Wildlife Conservation (DWLC), Central Environmental

Authority (CEA), National Water Supply and Drainage Board (NWDB), Tea, Rubber and Coconut Research Institutes, the Natural Resources Management Centre (NRMC) of the Department of Agriculture, National Building Research Organization, Agrarian Services Department, and the Land Use Division of the Irrigation Department. These institutions amongst other things are involved in research, development, and implementation of activities related to the rehabilitation of degraded land. The public has the right to participate in environmental decision making under the NEA. Having recognized this fact, a separate division has been established in the Ministry in charge of Environment and in the CEA.

The Land Use Policy Planning Division (LUPPD) was established in 1979, to promote systematic land use planning in the country. However, the widespread misuse of land, accelerated land degradation, Deforestation and the slow adoption of land use planning seem to indicate that the early efforts to reduce land degradation have not been entirely successful.

There are a number of other institutions dealing with land use planning. The newly created National Physical Planning Department is empowered to carry out land use planning and zoning throughout the country. The Urban Development Authority (UDA) has the power to engage in the preparation of development plans for areas declared for urban development under the UDA Act. The National Disaster Management Centre within the Ministry of Social Services has been established to enable the management of natural disasters more efficiently.

Universities usually undertake training. All of the main Universities in the country are involved in conducting education programmes in natural resources management and research and capacity building to deal with issues related to land management in the country.

The Council for Agricultural Research Policy (CARP) facilitates the coordination of agricultural research undertaken by various Ministries and institutions and sets policies and priorities in this sphere. However research studies on aspects related to land degradation financed by CARP are limited.

Co-ordinating Mechanisms

Most of the natural resources sectors have steering committees, coordinating committees, advisory bodies or expert committees that are intended to obtain technical inputs and also the participation of all those concerned in land management activities. Such important committees include, the Forestry Sector Steering Committee, National Committee for Organic Product Promotion, National Coordinating Committee on Climate Change, and the EIA Coordinating Committee.

An important forum for political leaders to discuss environmental matters and take decisions to resolve such the issues at local level is the Parliamentary Consultative Committee on Environment chaired by the Hon Ministry in charge of environment. Members of the opposition are also included in the committee.

The Committees on Environment Policy and Management (CEPOM) established in 1999 is one of the major coordinating mechanisms, aimed at integrating environment concerns into the development agenda at the national level. There are six CEPOM and the CEPOM on land, covers agriculture, mining and plantations as well. In addition the Committee on Integrating Environment and Development (CIEDP), is meant to assist the CEPOMs in important and complex policy decisions related to the environment.

The National Expert Committee on Land Degradation and Drought was set up to advise the government on matters relating to land degradation

and droughts including, the implementation of the UN Convention to Combat Desertification. The committee, which comprises of experts on land resources, state sector officials and representatives of NGOs, is expected to provide guidance and direction in resolving land degradation issues in a comprehensive manner.

A major drawback today is the lack of coordination between these committees. This has inevitably led to duplications and contradictions in the decisions made and activities carried out. The CEPOM and CIEDP mechanisms referred to above are expected to resolve these issues and provide a basis for coordination among the sector agencies concerned

4.3.2.2 Regional Level/ Provincial Level

Although there are coordination mechanisms at the national level, which are fairly well established, there are no formalized coordination mechanisms between the national level agencies and the provincial and local level agencies to discuss environmental related issues. Meetings and discussions for this purpose are held between the Ministries and provincial agencies on matters of interest from time to time depending on the urgency.

At the provincial level there are a large number of coordination committees to deal with subjects such as forestry, environment, planning, and for monitoring purposes. At the provincial level there are the Provincial Planning Steering Committee (PPSC) and the Provincial Environmental Committee. At the district level there are district level committees such as the District Law Enforcement Committee (DELEC) and the District Coordinating Committee (DCC). At the Divisional Level there are the Divisional Coordinating Committee (DICC), Divisional Environmental Steering Committee and the Divisional Timber Committee. In addition there are Local Authority Level committees such as Environmental Protection

Committee (EPC), and the Local Authority Planning Committee. Issues relating to a particular subject are discussed at these meetings and they are usually resolved. If more clarity is needed on an issue, it is generally referred to the national level agency concerned.

4.3.2.3. Local Level

In order to obtain the maximum benefits of participation in soil conservation efforts, it is necessary that all stakeholders are involved in the planning of such activities and in their implementation and evaluation. Over the years efforts have been made by the government to promote participatory processes in land management. Most of the policies formulated and plans prepared have paid particular attention to this factor as a means of increasing performance, when implementing various conservation oriented activities.

Community participation in policy and planning activities has been very marginal to date. On the other hand communities have become increasingly involved in implementation activities. This process was initiated with the Rural Development Societies and NGOs like the *Sarvodaya*, which organized communities to participate in the development activities at village level. The activities covered by the NGO's and CBO's have diversified over the years. In recent years natural resource management aspects have also been included.

Opportunities for the NGOs and CBOs to get involved in the planning and designing of projects and in implementing them have been provided by projects funded by donor agencies. In recent years capacity building in project preparation and implementation has been undertaken and this has enabled communities to get involved in project design guided by government officials. In some instances legislation has also been formulated with stakeholder participation, in order to ensure effective implementation.

National agencies have at all times provided support for capacity building through training, so that community groups could take over the added responsibilities. Many projects have also provided training to community groups, NGOs and farmers.

The involvement of schools in environmental activities has increased over the years. The Environmental Brigades formed in schools around the country are made aware of environmental problems; provided with opportunities to carry out environmental projects and; made to participate in competitions aimed at increasing their knowledge on environmental aspects. It is expected that capacity building and awareness creation at a younger age will enhance their role in environmental management in the future.

Recently divisional Environmental Officers have been appointed to each Divisional Secretariat by the CEA. This is an important step in linking the local level with the national level and also in ensuring environmental protection.

As a part of crop management, the private sector has adopted soil conservation and improvement measures, and some initiatives have been taken in watershed protection and reforestation activities. The Ceylon Tobacco Company for example has been very successful in promoting SALT among farmers involved in tobacco cultivation. This has been mainly due to the control exercised by the company over the crop produced.

There are moves to set up a networking with the provinces that would link up the local and community groups in environmental management. This is expected to resolve the issues of coordination between the national, provincial and local level agencies. It also represents a part of the efforts to develop an environmental management framework for

the provincial agencies, where the roles, responsibilities and jurisdiction of the agencies in environmental management can be defined and agreed upon.

5.0 NATIONAL ACTION PROGRAMME

5.1 PROCESS AND PARTICIPATION

Sri Lanka has signed and ratified the Convention to Combat Land Degradation (UNCCD) in 1995 and 1998 respectively. The Ministry in-charge of the subject of Environment (Ministry of Environment and Natural Resources) is the national focal point of the UNCCD and has a responsibility to coordinate and formulate policies and facilitate policy implementation to fulfill the requirements of the Convention. According to the article 9, 10 & 11, each contracting party should formulate the National Action Programme to combat land degradation and to mitigate the effect of drought.

The process of formulating the National Action Programme was initiated by the then Ministry of Environment and Forestry in 2000, with the preparation of a National Status Report on Land Degradation (Implementation of the Convention to Combat Desertification in Sri Lanka-2000). Subsequently a National Experts Committee on Land Degradation and Drought (NEC) was appointed to advise the Ministry on matters relating to land degradation and droughts in Sri Lanka including the implementation of the UNCCD. The NEC held several meetings and one of the issues discussed was the process of formulating the NAP.

During the second half of 2001 the Ministry of Environment and Forestry identified nearly 50 resource persons/experts drawn from Universities and other key Departments and Institutions to prepare a series of position papers on fields related to land degradation and

droughts. The objective was to involve the participation of more experts in the NAP formulation process and to build up the necessary information base. As a prelude to this a two- day workshop was held in December 2001 to discuss the status of land degradation and drought and to identify the issues to be addressed in the NAP.

The second National Status Report on Land Degradation was prepared in early 2002 and a one- day workshop was held in April 2002 to discuss and to receive comments. The report was finalized in June 2002.

After receiving fair number of position papers from the resource persons/ experts, a workshop was held in June 2002 to review and to entrust the formulation of the NAP to a team of consultants. The consultants commenced work on the preparation of the plan in July 2002. The preliminary draft that has been prepared is based on position papers and valuable information and suggestions contributed by a number of institutions and individuals.

The preliminary draft was presented to a group of experts for their observations and comments at a workshop held on 14th October 2002. The recommendations made by them have been incorporated in the revised draft.

5.2 GOALS AND OBJECTIVES

The goal of the NAP is the sustainable management of land resources for the well being of the people and the economy.

The objective of the NAP is to reduce land degradation and mitigate the effect of drought with the participation of affected communities, Public Sector Agencies, CBO's, NGOs, and the Private Sector. More specifically the NAP will:

1. Address all causes of land degradation and drought and identify measures to combat land degradation and mitigate the impact of drought.
2. Formulate a programme of action adopting a holistic approach for the implementation of projects and activities to deal with land degradation issues in the country.
3. Make necessary provision for dealing with land related socio-economic issues and poverty alleviation in the country to uplift the living conditions of the people and to ensure environmental stability.
4. To provide a basis for soliciting necessary funds for addressing land degradation issues in the country.

5.3 APPROACH AND STRATEGY

- 1 Adopt an integrated management approach to the management of land resources
- 2 In place of the present "command and control" approach in the management of land resources, promote active stakeholder participation in planning, implementation and monitoring and evaluation
- 3 Mainstream poverty alleviation into the national development agenda relative to the conservation of land resources and mitigating the effects of drought.

- 4 Empower sub-national level and local level agencies to implement NAP activities.

5.4 PROGRAMMES

The Programmes being proposed under the National Action Programme are being presented under two main categories - i.e Main programmes and Supportive Programmes. The main Programmes focus on some key issues such as soil and water conservation on degraded lands; forest decline and forest degradation; conservation of grasslands; mitigation of the effects of droughts. The supportive programmes are expected to create an enabling environment for the effective implementation of the main programmes. These programmes will promote sustainable agriculture; provide alternate income generating opportunities; strengthen the existing policy framework; review land related laws; enhance institutional capacity; promote capacity building of land users and other stake holders; promote data collection and information sharing; develop and transfer appropriate technologies and promote education and raise public awareness on environmental issues.

5.4.1 Main Programmes

5.4.1.1 Promote the Integrated Management of Upper Watersheds

There is widespread land degradation due to human activities such as cultivation of steep slopes, deforestation, burning of natural vegetation, construction of roads and buildings. Land degradation has not only reduced the productivity of large extent of agricultural land but has also led to off site damage such as reduced river flows, siltation of water bodies, increased incidence of floods and land slides.

Objective:

To protect and conserve watersheds to enhance water availability and to increase the productivity of agricultural and forest land and reduce downstream siltation.

Recommended Actions:

- (a) Develop master plans to integrate catchment conservation practices for important watersheds.
- (b) Identify and test ecologically viable and economically sound Land Use systems.
- (c) Identify degraded or degradation prone areas and regularize or relocate encroachers and settlers as the case may be.
- (d) Identify and demarcate landslide prone areas and relocate occupants in such areas
- (e) Promote on- farm and off- farm soil and water conservation measures in critical watershed areas
- (f) Promote and strengthen coordination among different organizations dealing with land and water management practices.
- (g) Promote participatory approaches to land resources management.
- (h) Finalize and implement the Land Use Policy and the Watershed Management Policy.

- (i) Expedite the implementation of the Soil Conservation (Amendment) Act and Soil Conservation Fund through the Soil Conservation Board.

5.4.1.2 Rehabilitate Degraded Agricultural Lands

Land degradation is wide spread in Sri Lanka. The cultivation of crops such as tea, tobacco, vegetable and other, annual crops on environmentally fragile areas has contributed to extensive soil degradation in the hill country. Already, a large extent of land used for tobacco cultivation and vegetable farming in the mid and hill country has been abandoned due to soil erosion and a severe decline in soil fertility. A concerted effort to rehabilitate these lands is required.

Objective:

Rehabilitate degraded agricultural lands by motivating and mobilizing farmers to adopt cost effective measures to improve soil fertility.

Recommended Actions:

- (a) Undertake soil erosion hazard classification and mapping of degraded land and prepare land suitability maps.
- (b) Promote proven low-cost soil improvement practices, vegetative conservation techniques, agronomic practices and agroforestry systems in degraded areas through demonstrations and awareness creation programmes.
- (c) Conduct further research studies on soil fertility improvement measures, conservation farming practices,

home garden models, and agroforestry systems including livestock.

- (d) Promote and implement organic farming and other nutrient management programmes in degraded agricultural areas
- (e) Rehabilitate degraded tea lands in the upcountry and mid country intermediate zones and other field crops in the Dry Zone and Mid Country Intermediate Zones.
- (f) Introduce better irrigation management practices/technologies to reduce soil erosion.
- (g) Provide incentives through a revolving fund, improved seeds etc, and promote farmers self help programmes for production and conservation through training and demonstrations.
- (h) Promote off-farm employment in order to reduce encroachment into fragile areas by subsistence farmers.

5.4.1.3 Protection of Streams and Stream Banks

Stream reservations are environmentally sensitive areas that need special attention. At present there is a serious threat to water sources in the hill country due to encroachments and misuse of stream reservations. The removal of vegetation, construction activities, diversion of polluted drainage water, diversion of sewage, dumping of garbage and cultivation of seasonal crops along stream banks has led to soil erosion, water quality deterioration and sedimentation.

Objective:

To minimize stream bank erosion

Recommended Actions:

- (a) Develop a database on stream reservations and demarcate and declare these reservations to prevent further encroachment.
- (b) Wherever necessary, relocate families residing in such reservations by providing them with alternate land and livelihood opportunities.
- (c) Strengthen implementation of restrictions imposed on sand mining.
- (d) Implement low cost bioengineering measures such as establishment of hedgerows and permanent multipurpose tree species for community use through participatory approaches
- (e) Acquire stream reservations in private lands if the land users do not adhere to recommended practices.

5.4.1.4 Protect Springs and Water Spouts

Thousands of small and large springs are found in the hilly areas. There are also spouts where water gushes out with pressure. Springs are the sources of water for streams and rivers and drying up of such springs results in reduced river flow. The land degradation in the hill country has led to a reduction of water flow in many of these springs.

Objective:

To provide protection for major springs and water spouts.

Recommended Actions:

- (a) Develop a comprehensive database on major springs/ water spouts and demarcate and declare them as protected areas.
- (b) Conserve and protect springs and water spouts through participatory approaches
- (c) Relocate families residing in hydrologically critical reservations by providing them with alternate land and livelihood.
- (d) Improve catchment management through appropriate conservation measures

5.4.1.5 Conservation of Reservoir Reservations

Soil erosion has not only resulted in the reduction of soil fertility on chena land and homesteads but has also caused severe damage to the reservoirs due to siltation. It has been observed that the sedimentation of the tanks endangers the livelihood of the entire village community due to the loss of storage capacity and a decrease in the cultivable extent. Failure to restore tank eco-systems has led to the continuous and accelerated siltation of tanks. There has also been a lack of participation of the community in the planning, decision-making and implementation of past rehabilitation activities.

Objective:

To prevent soil erosion in reservations and the siltation of tank beds and to enhance soil and water conservation through participatory tank eco-system management

Recommended Actions:

- (a) Map reservoir reservations and prepare management plans to restore tank eco- systems.
- (b) Enhance water conservation, reduce soil erosion in the reservations and increase productivity of tank command areas with the participation of the communities.
- (c) Introduce incentives to promote self help programmes for rehabilitating tank reservations.
- (d) Take steps to eject encroachers from tank reservations.

5.4.1.6 Reclaim Problem Soils

Thousands of ha of agricultural land in the coastal areas have become saline due to seawater intrusion or due to poor drainage. As there is no programme to control the situation the problem is being aggravated daily. There are also other soil problems caused by water logging; acidity and the accumulation of toxic substances. Inland salinity is also developing in some of the major irrigation projects.

Objective:

Improve productivity of agricultural lands affected by water logging, salinity and acidity.

Recommended Actions:

- (a) Develop a comprehensive database on areas with problem soils.
- (b) Identify areas suitable for housing, infrastructure etc. and enforce laws related to land filling.
- (c) Conduct further research on methods of reclamation; suitable crop varieties for the reclaimed; areas and management practices.
- (d) Demonstrate land and crop management technologies for the reclamation of problem soils.
- (e) Reclaim agricultural land already affected by water logging, salinity and acidity through participatory approaches.

5.4.1.7. Promote Sustainable Ground Water Management

Ground water is an important natural resource that is being over exploited in certain areas of the country at present. The main reason for such over exploitation is the lack of knowledge and information on the availability and existence of ground water. In some cases ground water levels in aquifers have gone down to the levels that affect the existence of natural vegetation. In other areas they have become saline. Furthermore, there is no coordinated and comprehensive programme to conduct research, survey and promote ground water use.

Objectives:

Map and inventorize occurrence of ground water availability and establish safe limits of extraction of aquifers.

Recommended Actions:

- (a) Develop a comprehensive database on ground water availability.
- (b) Establish safe limits and guidelines for the extraction of ground water.
- (c) Strengthen the research and development capacity of relevant institutions on ground water management.
- (d) Bring all aspects of ground water management under one umbrella organization.
- (e) Promote awareness programmes on extraction and sustainable use of ground water.
- (f) Regulate ground water extraction and prevent indiscriminate development of wells, specially in hard rock areas.
- (g) Enhance water use efficiency in all sectors.

5.4.1.8 Promote Integrated Biodiversity Conservation

The social and economic components of the environment very often progress at the expense of the natural component. When it comes to rural farming communities it is difficult to convince the importance of conserving the natural environment because of their struggle to earn their day to day living. Destroying of the natural environment simply leads to the degradation of biodiversity. It is important to conserve biodiversity for sustainable agriculture.

Objective:

To protect biodiversity for environmental conservation and protection

Recommended Actions:

- (a) Promote in situ conservation of indigenous species
- (b) Document indigenous knowledge on land races, and diverse food and medicinal plants.
- (c) Expand awareness programmes on bio diversity conservation

5.4.1.9 Prevent the Decline in the Forest Cover

The forest cover has been declining rapidly from 44% in 1956 to 23.9% in 1992 and 22.4% in 1999. Despite the efforts being made to safeguard the remaining natural forests deforestation is continuing due mainly to encroachments.

Objective:

Prevent encroachment on Forest Reserves and Proposed Forest Reserves

Recommended Actions:

- (a) Undertake a census of encroachments to assess the magnitude of the problem and update the data annually.

- (b) Complete the process of identifying Forest Reserves and Wildlife Reserves under extreme encroachment pressure.
- (c) Extend the boundary marking exercise to cover all Forest Reserves (FR) and Proposed Reserves (PR).
- (d) Extend encroachment related policy implementation of the Forest Department to all FR and PR.

5.4.1.10 Restore Degraded Forests

In 1994 approximately 7.0% of the country's land area was covered with sparse forests nearly all of which were in the Dry and Intermediate Zones. Within this area almost 85.0% was considered to be degraded due to chena cultivation, illegal felling of trees and the clearing of land for settlement purposes.

Objective:

Bring degraded forest areas under productive use.

Recommended Actions:

- (a) Establish farmer woodlots on degraded lands.
- (b) Expand recommended agro - forestry systems and Short Rotation Coppice (S.R.C.) for the productive use of the large extent of sparsely used and degraded forest lands.
- (c) Introduce environmental awareness amongst all stakeholders and children on the value of forests.

- (d) Provide long - term tenure by leasing agro - forestry and woodlot areas to farmers for the rotation age of the species to be planted.
- (e) Explore the possibility of expanding the cultivation of suitable nitrogen fixing plants recommended by the Department of Agriculture to restore degraded areas.
- (f) Ensure gender equity when providing extension and support services for agro forestry and woodlot establishment.
- (g) Promote the greater involvement of the private sector in the rehabilitation and management of degraded forest lands.

5.4.1.11 Conserve and Improve Grasslands

The grasslands particularly in the hilly country are under threat. In some areas there has been a tendency to cultivate potatoes or vegetables without effecting soil conservation measures leading to severe soil erosion. In the Dry Zone too many grasslands have become impoverished. Patana lands also go under fire each year subjecting the lands to severe erosion in the event of rainstorms.

Objective:

Conserve and improve grasslands and expand the extent under pasture.

Recommended Actions:

- (a) Prevent pernicious practices on grasslands such as the cultivation of temporary erosive crops and the practice of setting fire to patanas.

- (b) Propagate the cultivation of grasses and tree fodder crops with adequate measures adopted to minimize soil erosion.
- (c) Establish fire belts around grasslands.

5.4.1.12. Establish a Drought Early Warning System

It is possible to minimize the adverse impacts of drought to a considerable extent by making adjustments through a timely and accurate Drought Early Warning System (DEWS). The DEWS will provide warnings not only about forthcoming weather conditions but also about water and food shortages and the possible outbreak of pests and diseases.

Objective:

To minimize the adverse impacts of drought through timely and better Drought Early Warning Systems.

Recommended Actions:

- (a) Establish and operate a Drought Early Warning Unit in the Department Meteorology.
- (b) Establish a Drought Monitoring Committee comprising of representatives from line agencies.
- (c) Improve the mechanism for the dissemination of warnings and other related information.
- (d) Utilize traditional knowledge on perceiving, predicting, and making adjustments to drought.

5.4.1.13 Strengthen Drought Relief Systems

Government departments and a number of NGOs and CBOs are rendering a commendable service during disasters in providing relief to affected parties. However it has often been observed that there is a long delay in the process. There are also instances where victims get omitted either due to the lack of resources or weaknesses in the procedure adopted.

Objective:

To reduce the adverse effects of drought on the people living in drought prone areas.

Recommended Actions:

- (a) Strengthen the existing National Disaster Mitigation Centre.
- (b) Implement National Disaster Counter Measures Act.
- (c) Provide farmers in the drought prone areas with opportunities for alternative livelihoods.
- (d) Promote water conservation practices and domestic rainwater harvesting.
- (e) Create public awareness through media on droughts and adaptation to droughts.
- (f) Improve the facilities at the research centers involved in developing drought resistant crop varieties and appropriate technologies.

- (g) Establish an information exchange programme with recognized arid zone agricultural stations in countries such as India.

5.4.1.14 Strengthen Rainwater Harvesting systems.

Apart from some areas in the semi-arid parts of the north-west and south-east of the island where annual rainfall is less than 1000mm, the rest of the country receives more than 1000mm with some parts in the hill country receiving an annual rainfall of more than 5000mm. However the variability of rainfall both over space and time renders some areas and seasons highly susceptible to droughts. The adverse effects of drought could be mitigated to a large extent by promoting rainwater harvesting at the domestic level as well as at the village levels.

Objective:

To mitigate the effects of drought on domestic water supplies and agriculture by promoting rainwater harvesting.

Recommended Actions:

- (a) Promote domestic rainwater harvesting practices.
- (b) Improve water storage of tanks and reservoirs to enhance the retention capacity.

5.4.1.15. Promote Sustainable Agricultural Practices

Sustainable agricultural practices are expected to increase productivity in crops and at the same time maintain the soil fertility by adopting

conservation measures and good farm practices. The present agricultural policy promotes initiatives for increasing productivity by adoption of new technologies, for crop improvement, and for intensification of agriculture. It also highlights the need for competitiveness in production and marketing by increasing productivity, lowering production costs and by value addition to agricultural production. Increasing productivity would provide opportunity for investing in appropriate conservation measures and prevent degradation of agricultural land.

a) Increase Productivity in Agriculture

Agriculture is not attractive to many farmers due to low levels of productivity. Productivity is low due to a number of factors such as loss of soil fertility, high cost of production and, the low prices offered to agriculture produce. One major reason for low productivity is the poor matching of crops to land suitability.

Objective:

Enhancing agricultural productivity while reducing land degradation.

Recommended Actions :

- (a) Carry out research on the vulnerability and adaptability of agricultural crops to drought and desertification.
- (b) Monitor changes in agricultural areas arising from climatic changes and desertification
- (c) Encourage/ promote conservation farming practices.

- (d) Identify suitable indigenous and other varieties that enrich soil and reduce land degradation.
- (e) Provide incentives to farmers for conserving commercial and public lands.
- (f) Ensure that farmers use land according to land suitability classifications.
- (g) Promote efficient management of irrigation water, through farmer participation and by employing new water conservation technologies/ practices such as micro irrigation.
- (h) Promote Yaya programme concept initiated by the Department of Agriculture in all major rice growing areas.
- (i) Improve farmers knowledge and skills on crop - livestock-aquaculture integration

b) Strengthen Land Degradation related Agricultural Research and Extension Services

There has been considerable amount of research on arresting soil erosion, which is considered a major source for land degradation in the country. However, adapting such research especially in environmentally sensitive areas in the country has been rather slow.

The withdrawal of grass- root level extension officers from the field during the late eighties has had a negative impact in disseminating research knowledge among farmers.

The absence of a proven integrated approach in dealing with land degradation has also aggravated land degradation in the country.

Objective:

Strengthen the research capacity of the DOA and the extension services of the provincial departments of agriculture on land degradation.

Recommended Actions:

- (a) Carry out more needs based and location specific research so that application becomes more effective.
- (b) Expand the current programme of station and adaptive research in order to transfer the knowledge base to small farmers.
- (c) Provide adequate government funding for the continuation of research in identified priority areas in the Agriculture Research Plan dealing with efficient land management.
- (d) Strengthen networking with other local and foreign research organizations and institutions in carrying out research on climate change aspects.

5.4.1.16 Provide Alternative Income Generating Opportunities

It is widely accepted that environmental degradation and poverty are closely linked and that land degradation is one main element in this scenario. People in rural areas rely on natural resources, mainly on land for survival but do not have the ability to invest on improvements

to the resource base. This leads to the over use and neglect of resources. The high demand for land also encourages encroachments in environmentally sensitive areas causing severe degradation of land. Hence, finding alternatives to reduce the pressure on the natural resources base is an essential element in the quest to reduce poverty and improve environmental management in the country.

a) Promote Agro-based Industries in Rural Areas

Objective:

To reduce the pressure on land through the introduction of off farm employment opportunities.

Recommended Actions:

- (a) Promote and establish agro-based and other industries in rural areas for efficient use of agricultural products and for generation of additional income.
- (b) Make available appropriate technology to the poor through skills development programmes in order to encourage setting up of enterprises.
- (c) Promote livestock farming including poultry and small ruminants.

b) Mainstream Poverty Reduction Programmes into the National Development Agenda

Objectives:

Ensure poverty reduction programmes are an integral part of the national development agenda.

Recommended Actions:

- (a) Carry out in-depth studies on the relationship between poverty and land degradation and on remedial measures to be taken to address the issue.
- (b) Ensure poverty alleviation programmes are in consonance with the macro-economic policies adopted by the Government, so that poverty reduction programmes can be harmonized with sectoral development programmes.
- (c) Maintain an information base on the poor and monitor the poverty reduction programmes in a systematic manner.
- (d) Target poorer segments of the farmers living in critical areas as the main initiative to combat land degradation.

5.4.2. SUPPORTIVE PROGRAMMES

The main programmes outlined above are meant to combat land degradation, arrest forest decline and degradation and mitigate the effects of droughts. However, in view of the complexity and magnitude of the problems these programmes by themselves will not be able to address all of the issues. They have to be supported by other programmes. Some of the new programmes that have to be in place are outlined below;

5.4.2.1 Strengthen the Policy Framework

In the past environmental issues in general and land degradation in particular have been addressed on a sectoral basis. There is a need to move away from this approach and adopt a more integrated approach

towards natural resources management. The problem has been aggravated because in the past, policies have focused more on growth rather than on the notion of sustainability.

a) Adopt an Integrated Approach to Land Management

Objectives:

Ensure all sectoral policies are directed toward promoting integrated land resources management.

Recommended Actions:

- (a) Develop and implement a model community-wide programme for integrated resource management.
- (b) Evaluate all sectoral policies to identify gaps and inconsistencies that have a negative impact on integrated land resources management.
- (c) Formulate policies and strategies to address land degradation, drought, and measures to prevent future desertification.

b) Ensure that Environmental Concerns are Addressed in the Formulation of Economic Policies

Objective:

Incorporate environmental concerns including costs into decision-making pertaining to land resources management.

Recommended Actions:

- (a) Review existing macro-economic policies and reformulate them in order to internalize environmental concerns.
- (b) Ensure that Environmental Valuation is used as a tool in guiding decision-making.
- (c) Include costs associated with soil loss, fertility decline and siltation in national accounting exercises.

**b) Review Current Land Alienation and Encroachment
Regularization Policies****Objective:**

Ensure that land is not alienated in environmentally fragile areas and that secure title is provided to those adopting good land management practices

Recommended Actions:

- (a) Develop a comprehensive programme to prevent further encroachments in environmentally fragile areas.
- (b) Formulate a land alienation policy that would discourage encroachments on environmentally fragile state land.
- (c) Provide land titling to encroachers in areas that are not environmentally fragile to enable them to have access to credit, inputs, etc, that would facilitate efficient land management

d) Introduce Economic Instruments to Minimise Land Degradation

Objective:

To provide necessary incentives and disincentives to land users in order to promote efficient land management and minimise land degradation.

Recommended Action:

- (a) Introduce a comprehensive package of economic instruments in the form of financial inputs such as loans; subsidies and taxes for promoting land conservation.

5.4.2.2 Review Land Related Laws

The presence of a large number of land related laws do not provide a sound basis for efficient land management. Despite the large number of laws, land degradation continuous unabated. The main reason for this is that these laws were developed for different objectives and not effectively to address land degradation issues in the country. Hence, there is a need to review the existing related laws and regulations and develop an appropriate legal framework to address land degradation, drought and other issues in a comprehensive manner.

Objective:

To develop a legal framework to support policy initiatives and to provide an enabling environment for effective implementation of land management programmes.

Recommended Actions:

- (a) Review all existing land related laws and regulations and assess legal impact on land degradation and suggest necessary changes.
- (b) Explore the possibility of developing an “umbrella framework” law to deal with land related issues in a cohesive manner.

5.4.2.3 Enhance Institutional Capacity

Institutions play a vital role in supporting the implementation of policy initiatives and legal services. Since land is a cross cutting area it cannot be dealt with by a single institution or a few institutions alone. The large number of institutions that are in existence at present, needs to be strengthened to deal with land degradation issues more effectively. At the same time steps should be taken to promote coordination among the institutions dealing with land management.

Objective:

Establish effective land coordination mechanisms and strengthen the capacity of institutions managing land resources.

Recommended Actions:

- (a) Strengthen Institutions mandated to undertake land use planning so that land use mapping can be undertaken and the required information for implementing the Land Use Policy generated.

- (b) Strengthen the capacity of all institutions engaged in research and development on land resources management.
- (c) Allocate resources to undertake priority research on land management in environmentally fragile areas.
- (d) Establish a Land Secretariat (or apex body) to deal with land related issues, to provide technical guidance and to ensure that land management is given priority in the sectoral programmes/projects implemented.
- (e) The Watershed Management Groups initiated by the PLMC can be expanded to other areas to give responsibility to Community Groups in co-ordination with local/provincial authorities to facilitate watershed management activities.

5.4.2.4 Promote Capacity Building of Land Users and Other Stakeholders

It is important to build technical know how and skills of land users for implementing land management programmes effectively and efficiently. Capacity building must be carried out at various levels, with due emphasis on the farmer community.

Objective:

Identify and develop amongst land owners and stakeholders necessary knowledge and technical skills required for dealing with land management issues in the country.

Recommended Actions:

- (a) Formulate a programme to train land managers, and officials of research and other institutions dealing with land management.
- (b) Promote good land management among private land owners through the provision of guidelines.
- (c) Support improved natural resource management practices through education and training to enable land managers and rural communities to adopt new and innovative management approaches.
- (d) Provide farmers with formal and informal training and obtain a continuous feedback to enable the modification of management practices.
- (e) Identify and support leaders and "champions", who can demonstrate the benefits of better land management to motivate other land issues.
- (f) Network skills in leadership development so as to encourage participatory and partnership approaches in land management.
- (g) Build the capacity of provincial officials in order to obtain their active participation of provincial officials in environmental decision- making.

5.4.2.5. Develop and Transfer Appropriate Technologies

As Land Degradation become more acute, there are many emerging new technologies in the world to deal with the situation in a systematic manner.

Hence farmers should have quick access to such new technologies and their field problems need to be fed back to the research institutes for further research interventions. Replicable models of conservation and farming systems have to be taken to the farmers through various channels such as demonstrations, training, and participatory pilot testing.

Objective:

To improve the capacity of land users in management of their land maintaining higher level of Production

Recommended Actions:

- (a) Test and identify suitable conservation and land management technologies for different land types.
- (b) Carry out studies to identify potential desertification areas.
- (c) Develop appropriate models of land management for potential desertification areas
- (d) Demonstrate these models with active farmer participation so that land users could choose the technologies that are most acceptable.

- (e) Prepare guidelines and manuals on land conservation and land rehabilitation technology.
- (f) Use media and other channels to create awareness and to educate and develop necessary skills amongst land users.

5.4.2.6. Promote Data Collection and Information Sharing

Information is an essential input to the effective use of land resources and the sustainable management of the environment. A part of this information has been generated but a great deal more remains to be collected. Even the information generated is not at the level of detail and accuracy required. Furthermore, the collation, analyses and sharing of information has also been poor and the information that is available is often not easily accessible decision makers at different levels.

At present data collection is hampered by the several institutions collecting information and the low level of coordination amongst them. The absence of coordination has often made it difficult to agree on a common terminology, common classification systems and in developing appropriate mechanisms for exchanging data. Furthermore there is no central place for storing land resources information; nor is there mechanism by which stakeholders can access the required information.

Objective:

To collect the data needed for the effective use of the land resources; promote coordination amongst institutions collecting and store the data in a manner in which all stakeholders can access the data.

Recommended Actions:

- (a) Identify the data that needs to be collected for managing land resources, establish a Land Resources Information System as a basis for decision-making and develop a mechanism for exchanging data.
- (b) Make the information available to all institutions with responsibilities relating to land.

5.4.2.7. Promote Education and Raise / Public Awareness on Environmental Issues

Changing the behavior patterns of land users is one important element in the draft National Environmental Policy. In order to achieve this, comprehensive education and awareness programmes should be initiated aimed at different target groups.

Objective:

Create mass awareness on land degradation and its impacts especially among school and university students and vulnerable communities on environmental issues.

Recommended Actions:

- (a) Incorporate environmental communication into all natural resources management projects, through which coordination, consultative and dissemination processes can be facilitated.
- (b) Incorporate environmental issues and concerns into school and university curricula.

- (c) Develop programmes to address target groups in specific areas and create awareness on critical issues such as the extraction of ground water and the value of forests.
- (d) Strengthen the existing extension and promotion divisions of natural resource management agencies to deal with land degradation issues in a more coherent manner.
- (e) Prepare manuals and handouts pertaining to the efficient use of land resources.
- (f) Strengthen on going awareness programmes using electronic print and visual media.

6.0. PROPOSED PROJECTS

The thrust of the action plan is towards addressing the burning issues relating to land degradation, which requires immediate attention of all stakeholders concerned. In order to address these issues in a coherent manner the action plan is presented based on main programmes and supporting programmes.

The section on projects is aimed at facilitating the implementation of the recommendations made in the action plan to combat land degradation in the country. It is expected that the proposed projects would facilitate donor assistance towards implementing them. The projects have being selected based on the priority areas identified within the programmers and recommended activities. It is expected that the implementation of projects would create a strong basis for addressing land degradation issues as a whole.

The projects are presented under each programme identified in the action plan. Based on the project concept, it is necessary to work out

the details of cost of the activities to be carried out under the project and also the timing. This however should be based on more detailed analysis. Since land degradation is a vast and complex issue, it is necessary that all stakeholders are involved in its planning and implementation.

The proposed projects for each of the programmes are given in Table 2

Table 2- Proposed Projects

Programme	Proposed Projects
5.4.1.1. Promote the Integrated Management of Upper Watersheds	I. Prepare watershed development Master Plans for important watersheds II. Identify and test ecologically viable and economically sound land use systems. III. Promote on-farm and off-farm soil and water conservation measures in critical watershed areas.
5.4.1.2 Rehabilitate Degraded Agricultural Lands	I. Undertake soil erosion hazard classification and mapping of degraded land including land suitability maps. II. Identify and evaluate various conservation farming systems including livestock, agro forestry and home garden models and demonstrate their value for land rehabilitation. III. Promote and implement organic

	farming and other soil nutrient management programmes in the mid country intermediate zone and in the low country dry zone.
5.4.1.3 Protection of Streams and Stream Banks	I. Demarcate and conserve stream bank reservations II. A pilot project to demonstrate participatory management approaches of state owned stream banks
5.4.1.4 Protecting Springs and Water Spouts	I Map, demarcate and declare major springs and spouts as Protected Areas. II. Implement catchment management through participatory approaches.
5.4.1.5 Conservation of Reservoir Reservations	I. Map reservoir reservations and prepare management plans to restore tank eco-systems II. Implement management plans through participatory approaches.

5.4.1.6 Reclaim Problem Soils	I. Develop a comprehensive database on problem soils (water logging, salinity, acidity). II. Conduct farmer participatory programmes for land reclamation/management. III. Enforce laws related to land filling.
5.4.1.7 Promote Sustainable Ground Water Management	- I Prepare an inventory of ground water resources with guidelines for safe limits of extraction. - II Strengthen research and development capacity of institutions dealing with ground water management
5.4.1.8 Promote Integrated Biodiversity Conservation	I. Promote conservation of indigenous agricultural germplasm in gene banks and botanical gardens. II. Identify important components of biodiversity and introduce them in home gardens and tank ecosystems III. Study the changes in form and content over time of vegetation in

	drought prone areas.
5.4.1.9 Prevent the Decline in the Forest Cover	I. Map and classify Encroachments in all forested areas since the last cut off date for regularization (15 th June 1995) in order to review and prevent encroachments.
5.4.1.10 Restore Degraded Forests	I. Establish agro-forestry systems on degraded forest lands. II. Establish S.R.C. energy plantation based power generation projects in selected areas. III. Develop and implement feature programmes on the value of forests through the mass media i.e Print Media, and electronic media
5.4.1.11 Conserve and Improve Grasslands and Patana Lands	I. Develop an information base on grasslands. Information should include the distribution, type and quality, threats and the potential for improvement of the grasses. II. Prepare a comprehensive management plan for conserving

	grasslands.
5.4.1.12 Establish a Drought Early Warning System	I. Enhance the monitoring and weather forecasting capabilities of the Department of Meteorology. II. Conduct a study on the contribution of land use practices to desertification in 3 selected areas – i.e Dry Zone Hill Country, N.W. Dry Zone and S.E. Dry Zone.
5.4.1.13 Strengthen Drought Relief Systems	I. Establish and manage a Drought Relief Fund or a Drought Insurance Scheme.
5.4.1.14 Strengthen Rainwater Harvesting Systems	I. Develop and disseminate new technologies for rainwater harvesting. II. Train masons and technicians to construct rain water storage tanks in the rural areas of the Dry Zone.
5.4.1.15 Promote Sustainable Agriculture	I. Establish location specific and integrated location specific development programme

5.4.1.16 Provide Alternative Income Generating Opportunities	II. Develop a climate change and desertification-monitoring Programme to monitor changes in agricultural areas. III. Develop a research programme and strategies on adaptative and vulnerability of agricultural crops to drought and desertification. IV. Promote district wise land suitability classification and develop appropriate farming models. I. Identify and provide support for setting up suitable agro- based industries that will provide off farm employment for farmers operating in environmentally fragile areas. II. Develop procedures to ensure that poverty reduction strategies that reduce dependency on land are incorporated into the sectoral development planning process.
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Supportive programmes 5.4.2.1. Strengthen the policy framework 5.4.2.2. Review Land Related Laws 5.4.2.3. Enhance Institutional Capacity 5.4.2.4 Promote Capacity Building of Land Users and Other Stakeholders	I. Develop a pilot project to introduce economic instruments in selected upper watershed areas to arrest soil erosion II. Formulate a land alienation policy. I. Review existing laws related to land resources and prepare an “umbrella law” for the purpose of effective land resources management I. Establish a Secretariat in the Ministry of Lands to coordinate land related matters. I. Develop pilot projects to train university academics and farmers jointly in order to share knowledge and experience II. Provide training and develop
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	guidelines in land management for private landowners. III. Carry out special training for provincial and local level officers in planning and implementing natural resources management project and activities.
5.4.2.5. Develop and Transfer Appropriate Technologies	I. Develop a model technology transfer project involving farmers and experts for facilitating participatory technology development and testing for land management in conservation areas.
5.4.2.6 Promote Data Collection and Information Sharing	I. Identify potential desertification areas. II. Establish a land information system.
5.4.2.7. Promote Education and Raise/ Public Awareness on Environmental Issues	I. Develop a comprehensive awareness and education programme to sensitise the general public and target groups in good land management practices

	II Develop an implement a feature programme via mass media to expose both good and bad land management practices in the country
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7.0. PROGRAMME IMPLEMENTATION, MONITORING AND EVALUATION

The Action Plan will identify clearly the role and responsibilities of the various partners in implementing the activities concerned. However, the implementation must be monitored and evaluated from time to time by a body mandated to do so, so that issues in implementation can be discussed and remedial measures taken to ensure effectiveness of the activities carried out.

7.1 IMPLEMENTATION ARRANGEMENTS

The Ministry of Environment and Natural Resources (M/E&NR) will be the focal point for ensuring that the Action Plan is implemented as envisaged. Implementation of the programmes and activities recommended in section 5 of the plan, would involve the active participation of all stakeholders concerned at the National, Provincial, Local and Community levels and would involve policy makers, private sector, communities, farmers, NGO's and CBO's. Proposed implementing agencies for the recommended programmes and actions are review in Table 3

Table 3- Main Programmes, Recommended Actions and Proposed Implementing Agencies

Main Programme	Recommended Actions	Proposed Implementing Agency
5.4.1.1. Promote the Integrated Management of Upper Watersheds	(a) Develop master plans to integrate catchment conservation practices for important watersheds.	MOE, MOAL
	(b) Identify and test ecologically viable and economically sound land use system	MOAL, DOA
	(c) Identify degraded or degradation prone areas and regularize or relocate encroachers and settlers as the case may be.	MOE, SD, LC, FD, LUPPD MOL
	(d) Identify and demarcate landslide prone areas and relocate occupants in such areas	NBRO, UNIV, NDMC, GSMB, CHPB
	(e) Promote on -farm and off -farm soil and water conservation measures in critical watershed areas	DOA, MASL, NGOO, PC, CBOO

5.4.1.2 Rehabilitate Degraded Agricultural Lands	(f) Promote and strengthen coordination among different organizations dealing with land and water management practices.	MOE, MOAL, MOL, MOI, PC
	(g) Promote a participatory approach to land resources management.	MOA, DOA, NRM, FD, MOL, PC, NGO, CBO
	(h) Finalize and implement the Land Use Policy and the Watershed Management Policy.	MOL, LUPD
	(i) Expedite the implementation of the Soil Conservation (Amendment) Act and Soil Conservation Fund through the Soil Conservation Board.	MOAL, DOA, MOF
	(a) Undertake soil erosion hazard classification and mapping of degraded land and prepare land suitability maps.	MOAL, DOA/ NRM, MOL, (LUPD), MASL
	(b) Promote proven low-	DOA, FD, MASL

	cost soil improvement practices, vegetative conservation techniques, agronomic practices and agroforestry systems in degraded areas through demonstrations and awareness creation programmes.	PC, ,NGOO, CBOO
	(c) Conduct further research studies on soil fertility improvement measures, conservation farming practices, home garden models, and agroforestry systems including livestock.	MOAL, DOA, DAPH, UNIV
	(d) Promote and implement organic farming and other nutrient management programmes in degraded agricultural areas	DOA, PC, PLC, NBOO, CBOO
	(e) Rehabilitate degraded tea lands in the upcountry and mid country intermediate zones and other field crops in the dry zone and mid country intermediate	MOP, PLC

5.4.1.3 Protection of Streams and Stream Banks	zones. (f) Introduce better irrigation management practices/technologies to reduce soil erosion. (g) Provide incentives through a revolving fund, improved seeds etc, and promote farmers self help programmes for production and conservation through training and demonstrations. (h) Promote off-farm employment in order to reduce encroachment into fragile areas by subsistence farmers. (a) Develop a data base on stream reservations and demarcate and declare these reservations to prevent further encroachment. (b) Wherever necessary, relocate families residing in such reservations by	MOI, DOI DOA, PDA, DAD, PC MOAL, MASL MOF, DOA, DAD, PC MOIND, & other relevant Ministries SD, LUPPD, FD, DWLC, DOI, GSMB,CE A SD, LUPPD, FD, DWLC, CEA, DOI

5.4.1.4 Protect Springs and Water Spouts	providing them with alternate land and livelihood opportunities. (c) Strengthen implementation on restrictions imposed on sand mining. (d) Implement low cost bioengineering measures such as establishment of hedgerows and permanent multipurpose tree species for community use through participatory approach (e) Acquire stream reservations in private lands if the land users do not adhere to recommended practices. (a) Develop a comprehensive data base on major springs/ water spouts and demarcate and declare them as protected areas. (b) Conserve and protect springs and water spouts	GSMB, DSS DOA, NRMC, MASL, FD SD, MOL, DOA, NRMC SD, LUPPD, DI, FD, PC PC
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5.4.1.5 Conservation of Reservoir Reservations	through participatory approaches	
	(c) Relocate families residing in hydrologically critical reservations by providing them with alternate land and livelihood.	SD, LUPPD, DOI, FD, PC
	(d) Improve catchment management through appropriate conservation measures	FD, MASL, PC
	(a) Map reservoir reservations and prepare management plans to restore tank eco- systems.	MOI, DOI MASL
	(b) Enhance water conservation, reduce soil erosion in the reservations and increase productivity of tank command areas with the participation of the communities.	DI, MOI, DOA, CEA, PC
	(c) Introduce incentives to promote self help programmes for rehabilitating tank	MOL, PC

5.4.1.6 Reclaim Problem Soils	reservation. (d) Take steps to eject encroachers from tank reservations	MOL, SD, DOI, LC
	(a) Develop a comprehensive database on areas with problem soils.	MOAL, DOA, MOE, LUPPD, CEA
	(b) Identify areas suitable for housing infrastructure etc. and enforce laws related to land filling.	All relevant departments and provincial Councils
	(c) Conduct further research on methods of reclamation; suitable crop varieties for the reclaimed areas; and management practices.	DOA, UNIV
	(d) Demonstrate land and crop management technologies for the reclamation of problem soils.	DOA, PC
	(e) Reclaim agricultural land already affected by water logging, salinity and acidity through	DOA, DI, DAD, PC

5.4.1.7 Promote Sustainable Ground Water Management	participatory approaches (a) Develop a comprehensive database on ground water availability. (b) Establish safe limits and guidelines for the extraction of ground water. (c) Strengthen the research and development capacity of relevant institutions on ground water management. (d) Bring all aspects of ground water management under one umbrella organization. (e) Promote awareness programmes on extraction and sustainable use of ground water. (f) Regulate ground water extraction and prevent indiscriminate development of wells, specially in hard rock	WRB, DOI, MOI WRA DI, WRB, DOA, NRMC, UNIV DI, WRB, WRA DOA, WRB, WRA WRA, DOI, PC
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	areas.	
	(g) Enhance water use efficiency in all sectors.	All relevant Departments and Private Organizations
5.4.1.8 Promote Integrated Biodiversity Conservation	(a) Promote in situ conservation of indigenous species	DOA, PGRC, FD
	(b) Document indigenous knowledge on land races and diverse food and medicinal plants.	DOA, PGRC,
	(c) Expand awareness programmes on biodiversity conservation	MOE, PGRC
5.4.1.9 Prevent the Decline in the Forest Cover	(a) Undertake a census of environment, to assess the magnitude of the problem and update the data annually.	SD, FD, DWLC
	(b) Complete the process of identifying Forest Reserves and Wildlife Reserves under extreme encroachment pressure.	SD, FD, DWLC
	(c) Extend the boundary	SD, FD, DWLC

5.4.1.10 Restore Degraded Forests	marking exercise to cover all Forest Reserves (FR) and Proposed Reserves (PR).	
	(d) Extend encroachment related policy implementation of the Forest Department to all FR and PR.	FD
	(a) Establish farmer woodlots on degraded lands.	FD
	(b) Expand recommended agro - forestry systems and Short Rotation Coppice (S.R.C.) for the productive use of the large extent of sparsely used and degraded forest lands.	FD, DOA
	(c) Introduce environmental awareness amongst all stakeholders and children on the value of forests.	MOE, FD
	(d) Provide long - term tenure by leasing agro -	MOL, SD, LUPPD

	forestry and woodlot areas to farmers for the rotation age of the species to be planted. (e) Explore the possibility of expanding the cultivation of suitable nitrogen fixing plants recommended by the Department of Agriculture to restore degraded areas. (f) Ensure gender equity when providing extension and support services for agro forestry and woodlot establishment. (g) Promote the greater involvement of the private sector in the rehabilitation and management of degraded forest lands.	FD, DOA, MOI FD FD, NGOO, CBOO
5.4.1.11 Conserve and Improve Grasslands and Patana Lands	a) Prevent pernicious practices on grasslands such as the cultivation of temporary erosive crops and the practice of setting fire to patanas.	PC, DSS

5.4.1.12 Establish a Drought Early Warning System	b) Propagate the cultivation of grasses and tree fodder crops with adequate measures adopted to minimize soil erosion.	MOA, PC
	c) Establish fire belts.	FD, PC
	a) Establish and operate a Drought Early Warning Unit in the Department of Meteorology	DOM
	b) Establish a Drought Monitoring Committee Comprising representatives from line agencies.	DOM
	c) Improve the mechanism for the dissemination of warnings and other related information.	DOM
5.4.1.13 Strengthen Drought Relief Systems	d) Utilize traditional knowledge on perceiving, predicting, and making adjustments to drought.	DOM, DOA, DOI
	a) Strengthen the existing National Disaster Mitigation Centre.	DSS, NDMC

5.4.1.14 Strengthen Rainwater Harvesting Systems	b) Implement National Disaster Counter Measures Act.	MSS
	c) Provide farmers in the drought prone areas with opportunities for alternative livelihoods.	MOI, MOS, DOA, PC
	d) Promote water conservation practices and domestic rainwater harvesting.	DOA, PC
	e) Create public awareness through media on droughts and adaptation to droughts.	DOM, DOA
	f) Improve the facilities at the research centres involved in developing drought resistant crop varieties, and appropriate technologies.	DOA
	g) Establish an information exchange programme with recognized arid zone agricultural stations in countries such as India.	DOA
	a) Promote domestic rainwater harvesting practices.	DSS, NGO
	b) Improve water storage	DAD, DOI

5.4.1.15 Promote Sustainable Agriculture	of tanks and reservoirs to enhance the retention capacity.	
	a) Carry out research on the vulnerability and adaptability of agricultural crops to drought and desertification.	DOA
	b) Monitor changes in agricultural areas arising from climatic changes and desertification	DOA, PDA
	c) Encourage/ promote conservation farming practices.	DOA, PDA
	d) Identify suitable indigenous and other varieties that enrich soil and reduce land degradation.	DOA, PDA
	e) Provide incentives to farmers for conserving commercial and public lands.	MOF, MOE, DOA, PDOA
	f) Ensure that farmers use land according to follow land suitability classifications.	DOA , PDA

	g) Promote efficient management of irrigation water, through farmer participation and by employing new water conservation technologies/ practices such as micro irrigation.	DOA, DOI, DAD
	h) Promote Yaya programme concept initiated by the Department of Agriculture in all major rice growing areas.	DOA, MOAL, PDA
	i) Improve farmers' knowledge and skills on crop-livestock-aquaculture integration.	MOAL, DOA, PDA, PDAPH
5.4.1.16 Provide Alternative Income generating Opportunities		
a) Promote Agro-based Industries in Rural Areas	a) Promote and establish agro-based and other industries in rural areas for efficient use of agricultural products and for generation of additional income.	MOA, DOA, MOI, PC
	b) Make available appropriate	Samurdhi, MOA, PC

c) Main stream Poverty Reduction Programmes into the National Development Agenda	technology to the poor through skills development programmes in order to encourage setting up enterprises.	
	c) Promote livestock farming (medium- scale) involved in poultry and small ruminants.	MOAL, DAPH
	(a) Carry out in-depth studies on the relationship between poverty and land degradation and remedial measures to be taken to address the issues.	MOS
	(b) Ensure poverty alleviation programmes are in consonance with the macro economic policies adapted by the government, so that poverty reduction programmes can be harmonized with sectoral development programmes	MOS, MSS, PC

	(c) Maintain an information base on the poor and monitor the poverty reduction programmes in a systematic manner. (d) Target poorer segments of the farmers living in critical areas as the main initiative to combat land degradation.	MOS, MSS, DSS MOS, DOA, MASL, PC
5.4.2. Supportive Programmes 5.4.2.1. Strengthen the policy framework a) Adopt an Integrated Approach to Land Management	(a) Promote and establish agro-based and other industries in rural areas for efficient use of agricultural products and for generation of additional income. (b) Make available appropriate technology to the poor through skills	MOL MOL

	development programmes in order to encourage setting up of enterprises.	
	(c) Promote livestock farming (medium-scale) including poultry and small ruminants.	MOL, MOAL, MOE
b) Ensure that Environmental Concerns are Addressed in the Formulation of Economic Policies	(a) Review existing macro-economic policies and reformulate them in order to internalize environmental concerns.	MOE, CEA, FD, MOAL
	(b) Ensure that Environmental Valuation is used as a tool in guiding decision-making.	MOE, CEA, FD, MOAL
	(c) Include costs associated with soil loss fertility decline and siltation in national accounting exercises.	MOE
	(c) Review Current Land Alienation and Encroachment Regularization Policies	
	(a) Develop a comprehensive programme to prevent further encroachments in environmentally fragile	MOL, LC, SD

	areas.	
	(b) Formulate a land alienation policy that would discourage encroachments on environmentally fragile state land.	MOL, LC
	(c) Provide land titling to encroachers in areas that are not environmentally fragile to enable them to have access to credit, inputs, etc, that would facilitate efficient land management	MOL, LC
(d) Introduce Economic Instruments to Minimise Land Degradation	(a) Introduce a comprehensive package of economic instruments in the form of financial inputs such as loans; subsidies and taxes for promoting land conservation.	DOA, MOL, CEA, MOE
5.4.2.2 Review Land Related Laws	(a) Review all existing land related laws and regulations and assess legal impact on land degradation and suggest	MOL

5.4.2.3.Enhance Institutional Capacity	necessary changes.	
	(b) Explore the possibility of developing an "umbrella framework" law to deal with land related issues in a cohesive manner.	MOL
	(a) Strengthen Institutions mandated to undertake land use planning so that land use mapping can be undertaken and the required information for implementing the Land Use Policy generated.	MOL, MOI, MOA, MOE
	(b) Strengthen the capacity of all institutions engaged in research and development on land resources management.	MOA, MOE, DOA, NRMC, MOL
	(c) Allocate resources to undertake priority research on land management in environmentally fragile areas.	MOF, MOA, MOL
	(d) Establish a Land	MOL

	Secretariat (or apex body) to deal with land related issues, to provide technical guidance and to ensure that land management is given priority in the sectoral programmes/projects implemented.	
	(e) The Watershed Management Groups initiated by the PLMC can be expanded to other areas to give responsibility to Community Groups in co-ordination with local/provincial authorities to facilitate watershed management activities.	MOE, MOL
5.4.2.4.Promote Capacity Building of Land Users and Other Stakeholders	(a) Formulate a programme to train land managers, and officials of research and other institutions dealing with land management.	MOL, LC, LUPPD
	(b) Promote good land management among	MOE, MOA, MOL, DOA

	private land owners through the provision of guidelines.	
	(c) Support improved natural resource management practices through education and training to enable land managers and rural communities to adopt new and innovative management approaches.	MOE, MOA, DOA, MOL
	(d) Provide farmers with formal and informal training and obtain a continuous feedback to enable the modification of management practices.	MOE, MOL, MOA, PC
	(e) Identify and support leaders and "champions", who can demonstrate the benefits of better land management to motivate other land issues.	MOE, MOL, MOA, PC
	(f) Network skills in leadership development so as to encourage participatory and	MOE, MOL, MOA

5.4.2.5. Develop and Transfer Appropriate Technologies	partnership approaches in land management. (g) Build the capacity of provincial officials in order to obtain their active participation of provincial officials in environmental decision-making. (a) Test and identify suitable conservation and land management technologies for different land types. (b) Carry out studies to identify potential desertification areas. (c) Develop appropriate models of land management for potential desertification areas (d) Demonstrate these models with active farmer participation so that land users could choose the technologies that are most acceptable.	MOE, MOL, PC DOA DOA, NRMC, DOM MOE, MOA, DOA DOA, PDA
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	(e) Prepare guidelines and manuals on land conservation and land rehabilitation technology.	DOA, LUPPD
	(f) Use media and other channels to create awareness and to educate and develop necessary skills amongst land users.	MOE, MOAL, DOA, PDA
5.4.2.6. Promote Data Collection and Information Sharing	(a) Identify the data that needs to be collected for managing land resources, establish a Land Resources Information System as a basis for decision-making and develop a mechanism for exchanging data. (b) Make the information available to all institutions with responsibilities relating to land.	MOL, LUPPD, LC MOL, LUPPD, LC
5.4.2.7. Promote Education and Raise / Public Awareness on Environmental Issues	(a) Incorporate environmental communication into all natural resources management projects, through which	MOE, MOL, MOA

	coordination, consultative and dissemination processes can be facilitated. (b) Incorporate environmental issues and concerns into school and university curricula. (c) Develop programmes to address target groups in specific areas and create awareness on critical issues such as the extraction of ground water and the value of forests. (d) Strengthen the existing extension and promotion divisions of natural resource management agencies to deal with land degradation issues in a more coherent manner. (e) Prepare manuals and handouts pertaining to the efficient use of land resources. (f) Strengthen on going	MOE, UNIV MOE, MOA, MOAL, MOL MOE, MOAL, PC LUPPD, DOA MOE, DOA,
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	awareness programmes using electronic print and visual media.	LUPPD
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7.1.1 National Coordinating Body

The M/E&NR will be responsible for providing leadership in environmental management and ensure that the various partners concerned implement environment and natural resource policies. The Ministry will have the responsibility of ensuring that education; training, awareness and capacity building programmes are carried out as planned. The Ministry would coordinate such activities with the necessary guidance and direction from a National Steering Committee on Land Management (NSCLM) set up with representatives of all stakeholders concerned. This body will monitor the implementation of the plan on a periodic basis.

The Secretary, M/E&NR will chair this committee and would include senior officials from line agencies, private sector, NGOs, and experts in the area concerned. Decisions taken at the local level coordinating committees and the Experts Committee on Land will also be taken up for discussion.

7.1.2 Local Level Coordination

Local level coordination is very important, as the actual implementation will take place at that level. To ensure coordination and the implementation, the duties of the District Level Environmental Committee (DLEC) will be expanded to cover land aspects as well. This committee will comprise officials from related agencies, and CBOs. A sub-committee will be appointed to deal with this subject in detail and monitor the activities and report to the DLEC. The Sub-committee will be chaired by District Land Officer and would consist of forest and wildlife officials and the District Environmental Officers in the area. A representative of the M/E&NR will also attend these

meetings in order to assess the situation and assist in any implementation issues

7.1.3 Technical Advisory Group

The Expert's Committee on Land Degradation and Droughts (ECLDD) will include representatives from universities; research institutions and scientists related to land and related natural resources. This committee would provide advice on technical aspects to the NSCLM to facilitate policy development and decision-making. The ECL will be convened by the M/E&NR.

7.1.4. Programme Management and Implementing Agencies

The Natural Resources Management Division of the M/E&NR will provide guidance to the agencies, CBOs etc for the development of projects for implementation. Necessary financial assistance will be provided once the projects are prioritized and donor assistance solicited. Assistance to prepare project proposals will also be provided as part of capacity building.

Most of the activities under the projects will be combined to the ongoing-field activities, so as to enhance their impacts. Ensuring sustainability will be the main objective in all activities implemented. Awareness and capacity building will go hand in hand with the activities implemented.

A data base will be established in order to document and report on the work concerned and also to disseminate information to all concerned. A newsletter will be used for this purpose. Computers will be provided at strategic locations where most activities are located and data will be stored and reviewed for better land management

7.1.5 Stakeholders Participation

Effective stakeholder participation is the key to successful implementation of the programmes proposed in the Action Plan. The various activities in the plan will have to be implemented by the plantation companies managing tea, rubber and coconut, other private sector companies engaged in agricultural production, farmers, households, community groups, CBOs etc.

7.2 MONITORING AND EVALUATION

Monitoring will be done at various levels and intervals in order to generate information and to assess progress and effectiveness of the activities implemented. The details of the information collected will vary between the levels. At the national level monitoring will be done on a quarterly basis and the information collected will be at a macro level. At the local level detailed information will be collected as part of the monitoring process on a monthly basis. This information will be analyzed and summarized and submitted to the national level institutions for assessing the performance of the work. At the field level more detailed information would be collected for research purposes that can be used for field level interventions and improvements in land.

The M/E&NR has a well-established monitoring system, which monitors progress in detail on a quarterly basis. The progress review meetings held review the progress of activities, projects etc and discuss issues and remedial measures.

A prerequisite for the monitoring system on land degradation is the development of a database, which should be linked to a land management information system. Lack of data on different aspects of

land degradation, magnitude, associated socio-economic factors etc is common issues hampering cohesive land management decision-making.

ANNEX I

PROPOSED IMPLEMENTING AGENCIES FOR RECOMMENDED ACTIONS

Central Environment Authority	CEA
Centre for Housing Planning and Building	CHPB
Department of Agrarian Development	DAD
Department of Agriculture	DOA
Department of Agrarian Development	DAD
Department of Animal Production and Health	DAPH
Department of Irrigation	DOI
Department of Meteorology	DOM
Department of Social Services	DSS
Department of Wild Life Conservation	DWLC
Divisional Secretaries	DSS
Forest Department	FD
Geological Survey and Mines Bureau	GSMB
International Union for the Conservation of Nature	IUCN
Land Commissioners Department	LCD
Land Use Policy Planning Division	LUPPD
Mahaweli Authority of Sri Lanka	MASL
Ministry of Agriculture and Livestock	MOAL
Ministry of Education	MOED
Ministry of Environment	MOE
Ministry of Finance	MOF
Ministry of Industries	MOIND
Ministry of Irrigation	MOI
Ministry of Lands	MOL
Ministry of Samurdhi	MOS
Ministry of Social Services	MSS
National Disaster Management Centre	NDMC
National Physical Planning Department	NPPD
Natural Resources Management Centre of the DOA	NRMC
Non Government Organizations	NGOO
Community Based Organizations	CBOO
Plant Genetic Resources Centre of the DOA	PGRC
Plantation Companies	PLC
Provincial Councils	PC
Provincial Department of Agriculture	PDA
Provincial Department of Animal Production & Health	PDAPH
Survey Department	SD
Universities	UNIV
Water Resources Authority	WRA
Water Resources Board	WRB

ANNEX II

LIST OF POSITION PAPERS PREPARED

- Present Status and Impacts of Soil Erosion in the Up Country of Sri Lanka
Dr. H.B. Nayakekorala
- Present Status and Impact of Soil Erosion in the Mid-Country Area
Mr. Henry Gamage
- Present Status and Impacts of Soil Erosion in the Low Country Dry Zone
Dr. P.B. Dharmasena
- Present Status of Economic Losses of soil Erosion (On Site and Off Site)
Dr. B.M.S. Batagoda
- Present Status and Impacts of Sedimentation in Dry Zone Cascaded Tank Systems
Dr. P.B. Dharmasena
- "AGROFORESTRY" As a Potential Tool to Combat Land Degradation in Arid and Dry Zones of Sri Lanka
Dr. D.K.N.G. Pushpakumara
- "AGROFORESTRY" A Potential Tool to Rehabilitate Degraded Land Caused by Soil Erosion in Mid and Up Country Area of Sri Lanka
Dr. S.P. Nisshanka
- Integrated Plant-Animal Agro-forestry System to Control land degradation in arid and Dry -Zones of Sri Lanka
Dr. L.P.Silva & Dr. V.P. Jayawardena
- Conservation and Sustainable Use of Traditional Crop Varieties in Dry and Arid Zones of Sri Lanka
Mr. S. Vaheesan
- Role of Promoting Export Agriculture Crop Based Cropping Systems to Combat Land Degradation in Sri Lanka
Mr. A.P. Heenkende & Mr. I.H.M.H.B. Herath
- An Assessment of Salinaization Status of Major Irrigation Schemes (Except Mahaweli Systems) in Southern Dry Zone of Sri Lanka
Mr. M.A. Roonage & Mr. T.M.J. Bandara
- An Assessment of Salinization Status of Soils in Mahaweli Systems
Mr. K.M.A. Kendaragama
- An Assessment of Salinization Status of soils in the North central dry zone Except Mahaweli Areas
Mr. K.M.A. Kendaragama
- Present Status of Rain Water Harvesting in Dry zone of Sri Lanka
Mr. G. Jayasinghe

- Present Status of Water Requirement for Conservation of Wildlife in the Dry and Arid Zones of Sri Lanka
Dr. Channa Bambaradeniya and Mr. Ajith de Silva
- Status of Ground Water extraction in the Dry and Arid Zones of Sri Lanka
Mr. Henry Gamage
- Impacts of Unsustainable Agriculture on Quality of Groundwater with Special Reference to Kalpitiya Peninsula
Dr. D.S.P.Kuruppuarachchi
- Impact of Fertilization on the Quality of water and Soil in Upcountry
Dr. K.A. Nandasena
- Effect of Land Titling in the Control of Land Degradation
Ms. Chandima Wickramasinghe
- Roles of Government, Private Sector and NGOs and Present Status of Community Based Resources Management to Combat Land degradation
Ms. M.A. Kumaradasa
- Policies Pertaining to Land Degradation
Dr. Percy Silva
- Land Related Legislation to Combat Land Degradation
Dr. Percy Silva
- Trends and Conditions of Drought
Mr. N.A.Amaradasa
- Present Status of Animal Breeding Programs for Dry and Arid Zones
Dr. L.P. Silva & Dr. C.M.B. Dematawewa
- An Assessment of Economic losses of Droughts
Dr. B.M.S. Batagoda
- Mitigation of Impacts of Natural Disasters on Land Degradation
Mr. N.M.S.I. Arambepola & Mr. R.M.S. Bandara
- Soil Fertility Status of Soils in Dry and Arid Regions of Sri Lanka
Dr. K.A. Nandasena
- Present Status of Soil Degradation in Sri Lanka
Dr. K.A. Nandasena
- Present Status of Research on Land Degradation and Drought
Mr. I. Dissanayake
- Guidelines for Drought Policy, Drought Preparedness Plan and Early Warning Systems for Mitigating the Impacts of Drought in Sri Lanka
Dr. B.V.R. Punyawardena
- Vegetation Recovery in Degraded Lands in Sri Lanka Attempts, Problems and research Needs from a Silvicultural and Agronomic Perspective
Dr. D.K.N.G Pushpakumara

ANNEX III

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