The Action Plan

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Foreword

Foreword

The Malawi Constitution, Chapter III, Section 13 (d) calls upon the State "to manage the environment responsibly in order to:

a. prevent the degradation of the environment;
b. provide a healthy living and working environment for the people of Malawi;
c. accord full recognition to the rights of future generations by means of environmental protection and sustainable development of natural resources, and
d. conserve and enhance biological diversity of Malawi."

Malawi participated at the United Nations Conference on Environment and Development (UNCED), popularly referred to as The Earth Summit, which was held in Rio de Janeiro, Brazil, in June, 1992. The principal outcome of the Conference is Agenda 21, an action plan for the whole world from now to the 21st Century and beyond, elaborating strategies and integrated programme measures to halt and reverse the effects of environmental degradation and to promote environmentally sound and sustainable development in all countries.

In pursuance of the constitutional responsibility and in response to the agreement made under the Rio Conference, Malawi's first task has been to produce a National Environmental Action Plan which details Malawi's environmental situation at the moment, with proposals on how environmental degradation may be slowed down, arrested or even reversed.

The National Environmental Action Plan has been produced using information gathered from both the private and public sectors, including the Non-Governmental Organizations; the local communities as well as from external consultants in specialised fields. It is, however, a national effort which belongs to the Malawi people.

The National Environmental Action Plan should be used as a reference document by all planners and developers including the donor community, to ensure that environmental protection and management is integrated into development programmes; and by all people from all walks of life to ensure sustainable development which will allow future generations to enjoy equally the natural

resources that we are enjoying today.

There are a lot of recommendations on what actions should be taken regarding specific degradations or environmental concerns. The people to undertake the different actions have also been mentioned. It is, however, everyone's responsibility to ensure that our natural resources are properly utilized and not to look for a specific regulation in order to respond.

I wish to urge all Malawians and both national and international investors, to follow the recommendations on actions stated in this document, and the ensuing laws and regulations on the management of the environment.

BAKILI MULUZI
STATE PRESIDENT

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Acknowledgements

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Abbriviations

ACB	Agricultural Communications Branch
ADD	Agricultural Development Division
ASA	Annual Survey of Agriculture
CITES	Convection on International Trade in Endangered Species
DAET	Department of Agriculture Extension and Training
DAHI	Department of Animal Health and Industry
DAR	Department of Agriculture Research
DC	District Commissioner
DDC	District Development Committee
DEAP	District Environmental Action Plan
DEVPOL	Statement of Development Policy
DGS	Department of Geological Surveys
DLV	Department of Lands and Valuation
DNPW	Department of National Parks and Wildlife
DOE	Department of Energy
DOF	Department of Forestry
DOI	Department of Irrigation
DOW	Department of Water
DR	Department of Roads
DREA	Department of Research and Environmental Affairs
DWASCO	Dwangwa Sugar Corporation
EAD	Environmental Affairs Division
EIA	Environmental Impact Assessment
EIP	Environmental Investment Programme
EIS	Environmental Information System
ESCOM	Electricity Commission of Malawi
FAO	Food and Agriculture Organisation
FD	Fisheries Department
FPA	Focal Point of Action
FPI	Focal Point of Intervention
GDP	Gross Domestic Product
GIS	Geographic Information System

GNP	Gross National Product
HYV	High Yielding Variety
IDEAS	Initial District Environmental Action Suggestions
IEC	Information Education and Communication
ITCZ	Inter Tropical Convergence Zone
KEI	Key Environmental Issue
LA	Local Authorities
LRCB	Land Resource and Conservation Branch
MEM	Ministry of Energy and Mining
MEPD	Ministry of Economic Planning and Development
MFNR	Ministry of Forestry and Natural Resources
MOA	Ministry of Agriculture
MOCIT	Ministry of Commerce Industry and Tourism
MOCS	Ministry of Community Services
MOF	Ministry of Finance
MOEST	Ministry of Education Science and Technology
MOHEA	Ministry of Health and Environmental Affairs
MOJ	Ministry of Justice
MOLMD	Ministry of Labour and Manpower Development
MOWCA	Ministry of Women and Children Affairs
NABW	National Association for Business Women
NCC	National Consultative Council
NCE	National Committee for the Environment
NEAP	National Environmental Action Plan
NGO	Non Governmental Organisation
NSO	National Statistical Office
OPC	Office of the President and Cabinet
PI	Project Ideas
PSIP	Public Sector Investment Programme
TA	Traditional Authority
SADC	Southern Africa Development Community
TF	Task Force
TFR	Task Force Report
STA	Sub Traditional Authority
SUCOMA	Sugar Corporation of Malawi
UNCED	United Nations Conference on Environment and Development
VDC	Village Development Committee

WRB	Water Resources Board
ZAB	Zaire Air Boundary

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Chapter 1: Introduction

1. Introduction

Malawi is a landlocked, densely populated country south of the Sahara. It occupies the southern part of the East African Rift Valley. The country lies between latitudes 9° 22' and 17° 03' S and longitude 33° 40' and 35° 55' E. The total territorial area is 119,140 km^2 of which, 20,908 km^2 (20%) is covered by surface water resources dominated by Lake Malawi. The country is bordered by Mozambique to the south, east and west; Tanzania to the north and Zambia to the west (Map.1).

Malawi is endowed with natural resources, which includes some of the most fertile soils for agricultural use in Southern Africa. The country has forest resources covering almost 40% of the land area, abundant water resources and a remarkably diverse flora and fauna, of which the uniquely rich and diverse fish resources stand out. If properly utilized, these resources can support sustainable development of the country. However these resources are currently challenged by a complex interaction of several factors which include:

The rapid rate of population growth of 3.2% per annum imposes an ever rising pressure on the country's natural resources, the human habitat and economic and social infrastructure;

i. frequent adjustments in fuel wood rates and urban and district water tariffs,
ii. stricter enforcement of estate conservation and afforestation covenants,
iii. strengthening of regulatory framework for pesticide use and industrial pollution,
iv. development of new soil conservation measures, and
v. institutional strengthening in environmental policy formulation.

Malawi is also committed to international environmental conventions as Contracting Party and has acceded to a number of conventions, listed in section 6.2.2.5.

In accordance with its own policies and as a signatory to 'Agenda 21' of the United Nations Conference on Environment and Development (UNCED), Malawi has shown greater commitment to environmental protection for sustainable development by

having its National Environmental Action Plan (NEAP).

The NEAP is a government undertaking to provide the framework for integrating environment in the overall socio-economic development of the country through broad public participation. Its specific objectives are:

1. to document and analyze all major environmental issues and measures to alleviate them;
2. to promote sustainable use of natural resources in Malawi;
3. to develop an environmental protection and management plan.

The NEAP also provides specific guidelines to:

a. actions to be taken by local communities with or without government/non-governmental assistance;
b. actions to be taken by government or ether agencies;
c. modify existing programmes and projects to adequately cover environmental concerns; and,
d. selection of projects for the Environmental Investment Programme (EIP).

The NEAP consists of three volumes, namely:

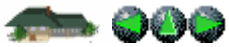
Volume 1: The Action Plan, which describes the environment and development in Malawi, identifies and discusses key environmental issues, prescribes actions to address these, and draws up the institutional framework for the implementation of the NEAP.

Volume 2: The Initial District Environmental Action Suggestions (IDEAS), which presents the conclusions from eight district workshops.

Volume 3: The Preliminary Environmental Investment Programme (EIP), containing project concepts, which have emerged through the NEAP process as priorities for further project preparation, thereafter it will become an investment programme in support of the Action Plan within the Public Sector Investment Programme (PSIP) .

The NEAP document has seven chapters. Chapter one gives the background and the objectives; while chapter two describes the process leading to the production of this document. Environment and development are discussed in chapter three, while environmental issues are analyzed in chapter four. Actions to mitigate environmental problems are presented in chapter five and the institutional framework for the implementation of the actions is presented in chapter six. The final chapter makes a

summary of the document and draws attention to the most important recent environmental policy decisions taken by the Government and highlights the most urgent policy recommendations of the NEAP.



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Chapter 2: The Neap Process

The Neap Process

The Malawi NEAP has been prepared through a broad integrative and participatory process as shown in Figures-2.1. and 2.2. The process was initiated by 18 task forces, based on sectors, resources or environmental problems as follows:

1. National Context;
2. Fisheries;
3. Forestry;
4. Water Resources;
5. Agriculture;
6. Energy and Mineral Resources;
7. Industry;
8. Tourism;
9. Transport and Communication;
10. Health and Sanitation;
11. Land Use Planning and Management;
12. Natural Hazards;
13. Population and Human Settlement;
14. Biological Conservation,
15. Policies and Institutional Framework;
16. Education and Public Information,
17. Research; and
18. Pollution Control and Waste Management.

Membership of task forces was drawn from Government Ministries and Departments, parastatals, including the University of Malawi, non-governmental organisations and the private sector. Through the task forces 185 persons from 51 institutions were involved in the preparation of the NEAP. The 18 task force reports provided descriptions, analyses, and identification of environmental issues as well as recommended remedial actions and project proposals. These reports (see Appendix 1), which were presented by September 1993, constituted technical background to the NEAP and are available to the public. The task force members also participated in the NEAP process through regular consultations as shown in Figure 2.2.

To ensure the participation of the local population to the NEAP process, eight consultative district workshops, each with the participation of three districts, were held between November 1993 and January 1994. Participants in these workshops included

government agents, politician, traditional authorities, journalists, and representatives of the private sector, and women income generating groups from each district. The workshops reflected the multiparty development of Malawi as eventually all parties were represented.

The main objective of the workshops was to involve local communities in the identification of localized environmental problems and in the formulation of possible solutions. Nearly nine hundred people attended the workshops as shown in Table 2.1 while the grouping of the districts for the workshops is shown in Map 2.

Each consultative workshop lasted 3 days. The preparation for the workshops involved a planning meeting with departments in direct contact with the rural communities to determine the type and number of participants but also to agree on the objectives of the workshops. The list of participants was sent to the Office of the President and Cabinet (OPC) which advised District Commissioners (DCs) to invite the participants accordingly.

During each workshop, the NEAP Secretariat introduced the objectives of the NEAP to the participants who thereafter worked in groups according to their district. This was followed by discussions in a plenary session. The groups identified environmental problems, possible solutions and principal players. Each workshop produced reports on the proceedings, specifying for each district environmental issues and recommended actions. These reports, initially produced in the local language, were translated into English by the NEAP Secretariat and are presented as Volume 2 of the NEAP. Hence constituted important inputs into the NEAP by the local population and will be the basis for future preparation of District Environmental Action Plans (DEAP).

The national media, both the newspapers and the radio, also played a key role by reporting regularly on the preparation of the NEAP.

From February through May 1994 improved NEAP drafts were submitted for consultations and scrutiny. The first draft was submitted to chairpersons and lead-person of all 18 task forces for written comments. The second draft was submitted for comments to Heads of Ministries and Departments, General Managers of parastatal organisations, Non-governmental Organizations and Private Sector as well as the donor community, all together 135 institutions. The same draft was then discussed at a 3 days National Workshop in May 1994. Thereafter the third NEAP draft was presented to and accepted for adoption by the National Committee for the Environment (NCE). The Government has formally adopted this document as its environmental policy document.

All together over 1,300 people from nearly 85 institutions participated in the process (see Appendix 2).

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Chapter 3: Environment and Development in Malawi

3. Environment and Development in Malawi

3.1 Introduction

Malawi is endowed with a number of renewable natural resources such as land, water, fish, wildlife and forests, which provide the basis for the sustainable socio-economic development of the country. This chapter gives an overview of Malawi's environment and natural resources, describes the countryman economy and productive potential. It also presents main characteristics of the human resources, population growth and finally introduces the institutional framework for the management of the country's natural resources and socio-economic development. This chapter is a summary of the description and analysis presented in the 18 NEAP task force reports. It also incorporates environmental concerns expressed by the eight consultative district workshops (see NEAP Volume 2).

3.2 An overview of Malawi's environment and natural resources

3.2.1 *Physiography*

Physiographically, Malawi can be divided into five zones; Rift Valley Floor, Rift Valley Scarp zone, Hill zone, Plains, and High Plateau. These are shown in Map 3 while Fig 3.1 shows the cross-section from Mulanje Mountain to the Shire River. The characteristics of the zones are shown in Table 3.1. Variations in altitude and latitude have given rise to a wide range of climate, soil and vegetation types.

3.2.2 *Climate*

Many climatic elements such as the rain, radiation and the wind have been successfully harnessed to provide food and energy for sustenance of life. Natural climatic fluctuations from year to year are termed climate variability. However, a change, which is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, and which is in to natural addition climate variability observed over comparable time periods is termed climate change. The climate change is attributed to an increase in atmospheric concentrations of

greenhouse gases: carbon dioxide, methane, chlorofluorocarbons and nitrous oxide, which are all a result of emissions from human activities. These gases trap outgoing long wave radiation in the lower levels of the atmosphere thereby resulting in global warming. The other contributing factor to climatic change is deforestation, which lays bare the earth's surface resulting in a radiation imbalance.

The impact of this climate change includes changes in precipitation, evaporation rates, and soil moisture among others. These may have serious effect on agriculture, water resources, energy, vegetation, health and the economy.

3.2.2.1 *Malawi's climate*

Malawi's climate is influenced by the country's proximity to the huge lake that covers almost two-thirds of its length. The climate is tropical continental with two distract season, the rainy season from November to April and the dry season from May to October. However, from May to July it is relatively cool and in some high altitude areas drizzles (Chiperoni rains) are common.

Annual rainfall in Malawi ranges from 700 to 1800mm. Its distribution is influenced by topography (orographic effects) and proximity to the lake. Least rainfall is registered in rain shadow areas such as in the Shire Valley, west of Shire Highlands and Zomba plateaux (e.g. Lake Chirwa area), north-west of both Viphya and Nyika plateaux. Highest rainfall is experienced in high altitude areas; for instance, Mulanje, Nyika and Viphya plateaux.

The main rain bearing system in Malawi is the Inter Tropical Convergence Zone (ITCZ). This is a Pro- cone in the equatorial low pressure belt towards which tile north-easterly and south-easterly trade winds of the two hemispheres converge. The ITCZ oscillates randomly across the country during the rainy season and produces widespread rainfall. The rains start in the Southern Region and progress northwards. Other rain bearing systems that affect Malawi are:

Zaire Air Boundary (ZAB) - a recurred south Atlantic south-east trade winds which after picking moisture over the Atlantic and Congo (Zaire) rain forests arrives in Malawi via Zambia as a moist north-westerly wind bringing widespread rainfall.

Tropical Cyclones - are intense low-pressure cells that originate in the Indian Ocean and move from east to west and can bring widespread heavy, rainfall, mainly in the south, depending on their position in the Mozambique Channel. These rains usually result in flooding.

Convergence ahead of pressure surges - as high pressure cells continue to move over the southern tip of the sub-continent, convergence develops ahead of pressure surges, causing isolated but locally heavy, rains that precede the onset of the rainy season, i.e. before the ITCZ becomes established over the country.

Easterly Waves - towards the end of the rainy season, around March and April, easterly waves exist in the upper levels of the atmosphere, resulting in isolated but locally heavy rains in some parts of the country.

The mean annual minimum and maximum temperatures for Malawi range from 12 to 32 degrees Celsius. The highest temperatures occur at the end of October or early November, but thereafter the rains bring moderating effects. The coldest months are June and July.

Highest temperatures are recorded in the Shire Valley and along the lake shore while the lowest are recorded over the high attitude areas particularly the Shire Highlands, the Viphya and Nyika plateaux, Dedza and Mulanje mountains and other high-altitude areas. Frost is rare but has at least been recorded at chitedze, Lilongwe, Dedza, Bvumbwe, Mimosa, Chichiri and Mzimba meteorological stations.

3.2.3 *Soil classed*

The country has four main soil classes, namely:

(i) Latosols: These are red-yellow soils which include the ferruginous soils of Lilongwe plain and some parts of Southern Region and are among the best agricultural soils in the country. The weathered ferrallitic (plateau or sand-veld) soils some with a high lateritic content, are of low natural fertility and can easily be exhausted. Ferrallitic soils cover large parts of the plains along the western border of the country. In high rainfall areas such as Nkhata Bay, these soils are leached.

(ii) Lithosols: The most wide-spread of the lithosol group are the shallow stony soils that are associated with steep slopes. These occur in all areas of broken relief in the country.

(iii) Calcimorphic soils: This soil group includes the alluvial soils of the lacustrine and riverine plains; the vertisols of the Lower Shire Valley and the Phalombe plain; and the mopanosols in the Liwonde and Balaka areas.

(iv) Hydromorphic soils : These are grey soils of the hydromorphic group which are in found either seasonally or permanently wet areas, as in Lake Chilwa plain and Lower Shire

Valley, and localized marshy areas known as "dambo".

Most of the soils in the rift valley are of; alluvial origin, rich in nutrients and ideal for agricultural production. On the escarpment slopes and plateaux the soils are heavily leached and of medium fertility. In the hilly places the soils are shallow, and such areas are used as catchment areas and for protection of indigenous fauna and flora.

3.2.4 *Land Resources*

3.2.4.1 *Present and potential land suitability*

The distribution of present and potential land suitability for rain-fed agriculture is affected by factors such as: topography, slope, rainfall, temperature, soil type and depth. The pregnant and potential land suitability by region is shown in Table 3.2.

At national level, only 31% of the country's total land area is suitable for rain-fed agriculture at *traditional level of management*; another 31% is only marginal. However, the amount of suitable land almost doubles, from 2,954,500 ha to 5,741,950 ha (61%) with *improved level of management*. This increase comes from the decreases in marginal and unsuitable land percentages from 31% to 17.5% and 37% down to 21.6%, respectively.

At present, cultivated land exceeds the suitable land for rain-fed agriculture at traditional level of management (Table 3.3.)

By 1990, 49% of the country's land resources was under cultivation, yet only 31% of the countrymen land is suitable for rain-fed agriculture; an indication that the 18% must have come from marginal land. At improved level of management total suitable land for the country is 61% (5,917,950 ha) i.e. suitable and marginal land. Since cultivable land and human population are not evenly distributed, there is a good chance that not only is marginal land increasingly being cultivated, but unsuitable land as well is brought under arable cultivation at a very fast rate. Indeed, visual observation throughout the country supports this.

As many farmers do not follow soil conservation practices, expansion of agriculture into marginal and unsuitable areas poses a lot of problems for the country's sustainable agricultural development.

It is also important to note that some of the suitable land,: about 500,000 ha, is in reserved areas, national parks, forest and wildlife reserves; while another 250,000 ha is staying idle in estates (Eschweiler, 1993)

3.2.5 *Wetlands*

Malawi contains some of the world's important wetland ecosystems. The most important wetlands include shoreline plains of Lakes Malawi, Chiuta, and Chilwa, a diversity of dambo ecosystems, and marshes of the Shire river system.

3.2.6. *Vegetation types*

The wide variation in physiography, climate and edaphic factors has given rise to a large variety of vegetation types. Several attempts have been made to identify major biotic communities and Clarke (1983) noted the following as the major biotic communities of Malawi:

1. montane evergreen forest;
2. montane grassland;
3. semi-evergreen forest;
    a. closed canopy woodland of wetter uplands (tall Brachystegia spp);
    b. open canopy woodland of plateaux Brachystegia / Julbernadia / Isoberlinia);
    c. open canopy woodland of hills and scraps (Brachystegia spp);
    d. open canopy woodland fertile areas (Piliostigma / Acacia / Combretum);
    e. mixed thicket/woodland of drier upland;

5.
    a. mopane woodland;
    b. wood land soft fertile areas (Adansonia / Cordyla / Falderbia albida);
    c. thicket/savanna of poorer areas (Combretum/Acacia);
    d. woodland savanna of poorer areas (mixed species);

6. sand dune vegetation;

    a. Grasslands (seasonally wet);
    b. grasslands (perennially wet/swamp);
    a. lakes (fresh water);
    b. somewhat saline lakes (without outlet); and

7. Islands.

Only four of the biotic communities (4a, 4d, 6 and 8b) are not under the protection of forest, national parks and wildlife reserves. However the protection of 8a and 9 is limited to about 12 km^2 as represented by the Lake Malawi National Park.

3.2.7 *Forest resources*

Malawi's forest occupies 3.6 million hectares or 38% of the country's land area. Indigenous forests cover 97% of this area, while the balance consists of plantations. The type of forest cover varies according to climatic, physiographic and edaphic factors. It has been estimated that there are about 6000 species of flora in Malawi. The most dominant forest species are Brachystegia, Julbernadia and Isoberlinia. These species produce high quality firewood and building poles.

The regional distribution of forest resources and population is shown in Table 3.4. Forests are a vital natural resource in Malawi. They supply 93% of the country's energy needs, provide timber for construction and industrial use and environmental and recreational services. It is estimated that about 48% of indigenous forests are held under customary land tenure (see section 3.5.1) by the local communities (Eschweiler 1993). These forests are not managed and there is no charge on wood collected from customary forests by local people for household use. However, extraction of protected trees (Table 4.5) from customary land as well as from forest and wildlife reserves require payment of fees, but these are rarely collected due to deficiencies in the revenue collecting institutions of the Ministry of Forestry and Natural Resources (MFNR).

Gazetted forest reserves are somehow better managed than wildlife reserves and customary forests which are not managed at all. Although productivity of indigenous forests, is generally low, there are variations between customary forests, forest reserves and wildlife reserves attributed to forestry management.

All wood products from Government forest reserves require payment of a higher fee for commercial use than a lower fee for household users.

3.2.8 *Water resources*

Malawi has rich surface water resources comprising a network of river systems and lakes, covering 20% of the country's territorial area. The most dominant water body is Lake Malawi. Other extensive water bodies include Lake Chilwa, Lake Chiuta, Lake Malombe, and the Shire River. The most important rivers are Shire, Songwe, North Rukuru, South Rukuru, Dwangwa, Bua, Linthipe, Ruo, Phalombe and Mwanza Rivers (Map 2)

The surface water resource is totally dependent on rainfall. Most rivers and lakes display seasonal flow patterns and dry up to a large extent in the dry season. Shortage of domestic water supply is common in rural areas during the dry season, and in urban

areas during drought.

The drainage system has been divided into 17 water resources areas which are further subdivided into 78 water resources units. The most important characteristics of the major river basins are shown in Table 3.5.

The country's ground water resources are not yet fully quantified. Nevertheless two major types of aquifers have been identified, the extensive but low yielding (1-2 litres, per second) weathered basement aquifer of the plateau area, and the high yielding (up to 15 litres per second) aquifer of the lakeshore plains and the lower Shire River.

Malawi depends on its water resources for various purposes such as drinking, industrial development, hydro-power, rain-fed and irrigated agriculture. However, irrigation has plated only a small part in agricultural development in Malawi. At present about 25,000 ha are irrigated, of which 16,000 ha are on two large sugar estates (SUCOMA at Nchalo and DWASCO at Dwangwa) and a further 3,600 ha on 16 government owned smallholder rice schemes scattered throughout the country. The main potential for future medium-sized and large scale irrigation development lies along the lakeshore, using water pumped from Lake Malawi and in the long term, by major gravity canals. There is also some potential in many areas for small-scale self-help irrigation, for which the potential is estimated at over 100,000 ha.

Feasibility studies for an extensive irrigation project in the Lower Shire have been conducted but possible benefits for such projects should be weighed against the threat they may pose to the affected wetlands.

Lake Malawi and the Shire River also serve as a cheap means of transportation. Passenger and cargo vessels ply the Lake Malawi waters while smaller passenger boats cruise on the Shire River. The two water bodies have some of the finest tourist attraction sites in the country.

3.2.9 *Energy resources*

Malawi's main source of energy is biomass, accounting for 93% of total energy used. Forests are the major source of bio-energy. Petroleum products account for 3.5% while hydro-electricity constitutes only 2.5% of the energy consumed. The remaining 1% comes from coal, ethanol and other forms of energy not widely used e.g. solar energy.

The hydropower potential is concentrated on the Shire River. Its estimated total capacity is about 600 Megawatts, which would

provide nearly 3,500 Gwh of electrical energy. To date, 164 the plant capacity has been installed. A number of hydro-power plants are under construction on the Shire River and these include a 50Mw at Tedzani falls to be commissioned in 1995 and 128Mw at Kapichila falls to be available towards the end of this century. There is also a mini-hydro project of 4.5Mw on the Wovwe River, which will be commissioned in 1996. This is part of rural electrification programme. Several smaller rivers, such as the Songwe, South Rukuru, Dwangwa and Bua have limited hydropower potential at a number of small sites, estimated at about 300-400 Mw.

With regard to petroleum products, the country relies wholly on imports as nothing is produced locally except ethanol, which is used for blending with petrol. Ethanol production is nearly 18 million litres annually.

At present coal production is at Mchenga Coal Mine in the north and is about 52,000 tonnes per year (1991/92) while the demand is estimated at 110,000 tonnes. Coal deposits of various grades occur at several locations in the country. This is generally high quality coal with low sulphur content. It may therefore be exploited, subject to Environmental Impact Assessment to determine the effects of such mining operations and of the utilisation of the coal.

While investigation on application of alternative sources of energy such as biogas and wind energy is required, little has been done so far. The wide utilisation of solar energy is, however, hampered by the high cost of solar energy apparatus.

The contribution the energy sector makes to the economic and social development of the country is obvious. However, the extremely high reliance on biomass for energy needs imposes heady strains on the country's forest resources and contributes to their rapid depletion. Hence there is need to develop alternative energy sources and/or increase availability of electricity and coal at affordable prices to the ordinary Malawian.

3.2.10 *mineral resources*

The mineral resources of Malawi are not fully known and only a few have been identified and quantities estimated. Among them are bauxite at Mulanje and rare earth element minerals. Identified elements include monazite and strontianite, usually in association with pyrochlore, apatite and zircon. World demand for rare earth elements for use in high technology applications such as permanent magnets, colour television, lasers and superconductors has increased. Hence the identified elements could be exploited for the benefit of the country. In addition, traces of gold have been located in Lisungwi Valley, but more work is required to

determine available quantities.

Some industrial minerals have also been identified in Malawi. Deposits of limestone, marble, vermiculite, kaolinitic clay, corundum, kyanite, glass sands, graphite, phosphates and heavy mineral sands have been ascertained.

Although the country has these minerals, the mining industry is still in its infancy. The existence of bauxite on Mulanje Mountain, said to be the largest in the SADC Region, has been known for sometime, but it is only now that a feasibility study to exploit it is being done. Similarly, it is now that feasibility studies are programmed for vermiculite, and graphite. Portland Cement Company is making good use of limestone through quarry and clinker factory at Changalume in Zomba and a milling factory in Blantyre. A total amount of 107,040 tonnes of limestone was quarried in 1987 and 72,831 tonnes of cement were sold.

3.2.11 Fish resources

Malawi has diverse fish resources, comprising 500-1000 species. All but six of which are endemic. Lake Malawi is the most major source of fish. The diversity of fish fauna in the lake is influenced by its unique biophysical characteristics: long, deep and narrow basin; clear water which permits visual detection of fish at depths of 17 metres; anoxic water below 250 metres, which are largely devoid of fish life; a marked seasonality of weather and lake surface conditions; and large stocks of mostly small-sized fish. Main types of fish from Lake Malawi are Oreochromis Spp (Chambo), Baplochromis spp (Kampango), Lethrinops spp (Chisawasawa), Clarias spp (Mlamba), Bathyclarias spp (Bombe), Lebeo mesons (Ntchila), Opsaridium microlepis (Mpasa) and Opsaridium microcephalus (Sanjika). Oreochromis spp are predominant in landings in the south, whereas Haplochromis (Utaka) are most predominant in the north.

Percentages of total fish landings are shown in Table 3.6. Lake Malawi contributes between 40 and 60% of total fish landings while Lake Chiuta contributes only 1 to 3%. In addition rivers on their own have some 30 species of fish and more than half of them are cyprinids. With the exception of the catfish (Clarias gariepinus) all of the commercially important species are endemic cyprinids and most are of high unit value.

A number of rivers drain into the lakes, thereby replenishing nutrients for primary production of phytoplankton. The balance of nutrients in the lake is a function of factors such as seasonal inflow from rivers, losses into the deeper water and through the Shire River and the release of nutrients from deeper levels due to wave action.

The fishing industry is labour intensive with an estimated 35,000 full-time artisanal and an additional 1,000 employed in the commercial sector. Almost 90% of all fish landings come from artisanal fishermen who use dug-out canoes. Another 200,000 people are estimated to be working ashore as fish traders, boat builders, net makers and in other support industries. The fisheries sector contributes about 4% to the Gross Domestic Product (GDP).

Overall fish production rose dramatically from 20,000 tonnes in 1965 to 84,000 tonnes in 1970s but has since fluctuated between 60,000 and 80,000 tonnes. The estimated potential sustainable catch is in excess of 100,000 tonnes. Lake Malawi's annual fish yield is about 50,000 tonnes with an estimated value in the order of MK200 million (US$50 million, 1993)

Fish accounts for 60-70% of the animal protein taken by the population (ICLAM/GTZ, 1991). Fish, especially the Oreochromis asp (Chambo) accounts for 10% of food expenditure of the average household in the lowest income category. Scarcity of fish will therefore cause a significant negative impact on the nutritional status of the population, particularly the children.

3.2.12 *Wildlife resources*

Malawi is endowed with diverse flora, fauna and microbiota, ranging from low-lying rift valley woodlands to montane forest grasslands and water bodies with at least 3,500, 4,000 and 1,000 species of plants, animals and micro-organisms that have been described so far. More are yet to be described. To date 1,500 species of vertebrates: 163 mammals, 92 reptiles, 54 amphibians, 538 species of fish and 620 species of birds have been described (Sweeney 1970, Konings 1990, Ansell 1985 and 1989, Ansell and Dowett 1988 and Newman et al 1992).

The distribution of animals in Malawi is mainly affected by the topography, vegetation types and human activities. In order to protect the rich biodiversity, the Government has established five National Parks and four Wildlife Reserves, accounting for 11.6% of the country's land. The areal extent of these protected areas is shown in Table 3.7. The spatial distribution of national parks, wildlife and forest reserves is depicted in Map 4.

The Lake Malawi National Park, established in 1980, is the first freshwater and underwater national park in Africa. It is now a United Nations World Heritage site.

The actual and potential benefits of wildlife to man are many and include: aesthetic, scientific, cultural and recreational values.

Protection and management of wildlife resources is important as a source of genetic diversity, food, trophies, timber and of tourist attraction.

At present the contribution of wildlife to the national economy is very small, largely because the potential of tourism has not yet been exploited fully.

3.3 **An overview of population and human resources**

Malawi's population growth rate, currently at 3.2% is one of the highest in the world. This high rate is due to a number of factors such as a high and stable total fertility rate of 6.7 births per woman (1992), early marriages for women, a low percentage of families practicing child spacing partly due to low uptake of contraceptives. The crude death rate has declined slowly from 25 in 1977 to 19 per 1000 in 1987. The total fertility rate has slightly decreased from 7.6 in 1977, to 7.4 in 1987 and down to 6.7 in 1992. Although infant and child mortality rates have dropped to 16 and 26% respectively, they are still among the highest in the world.

3.3.1 *Demographic trends*

The population of Malawi, shown in Table 3.8, has increased from an estimated 737,200 in 1901 to the current 1994 estimate of about 10.0 million.

The Average Annual Growth Rate sharply increased from 2.9% to 3.7% from 1977 to 1987 partly due to high influx of refugees from Mozambique. At the peak of the influx there were over one million Mozambican refugees in Malawi. Approximately 50% have so far been repatriated.

The growth rate excluding the Mozambicans is now put at 3.2%.

According to 1977 and 1987 censuses, it is clear that Malawi has a young population with 46% below 15 years of age. This has brought about high dependency ratio of 1.01 for each economically active adult.

3.3.2 *Regional demograph tic profiles*

The distribution of Malawi population is not uniform among the three regions. The 1987 census showed that almost half of the population was in the Southern Region which has about a third of the country's land area t see Table 3.9). In contrast, the Northern Region, with a quarter of the land area, had 11% of the population.

In 1987, the population density was the highest in the South with 125 persons per square kilometer, followed by the Central and North with 87 and 34 persons per square kilometer respectively. These regional variations are partly a reflection of the disparities in employment opportunities and basic infrastructural facilities.

3.3.3. *Rural to rural and rural to urban migration*

Substantial rural to rural migration has been noted during the 1977-1987 period mainly from densely to sparsely populated districts. Similarly rural to urban migration has also been significant, at the rate of 3.6% per annum. In the 1977 census the total population living in urban areas was 8% but the percentage had risen to 11%.

3.3.4 *Literacy levels*

The male-female disparity in literacy in Malawi has been an area of policy concern. Table 3.10 shows that at national level only 34% of the population aged 5 years and comprising females attended education compared with 54% males. This situation is mostly attributed to the general preference of parents to invest more in male education than in female education. It is widely believed that there exists an inverse correlation between literacy and fertility rates. Total fertility rates begin to decline with higher female educational attainment.

In Malawi statistical evidence indicate that the low level of literacy among females may be one of the contributory factors to the high total fertility rate of 6.7. With low literacy levels large number of children offer an attractive alternate form of future social and economic security.

Table 3.10 also shows that less than half of the population aged 5 years and above had some education. It further shows that only 42% of the population of similar age attended primary school education only. The regional differentials are significant as shown by the figures.

3.4 **Overview of the economy and productive potential**

3.4.1 *Macroeconomic environment*

Following independence in 1964, Malawi's development strategy focused on open market, export oriented growth, based on agriculture. Special emphasis was placed on infrastructure and estate agriculture as the vehicles for increased production and growth. GDP grew at an average annual rate of 5.8% between 1965 and l980, and real per capita income grew by 3% a year. By mid-1970s, however, falling world prices for the countrymen

export (particularly for tobacco and tea), rising oil prices and the disruption of transport networks through Mozambique, led to rapid decline in Malawi's terms of trade, a fall of 2.8% between 1978 and 1981. This situation was aggravated by the drought in 1979/80 and other factors such as the need to import maize, the maturation of external debts, and rising interest rates. These factors led to a marginal positive GDP growth rates in 1980 and 1981; a balance of payment current account deficit, which rose from 7.1% of GDP in 1977 to 24.7% in 1979, and a budget deficit which increased from 7.6% of GDP in 1977 to 15.9% in 1981.

In 1981 Malawi, embarked on Structural Adjustment Programme. Despite improvement in the growth rate to 4.1% between 1982 and 1985, the country experienced further economic setbacks in the form of increased external transport costs, influx of Mozambican refugees and continued deterioration in the terms of trade. Notwithstanding the structural adjustment programmes, Malawi remains one of the poorest countries in the world whose per capita GNP in 1993 was MK991 (US$225). The withdrawal of non-humanitarian aid by the donors and drought in 1992 caused further deterioration in macro-economic indicators, with the 1992/93 fiscal deficit, before grants, rising to 15.7% of GDP and inflation reaching an average of 22% over 1992. However, in December 1993 most donors lifted the withholding of aid to the country.

3.4.2 *The structure of the economy and sector shares of the labour force*

Malawi continues to rely on agriculture as the backbone of the economy and main engine of growth. Agriculture supports 85% of the population and accounts for 35% of GDP (single largest sector) and 80% of the labour force (Tables 3.11 and 3.12, respectively). Agriculture also contributes 90% of foreign exchange earnings.

The industrial sector is the second most important in terms of output and accounts for about 13% of GDP and wage employment. This sector has, however, been on the decline in the recent past. After experiencing rapid growth in the 1960s and the 1970s, averaging 9.6%, the sector performed poorly in the 1980s, registering a growth rate of only 3.4%. In 1992 industry grew by 2.1% as compared to the 3.7% in 1991. However, its share to GDP has almost remained static, only rising from 12.3% in 1987 to 13.9% in 1992. Other important sections in terms of contribution to GDP are Government services and distribution, averaging 14% and 12% respectively.

3.4.3 *The Structure of the agricultural sector*

Malawi's agricultural sector is characterized by two distinct farming systems; the smallholder and the estate, which are differentiated by socio-economic conditions such as regulations which define production, marketing and pricing, and land use.

3.4.3.1 *The Smallholder sub-sector*

An estimated 1.6 million smallholder farm families operate under customary land tenure on 4.5 million hectares and produce 80 % of Malawi's food and 10% of exports.

The proportion of the smallholder farming households cultivating less than 0.5 ha has increased to 48% in 1992/93 from 23 percent in 1984/85 (refer Table 3.12). Since 77% cultivate less than 1.0 hectare, it indicates an increase in the smallholder population relative to the farming land. The majority of smallholders do not use improved seeds and fertilizer. Yet smallholders (77%) with less than 1 ha. produce 25% of the total maize production. Maize yield is usually 800 kg/ha since most do not have access to or cannot afford to purchase modern inputs. The resulting low incomes constrain their capacity to undertake soil conservation measures. This category of farmers are often net consumers and have to struggle to purchase maize for about four months prior to harvest at 30-50% above the producer price

3.4.3.2 The estate sub-sector

Estates are those farms which occupy leasehold and freehold land and a minimum of 10 hectares is required to register as an estate. In 1393 there were about 26,000 estates in Malawi occupying 1.2 million ha or about 19% of the total cultivated areas. Estates mostly produce flue-cured and burley tobacco on about 40% of the estate area and maize on about 42~. Other estate crops are tea, sugar, coffee and tree nuts. Estates contribute the major proportion of total exports, which was about 70% in 1990. Estate land has increased from 67,000 ha in 1967 to 843,327 ha in 1989. Currently the estate sector occupies 1.2 million ha and the majority of the estates are basically enlarged smallholder farms, since they lack all or most of the characteristics of an agricultural estate. Estate development has been most extensive in the central region accounting for 77% of the total number of estates and 67% of the total estate area. Estates have better access to modern farm inputs and credit facilities. Furthermore the security of tenure for estate provide improved incentives to undertake productivity enhancing investments in agriculture resulting in higher yields.

3.5 **Institutional framework**

3.5.1 *Political and administrative set-up*

Malawi gained its independence in 1964 from Britain and became a Republic within the Commonwealth in 1966. After adopting a one-party Constitution in 1967, it reverted to multi-party democracy in 1993 following a national referendum.

Administratively, the country is divided into twenty-four districts (Map 2) in three Regions. The Northern Region has five districts, the Central Region has nine while the Southern Region has ten. Each region is headed by a Regional Administrator; while the districts are headed by District Commissioners.

The State functions through a President, who heads the Government, consisting of Cabinet Ministers and their Ministries and Departments, which form the Executive Branch. The National Assembly, forms the Legislative Branch for promulgation of laws and the Judiciary, oversees the implementation of the laws. Apart from these, Traditional Authorities (TAB) administer customary laws.

National development projects are executed by ministries, departments and parastatals who submit their development project proposals to the Ministry of Economic Planning and Development (MEP&D) and the Treasury for approval and financing.

Each district has a District Development Committee (DDC), chaired by a District Commissioner. The DDC plans micro-projects executed by the local communities through self-help with government providing materials such as cement, timber and iron sheets and the people providing labour. Most of the projects involve construction of roads, bridges, school blocks postal agencies and teacher's houses. The DDC is represented at local level by Village Development Committee (VDC) for implementation of the projects.

Social services in the cities, town and district are provided by their respective councils that are treated as parastatals in terms of their development projects.

3.5.2. *Environmental institutions* .

In order to integrate natural resource issues and environment in economic planning, Malawi has developed an institutional structure comprising both sectoral and cross-sectoral agencies.

The MFNR includes four important departments: Departments of Forestry (DOF), Fisheries (FD), Geological Survey (DGS), and National Parks and Wildlife (DNPW) with responsibilities for the corresponding natural resources. Closely related to these is the Department of Energy (DOE). The Department of Lands and

Valuation (DLV) has the main responsibility to define, assess and execute land policies. The Water Resources Board (WRB) formulates water policies and oversees the management of these resources through the Department of Water (DOW), which also has the authority to carry out regulations regarding pollution control. In the Ministry of Agriculture (MOA) the four technical departments (agricultural research; agricultural extension and raining; animal health and industry and irrigation), the Land Resources and Conservation Branch (LRCB), Agricultural Communication Branch (ACB) as well as the Smallholder Agricultural - Credit Administration (SACA) all play an important role in the management of natural resources and the environment.

The MEP&D is responsible for appraising environmental implications of programmes and projects.

In 1982 the National Committee for the Environment (NCE) was established as a high level body composed of senior officials from Government departments, statutory bodies and the University. It is responsible for ensuring that all economic and social activities in the country are consistent with sustainable development goals and for resolving inter-departmental conflicts in environmental management. The current chairman of the NCE is the Secretary to the President and Cabinet.

In 1991 the technical secretariat of the NCE, called the Environmental Unit, was merged with the National Research Council of Malawi to become the Department of Research and Environmental Affairs (DREA) under the Office of the President and Cabinet (OPC). The former Environmental Unit was reorganized to become the Environmental Affairs Division (EAD) of PREA with wide ranging functions for overseeing, directing and coordinating environmental activities.

3.5.3 *Environmental legislation*

Malawi has more than forty statutes on the environment. The major legal regimes for these statutes include laws pertaining to land, forests, water, agro-chemicals, wildlife, and land use planning. Because of weaknesses that undermined the efficacy of the laws and indeed their enforcement, most of the statues have been revised while some are still being revised at present. Most notable weaknesses were in the scope and content of the statutes making it difficult to identify a party or parties responsible for environmental damages. Where the perpetrating parties were identified, the legislation failed to provide for adequate penalties to have any effect. Hence the ongoing revision should empower relevant departments with essential Pectoral legal instruments to bring perpetrators of the environment to book.

Another major weakness is that currently Malawi has no general environmental legislation that establish national conservation principles and provides guidance and coherence to natural resource management. The deficiencies lie in the absence of a framework law to deal with such cross-sectoral issues as overall environmental policy formulation, environmental planning, environmental quality criteria and standards, environmental impact assessment, pollution of environmental media, institutional co-ordination and conflict resolution, and the monitoring of implementation of environmental policies by Pectoral agencies. An "Environment Management Act" is being prepared to address this weakness. A first draft, prepared with UNEP technical assistance, is currently being reviewed by a special inter-ministerial task force.

3.5.4 *The property regimes*

Malawi embraced the capitalistic ideals since independence. People had exclusive rights to their property except when they were deemed enemies of state by sabotaging the economy, in which case their property was forfeited to Government. However, the Forfeiture Act has since been repealed.

With regard to land ownership, there are five distinct classes existing in, Malawi as follows;

3.5.4.1 *Customary land* : this is land held in trust for all the people of Malawi by the President, who delegates his authority to chiefs. The land is commonly held and distributed to the people by local chiefs. Although each person has recognised ownership to his piece of land, he cannot trade on it as the land can be reassigned to some other person if the Chief deemed it proper to do so. There is therefore no incentive for the "owners" to invest in long term conservation of the land. A coherent system in distribution of the land exists in both in matrilinial and patrilinial societies and ensures that there is no undue interference with known ownership. This system has allowed smallholder agriculture to survive without access to bank loans.

3.5.4.2 *Leasehold land*: this is part of private land that is leased by individuals or other legal persons. The lease period varies according to type of land and the purposes for that land. Currently these fall into three groups of 21 year old leases for agricultural land; 33 to 99 year old leases for property and infrastructure developments; and over 99 year leases for developers who may have to sub-lease to tenants on 99 year leases.

3.5.4.3 *Registered land*: this is grouped into two classes called customary registered and adjudicated land. The first exists in Lilongwe District only. This land is registered in area leader's

names with all the families in that area registered, including the sites of their land holdings. There is implicit freehold status for each family as it can trade in its holding by leasing out or selling bits of it with the group's consent. Loans can therefore be obtained on the strength of their certificate to the land. The second class is basically a simplified leasehold system, which allows for owners to have a certificate for their piece on the basis of a survey and registered number. This is currently in place in the Cities of Lilongwe and Blantyre. It is being introduced in Zomba and may be developed countrywide.

3.5.4.4 *Freehold/certificate*: this class embraces private land subdivided into:

(a) Freehold: this is land, which has been granted in freehold to persons. The Government has no specific control in the transactions on this land and no rent is charged. It is difficult to enforce conservation measures on this type of land;

(b) Certificate: a dying group of ownership, a relic from the colonial system, which allowed settlers to obtain a certificate for the land they were holding. These certificates have freehold rights and the environmental responsibilities are non-existent.

3.5.4.5 *Public land*: public land is Government land for Government's use. If there is need for infrastructure development, the land in question is converted to public land and utilized as such.

Schools, hospitals, government offices, markets and roads are built on this type of land. Forestry reserves, wildlife reserves and National Parks fall into this category too.

(see Table 3.13)

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The Action Plan

Chapter 4: Envirnmental Issues

4. Envirnmental Issues

4.1. Methodology for analysing environmental degradation in Malawi

The objectives of the NEAP are described in Chapter 1. Through the NEAP process, environmental degradation in Malawi has been analyzed and environmental issues identified with a view to establish a framework for specific actions to address environmental problems. These actions are presented in Chapter 5.

Identification of environmental issues was done by reading through the 18 NEAP task force reports (see Chapter 2). In these reports a wide range of environmental problems are described and analyzed. To get an overview of all environmental issues, the task force reports were analyzed to identify problems and causes in each report. Another source of data was a series of eight consultative district workshops on the environment. The definition of an environmental issue was rather broad, including both problems, factors, consequences and causes. These environmental issues were categorized and grouped together, and linkages between issues established through flow-charts, as shown in Figures 4.1 and 4.2. Using these flow charts a model was developed, illustrating environmental degradation in Malawi (see Figure 4.3). Through this model the following nine key environmental issues were identified, which are further described in section 4.3. of this chapter:

a. Soil erosion;
b. Deforestation;
c. water resources degradation and depletion;
d. Threat to fish resources;
e. Threat to biodiversity;
f. Human habitat degradation;
g. High population growth;
h. Air pollution;
i. Climatic change.

The flow charts (Figures 4.1 and 4.2) show that the causal chains for environmental and natural resource degradation are very complex and intertwined such that one set of issues may often being causes of other issues. The analysis also revealed that there

is one set of causal factors which are common to all key environmental issues and these constitute the nexus of population growth, poverty, illiteracy and lack of environmental information and awareness. This nexus is discussed in section 4.2, before each individual Key Environmental Issues is presented in section 4.3.

4.2 The nexus of population growth, poverty, illiteracy and lack of environmental information and awareness.

As indicated before, Malawi is among the poorest countries in the world whose per capita GDP was MK 991 (US$ 225) in 1993 and about 60% of its population was below the poverty line of US$ 40 per capita per year. Its population growth of 3.2% is high and so is the illiteracy rate above 50%, the latter contributes to the lack of environmental awareness. The land resource is threatened by the demand placed on it by the very poor who, because of low literacy, have little access to information on sustainable agricultural practices. This nexus of population growth, poverty and illiteracy has led to a sub-optimal and unsustainable resource utilisation. The poor, being the most affected, have heavily discounted future income and pursue sub-optimal social consumption decisions, leading to environmental degradation.

This nexus and its negative implications on the development of the country, represents enormous challenges, which the Government is trying to address. Unfortunately, inadequacies in development policies as well as in the legislation and its enforcement have made it more difficult to counteract the negative consequences on the environment. Over-reliance on agriculture as a main engine of economic growth and inadequate development in the industrial and service sectors have promoted agricultural expansion with land use that has progressively deviated from suitable use at the present level of technology (i.e. "traditional management"). The consequence of this is that an increasing proportion of the total cultivated land is exposed to degradation. Of the 4.6 million hectares of cultivated land, only 2.95 million hectares are suitable for agriculture under traditional management while the difference is marginal and unsuitable. This has been further exacerbated by other short-comings such as inadequate distribution and access to fertilizers as well as on a pricing policy where the incentive framework for adoption of soil conservation technology have been undermined.

The combinations of the nexus and the inadequacies have brought about unsustainable resource utilisation and improper land use and waste management. The effects have been resource depletion, deforestation, overgrazing, land scarcity, agricultural expansion and contamination (Figure 4.3) which have brought about the key environmental issues analyzed in section 4.3.

4.3 Key environmental issues

4.3.1 *Soil erosion*

4.3.1.1 *Extent of soil erosion*

Soil erosion is one of the major types of land degradation that poses biggest threat to sustainable agricultural production and also leads to contamination of water resources. Although no comprehensive studies have been conducted, results from spot trials of soil erosion under various cover and farming practices have shown that soil loss ranges from 0 to 50t/ha/year (Amphlett, 1986; Kasambara, 1984; Machira, 1984). An erosion hazard map of Malawi as compiled by Khonje and Machira (1987) shows the highest estimated soil loss to be 50t/ha/year (Map 5).

The World Bank (1992) estimated soil loss and calculated its impact on yield. The results are shown in Table 4.1 and Map 6. Soil loss ranges from 13t/ha/year in Machinga ADD to 29t/ha/year in Karonga and Blantyre ADDs. For the main agricultural areas in Malawi, Kasungu and Lilongwe ADDs, the soil loss was 20 and 22t/ha/year respectively. The national average was estimated to be 20t/ha/year. Taking into consideration different assumptions, the World Bank estimates that the above soil loss leads to a mean yield loss of between 4 and 11% for Malawi as a whole thus translating to economic value or mean annual income loss of between MK10 and MK29 per hectare. These estimated soil losses are higher than what Amphlett (1986) found for the Bvumbwe area where he reported soil losses for traditional level of management to be in the range of 4 to 14t/ha/year. However, it will be noted that Amphlett's results are localized and cannot be over-extrapolated to represent soil erosion rates for the country. On the other hand, the World Bank based estimation on reconnaissance erosion hazard map (Khonje and Machira 1987), land use maps for Malawi, available arable land and other government reports, which detailed the amount of uncultivable dambos, swamps, floodplains and steep slopes (World Bank, 1992). There is need for confirming these figures through research.

4.3.1.2 *Social cost of soil erosion*

Soil erosion has 'on-site' and 'off-site' costs. The first include declining soil fertility and loss in crop yield. The second refers to sedimentation and siltation of rivers and reservoirs. Fertile low-lying areas may become unproductive due to the deposition of infertile sand. In this section only on-site costs are considered.

Preliminary analysis shows that the social cost associated with

soil erosion is MK1, 155 million (US$165 million) which corresponds to 8.1% of the countryman GDP in 1994.The cost was arrived at by taking into account the relation between soil erosion rates and productivity and discounting production loss over a ten year period at 10% discount rate to bring the loss to the net present value in order to capture the cumulative effects of soil erosion.

4.3.1.3 *Institutional and legislation constraints*

Land resource degradation in general and soil erosion in particular is also attributed to institutional and legal constraints and these include:

(a) Ill-defined, insecure and unenforceable property rights leading to open access exploitation of any land for agricultural purpose.

(b) Limited information about the costs of degradation and the benefits of conservations causing greater uncertainty about the impact of the resource allocation decision.

(c) Lack of access to credit for soil conservation investments and fertilizers encourage soil-degrading practices by the majority of smallholders. Inter-generational subdivision of holdings and expansion into marginal and unsuitable land is characteristic of such farmers.

(d) Inadequacies in agricultural extension due to shortages of staff and logistical support.

(e) Informal tenancies in tobacco estates.

4.3.2 *Deforestation*

4.3.2.1 *Extent of deforestation*

The rapid expansion of agriculture from mid-1970's to the late 1980's, led to extensive deforestation. During that period the rate of deforestation was 3.5% per annum. At the moment however, the rate of deforestation has declined to 1.6% because there is not much arable land left to be deforested. Regional variation in deforestation is conspicuous; 2.5% in the north, 2.2% in the centre and 0.14% in the south (Eschweiler, 1993).

4.3.2.2 *Causes of deforestation*

The major causes of deforestation are agricultural expansion,

followed by wood fuel demands from households and other sources. The latter include tobacco leaf-curing, brick burning, fish curing and beer brewing. While the demands for wood energy from these diverse sources keep rising, sustainable supply of wood progressively lags behind, leading to deforestation in the Southern and Central regions. Most of the tobacco estates have failed to comply with the obligatory establishment of a wood-lot on 10% of the estate's area. Most of the fuelwood for tobacco leaf curing is from indigenous forests, including those under customary tenure. Government's failure to enforce the obligatory woodlot provision has encouraged estates to externalize private costs by deforestation. Other woodfuel-using industries are not even subject to any legal obligation to have their own woodlots or contribute in other ways to increase the national area under woodlands. The lack of functional communal institutions to protect and manage customary forests is a major cause of their depletion.

Infrastructure development, particularly road and settlement establishments can lead to deforestation. Woodfuel extraction and charcoal making for domestic, commercial and industrial use, contribute to deforestation too, but it is difficult to quantify the level of deforestation attributed to this segment.

4.3.2.3 *Social cost of deforestation*

Deforestation generates externalities that raise social costs and adversely affect social welfare in various ways (see sections 4.3.1, 4.3.3 and 4.3.5). The social costs of deforestation arise from increased use of forest products and increased incidence of soil erosion due to loss of tree cover. The former wan estimated by the replacement values of wood harvested above the sustainable yield, while the latter was estimated by the reduced crop yield as a result of soil erosion. The cost of deforestation was estimated at MK385 million (US$55 million), which is about 2.7% of the GDP in 1994.

4.3.2.4. *Productivity of forests*

The productivity of indigenous forest is generally low; 0.8, 1.2 and 1.0 m^3 per hectare per year for forests on customary land, forest reserves and national parks and game reserves, respectively. Productivity of agro-forestry systems is estimated at 0.9 m^3 per hectare per year while productivity of fuelwood plantation averages 14.0 m^3 per hectare per year, although productivity rates as high as; 40.0 cubic meters per hectare per year have been recorded in Mulanje (Forestry Department, 1993). The low productivity of indigenous forests implies that at current levels of bio-energy demands, harvest rates exceed sustainable yields.

4.3.2.5 *Woodfuel demand*

The World Bank (1992) estimated that the total woodfuel requirement in 1990 was 7.1 million cubic metres and the projection for the year 2000 was 8.7 million cubic metres. However, total wood demand for 1990 and l9gl was put at 8.5 and 10.5 million cubic metres respectively.

The Department of Forestry estimated that woodfuel deficit from 1983 to 1990 rose from 1.6 to 4.9 million cubic metres and the projected figures by the Department of Forestry for 1995 and 2000 are 7.6 and 7.8 million cubic metres respectively. The upward trend of woodfuel deficit indicates that the current afforestation programmes have not yet made significant impact.

4.3.2.6 *Institutional and legal constraints*

The Forestry Sector is governed by the Forest Act, (Cap:63:01) which is currently under review. However, one important feature about the present Forest Act is that forest reserves created on either customary or public land are the most strictly regulated. Land which is either public or customary, but not reserved, is subject to less control. Even more serious is the fact that private land is not subject to the Act. Although the Land Act lease stipulates that 10% of all leased land for agricultural purposes must be devoted to forest cover, enforcement of this covenant is outside the mandate of the Department of Forestry. Further, this covenant does not cover freehold land which is another category of private land. The Act does not properly relate to other acts such as the Electricity Act and Telecommunications Act administered by different organisations. However, the current Forest Act review should resolve these weaknesses to improve its effectiveness and efficiency.

In addition, ill-defined, insecure and unenforceable property rights and limited information about the costs of degradation apply here too. Equally important are:

(a) Weakness of local level management institutions. This was caused by erosion of the authority and legitimacy of traditional leaders and undermined their valuable role in natural resource management. Worse still, past policies failed to provide viable alternatives to local institutions.

(b) Deficiencies in the DOF due to shortage of staff and other logistic problems.

(c) Lack of effective coordination at the local level in natural resource management between the DOF and

Department of Agricultural Extension and Training (DAET).

(d) Property Rights: due to non existence of social rules governing exploitation of indigenous woodlands, the woodlands have been exploited as an open access resource. Consumers have no incentive to manage the resources on a sustainable basis beneficial to the whole community. Instead they seek to maximize short-term benefits which lead to deforestation.

(e) Access to Information: There is limited access by smallholders to information regarding appropriate silvicultural management, particularly in the area of seedling production and tree planting. This is due to staffing, logistical and budgetary constraints in the Extension Services in the DOF, as well as policies that favour exotic trees.

4.3.3 *Water resources degradation and depletion*

At present Malawi faces no serious problem of excessive abstraction of water resources, given the abundant supply of surface and ground water in relation to domestic, agricultural, commercial, and industrial use. However, the abundant water resources of Malawi are slowly but steadily getting degraded due to a number of factors as shown in Figure 4.2. Water resource degradation reduces both the quantity and quality of water supply.

4.3.3.1 *Sedimentation (siltation)*

The rapid population growth in the country has exerted great pressure on the land resource, promoting soil erosion and deforestation, as described in detail in section 4.3.1 and 4.3.2, respectively.

Silt loads surface water run-off lead to significant problems in downstream water quality, such as increased suspended solids and turbidity, water treatment costs and water flow problems. During the rainy season virtually all rivers carry heavy loads of sediments. The turbid water is not good for human consumption. The majority of people in rural communities depend on untreated river water supply and chances of drinking unclean water are therefore very high. Many of Malawi's principal rivers used for abstraction of potable water are carrying suspended solid loads in excess of WHO guidelines, as shown in Table 4.2.

Case studies show that catchment areas with high deforestation-

rates have higher rates of discharge, which in turn lead to increased levels of turbidity and suspended solids.

High sediment loads in the rivers bring about siltation of rivers and water reservoirs. The silted river course and water reservoirs tend to have reduced capacities so that when it rains the banks may overflow, causing flooding at times; or the water erodes the banks in order to accommodate the increased volume of run-off. The intake point for Nkula Hydro-electrical Power Reservoir, for instance, is frequently dredged for this reason. The effects of sedimentation on the fish resources are addressed in section 4.3.4.

Sediments are involved in nutrients cycle in a water body by releasing nutrients into the water column, which may cause eutrophication, particularly in shallow water bodies.

4.3.3.2 *Biological contamination*

Biological contamination of water resources arises from unplanned settlements and associated poor sanitary conditions, as well as improper disposal of waste, as further discussed in section 4.3.6. Many human settlements are established in river catchment areas and because many households either do not have latrines or the pit latrines are sited near water sources, the faecal material contaminates the surface water while the sludge in pit latrines may contaminate the groundwater resources. There is also discharge of inadequately treated sewage from some institutions into rivers and streams. Lack of authority to control sanitary installations and of maintenance of sewer reticulation network have led to overflow of septic tanks and sewers. Livestock, also, contaminate Surface water. Run-off from improperly located waste disposals also contributes to biological contamination of water resources.

As 50% of all illness in Malawi is attributed to water borne diseases (UNDP 1986) and 35% of the population does not have access to safe water at home, biological contamination from human beings is a very serious concern. Malawi's National Water Resources Master Plan states that as a result of inadequate sanitation facilities and other sources of organic pollution, the bacteriological quality of the major rivers is poor throughout the year. Three-quarters of rivers show faecal coliform counts in excess of 500 per 100 ml in dry season, which is dangerously above WHO guidelines of zero faecal coliform. In the wet season the situation in considerably worse because of surface run-off that brings more contaminants into the rivers.

4.3.3.3 *Chemical contamination*

Chemical inputs such as fertilizers and pesticides are important in

order to raise agricultural productivity, both in the estate sector and the smallholder sector. However, given the limited adoption of physical land conservation structures, run-off of agrochemical, depending on their chemical composition, may add nutrients or poisons to the aquatic environment. Eutrophication of water bodies and the growth of water weeds, some of which may be noxious, threaten fish resources in several reservoirs in the Southern and Central Regions. Furthermore, poisonous agrochemicals have caused death of fish in rivers and are a serious threat to human health.

Chemical contamination of stream water in the pert-urban areas is becoming a common problem due to improper disposal of industrial waste. In the cities improper use and poor sewer maintenance coupled with lack of spare parts often result in overflowing of sewers containing untreated industrial effluent and hazardous chemicals (refer to section 4.3.6 for details).

4.3.3.4 *Social cost of water degradation and depletion*

Given the extent of water pollution and lack of sanitation as highlighted above, it is quite clear that the situation has socio-economic cost implications. In social terms pollution, particularly faecal contamination, has contributed to the spread of water borne diseases such as diarrhoea, cholera, typhoid and bilharzia which are leading causes of high morbidity and mortality rates in Malawi. The effects have been severe economic costs for the country in terms of treatment costs, underdevelopment of human resources, low labour productivity and pervasive poverty.

The total costs in 1994 associated with water degradation was estimated to be MK105 million (US$15 million). The total number of reported deaths due to the diseases mentioned above is 850 annually (World Health Organization, 1994). These figures are an underestimate since they only account for the reported cases in hospitals and health centres and ignore all costs of diarrhoeal bouts on adults and children above s years of age.

4.3.3.5 *Institutional and legal constraints for water resources*

The government's policy is to provide clean potable water to all people so as to reduce the incidence of water borne diseases and the time devoted by individuals particularly women to water collection.

The Water Resources Act (Cap 72:03) and other acts pertaining to use of water for different purpose have been found inadequate in that they not cover all the relevant issues related to water resources management, especially concerning taking punitive measures against those who cause substantial water pollution by

discharge of effluent. The Water Resources Act is under review to remove such deficiencies.

4.3.4 *Threats to fish resources*

Although there is no overall assessment of the current status of exploitation or level of depletion of fish resources, new trends, especially in artisanal fisheries, show a large and widespread increase in fishing efforts but declining catch rates. This scenario has led to increased use of inappropriate fishing methods. Increasing agricultural pressure from the growing population within the catchment areas and subsequent land degradation have led to drainage of nutrients and sediment loads into the lakes and rivers resulting in a decline in the population of endemic anadromous fish whose habitats and spawning grounds have been lost. Over-fishing is also a response to the demand by the rising population. If these threats are not controlled, they will inevitably seriously undermine these important nutrition and income generating resources.

4.3.4.1 *Over fishing*

Over fishing causes a reduction in size and age of catch, and alters the genetic structure of the stock and this is the care with the chambo, utaka and other small cichlid species. Lake Malombe provides clear manifestation of risks associated with over fishing because fish production in this lake has dropped from 10,000 tones per annum in 1986 to present (1994) 200 to 300 tons per year. This dramatic decrease is a result of doubling in the number of fishermen over the last decade. The practice of lining nets with mosquito netting exacerbated the situation because juveniles caught by the netting will not be able to breed in the next generation. Non-compliance with "off-season" regulations means that fish in breeding stage are removed, again affecting the output of fish for the next generation.

There is no conclusive data on the actual level of depletion of the fish resources in the other lakes. But the same dramatic decline in catch that has occurred in Lake Malombe is beginning to show up in other lakes including Lake Malawi. This calls for urgent measures to be taken to protect the sustainability of the resource; otherwise this important nutrition and income generating sources could be irreparably damaged.

In summary, the main factors contributing to over fishing are as follows:

(a) increasing number of fishermen;
(b) non-compliance with "off-season" regulations;
(c) inappropriate fishing methods such as:

(i) nets with small mesh size and use of mosquito netting,
(ii) dynamite fishing,
(iii) fish poisoning,
(iv) fish traps at river outlets,
(v) fishing by blocking rivers,
(vi) fishing at breeding grounds,
(vii) fishing during breeding seasons.

4.3.4.2. *Degradation of ecological niches and destruction of breeding areas.*

Depletion of fish resources is known to occur both in rivers and lakes. However, most affected are lake fish which are among river breeders. The most dramatic case, demonstrating this trend, has been that of the Ntchila which in the 1950s was the major commercial species in Malawi, but is now threatened with extinction. Similarly, gravel spawners and grass spawners are also suffering from losses of spawning habitats. The main factors contributing to the decline of this type of fishery are:

(a) reduction in water flows and increased sedimentation because of agricultural and deforestation activities as described in sections 4.3.1 and 4.3.2;
(b) water pollution because of human waste, agricultural waste sad runoff and industrial waste as described in section 4.3.6;
(c) prevention of fish migration in rivers because of weir constructions and other obstructions to breeding areas.

In addition the introduction of non-indigenous fish and water weeds is an increasing threat. This is why the culture of carp in fish ponds has been stopped in preference to indigenous species.

4.3.4.3 *Social cost of fishery resource depletion*

The socio-economic cost associated with depletion of fish resources is quite significant. The dramatic decline in the catch has resulted in a sharp drop in the value of the total catch. The value of the catch has fallen 77% from about MK36 million in 1982 to about MK8.4 million in 1990. The decline in the value should be taken as an underestimate since the social cost of depletion associated with other lakes other than Lake Malombe is not taken into account.

4.3.4.4 *Institutional and legal constraints*

The Fisheries Act (Cap 66:05) provides the framework for the

control and management of the commercial and artisanal fisheries. The Department of fisheries under the Ministry of Forestry and Natural Resources is responsible for the enforcement of the Act through its District Fisheries Offices.

The major constraints are:

(a) weaknesses in the Fisheries Legislation, which requires revision in order to address environmental issues and sustainable management of fish resources;

(b) low enforcement capacity of Fisheries Act due to:

(i) management (staff) and financial constraints;
(ii) low levels of penalties for noncompliance;

(c) breaking up of traditional systems for regulation and control of exploitation of fish resources;
(d) inadequate information on fish resources to formulate guidelines for sustainable management of the resources;
(e) lack of coordination between Fisheries Act and other relevant Acts for example, Forestry Act, Land Act, Water Resources Act;
(f) weak compliance of subsidiary legislation and other relevant legislation because of lack of knowledge and low penalties for non-compliance.

4.3.5. *Threat to biodiversity*

Malawi is rich in biodiversity. The rich genetic pool is vital for scientific research, agricultural and medicinal values, and for the socio-economic development of the country. Biodiversity can be looked at in terms of 'wild' and domesticated fauna and flora. Figure 4.1 shows some factor leading to loss of biodiversity.

4.3.5.1 *Wild fauna and flora*

So far, about 4,000 fauna, 5300 species of indigenous plants and 1,000 microbiota have been described. Of the fauna nearly 1,500 are vertebrates such as mammals, 163; amphibians, s4; reptiles, 92; fish, 548; and birds 620 species (Sweeney 1970, Konning 1990, Ansell 1985 and 1989, Ansell and Dowsett 1988, Newman et al 1992). Due to high increase in human population and the need for land for agricultural purposes, most of the terrestrial faunas are found in national parks, game and forest reserves. Over the years these areas have been encroached and government has given in by changing some of the boundaries, thereby

reducing the sizes of the protected areas

Poaching is a major threat to wild fauna. The Rhinoceros (Diceros bicornis), for example, has been drawn to extinction and is now found because it has just been re-introduced into Liwonde National Park. Some of the rare, endangered and endemic animal species are shown in Table 4.3.

The flora of Malawi comprise vascular (tracheophytes) and non-vascular plants (e.g. green algae) and bryophytes (liverworts and mosses). However, not much attention has been given to the non-vascular plants. The vascular plants are divided into ferns (spore forming plants), gymnosperms (flowerless seed plants) and the angiosperms (flowering plants). Although not all of them have been studied, extensive studies have been conducted on the flowering plants. A summary of plants identified so far is shown in Table 4.4.

As is the case with fauna, most of the flora are found in protected areas (i.e. national parks, wildlife and forest reserves). However, four of the biotic communities 4a, 4d, 6 and 8b discussed in section 3.2.6 are not under the protection of forest, national parks and wildlife reserves while the protection of 8a and 9 is however limited to about 12 km^2 as represented by the Lake Malawi National Park. In order to protect some tree species from extinction, government has placed some trees under the protection of Forest Act (Cap. 63:01) of the Laws of Malawi. These trees are shown in Table 4.5. However, more trees will be protected under the revised Act.

In addition to plants and animals there are micro organisms, a heterogeneous group of taxonomically unrelated organisms. Some microbes are more closely related to the animals (protozoa)' others to the plants (green algae) while yet others are related to neither group (viruses, bacteria and fungi). The micro-organisms are important in improving soil fertility because some bacteria and fungi help in the decomposition of organic matter while others fix nitrogen into the soil. They are also important for pharmaceutical purposes and in industries.

4.3.5.2 *Domesticated fauna and flora*

The number of domesticated fauna is relatively small compared to domesticated flora. Among the fauna are cattle, goats, sheep, pigs, rabbits, poultry, doves, peacock, turkey and ducks. The most important ones are cattle, goats, pigs and poultry. The trend of estimated populations of cattle, sheep and goats from 1979 to 1991 is shown in Table 4.6.

As can be seen from the table, the population of cattle increased

steadily from 799,000 in 1979 to 1,011,000 in 1986; thereafter it declined and stabilized around 800,000. On the other hand, the population of goats has been increasing linearly and it is estimated that it will reach 1,033,000 by the year 2010 (Ng'ong'ola, Mtimuni, Kanyama-Phiri, Nothale and Wiyo, 1992). The population of sheep has also been fluctuating and it is estimated that it will stabilize around 50,000 by the year 2010. Although the population of cattle is low and will probably be decreasing, stocking density of rangelands will remain high. Already in Ngabu A.D.D., it is 2.02 livestock unit/ha (LSU/ha) while the stocking density for the country's rangeland varies from 0.48 to 2.02 LSU/ha. Overgrazing is likely to be a major environmental problem in many parts of the country.

The production of poultry and small mammal ruminants e.g. rabbits, appear to be of great significance if the uptake animal protein is to be increased.

Although more than 70% of cultivated land is grown to maize, a number of crops are grown either for food or for sale. The future of Malawians agriculture will depend on whether or not high yielding varieties (HYVs) with acceptable qualities can be developed. Appendix 3 shows a range of crops and some varieties grown in Malawi.

4.3.6 *Human habitat degradation*

The essential environmental components of human habitat are shelter, safe drinking water, and appropriate management of domestic and industrial wastes and effluent, as described in the following sections:

4.3.6.1 *Housing and human shelter*

Housing conditions in Malawi are generally poor. According to the 1987 Census about 84% of all houses were grass thatched, 53% had mud or wattle walls and 89% had mud floors. It is estimated that 50% of existing housing structures in rural areas are in inhabitable state, calling for urgent replacement. An important reason for this is the temporary nature of the building materials used. It is expected that both rural household and the shortage for rural housing will double in the next 10 - 15 years.

The demand for shelter and housing in urban areas are even more acute than in rural areas as a consequence of high immigration of rural households. This is further exacerbated by the low income for the majority of urban dwellers, which is too low for them to afford renting, building or buying adequate housing. As a result there is considerable over-crowding in existing traditional housing areas. Secondly, there is also an increasing number of

unauthorized construction of dwelling structures using unsuitable materials. Such dwelling units lack basic infrastructures and services such as roads, water supply and sewerage disposal. The great housing shortage has resulted in the growth of unplanned squatter settlements, especially in the four major urban areas, where it is estimated that 60 to 70 % of the total population live in traditional housing areas and in unplanned squatter settlements.

4.3.6.2 *Drinking water*

The Government's policy is to provide clean potable water to all people so as to reduce the incidence of water borne diseases and the time devoted by individuals to water collection. For urban water supplies, the aim is to meet the full demand for treated water with individual connections for those who can afford, and either stand-pipes or kiosk services for those who cannot. For the rural population, the target is the provision of clean but untreated water provided at a maximum distance of 500 metres. The rural population is advised to boil drinking water.

According to 1985 figures, 65% of Malawians population had access to clean or safe potable water (World Bank, 1990). The break-down shows that 85% of the urban population had access to safe drinking water and 45% of the rural population had access to clean water. This overall coverage is one of the highest in Africa. However, both rural and urban water supply systems suffer from significant operational problems. It is estimated that currently only one-third of the rural population has actually access to improved water supplies. Similarly, recent surveys indicate that the figure for urban areas is in the order of 60 - 70%.

4.3.6.3 *Externalities of human activities: wastes and effluent*

Many human settlements are established in river catchment areas. The habit of bush squatting, done by people who either do not have pit latrines or have pit latrines but are caught up with the call of nature whilst far from home, contaminates surface water through surface run-off. Sludge in pit latrines may contaminate ground water resources if the pit latrines are poorly sited.

There is also deliberate, unauthorized discharge of sewage from some institutions into river courses (see section 4.3.3.2 for details)

4.3.6.4. *Sanitation*

It is estimated that 64% of the households have some form of toilet with a significant difference between rural and urban areas of 61 and 94% respectively. The most commonly used type of

toilet is the pit latrine, being used by 74 and 59% of urban and rural households respectively. In rural areas 40 percent of the population discharge excrete directly or indirectly through surface run-off into the surface water resources. In urban areas only 15% of the population is connected to waterborne sewerage and 15% to septic tanks. However, many of these systems overflow posing environmental consequences for the population as discussed before (see section 4.3.3.2).

4.3.6.5. *Solid waste*

Solid waste is grouped into three basic classes:

a) Inert wastes, such as builder rubble, soil and spoil. They are harmless unless dumped in unsuitable areas, where they disturb the ecosystem in addition to being Anaesthetic and are also breeding grounds for rats and other vermin.
b) General wastes, such as commercial wastes, domestic waste and garden refuse and industrial waste. They are not hazardous, but pose a threat to human health and the environment when incorrectly managed, giving rise to the production of highly polluting leachate and malodorous as well as potentially explosive gaseous emissions.
c) Hazardous wastes: exhibit the following characteristics - inflammability, corrosivity, explosivity, toxicity, mutagenicity, carcinogenicity and eco-toxicity. They pollute water and diminish public health safety when improperly managed. They are highly corrosive and a potential threat to public sewers. Discharging them into waterways means pollution of drinking water and threats to aquatic life. Disposal of hazardous wastes on land renders arable land unsuitable for farming, vegetation is destroyed and the toxicity is a threat to man and animals.

Urban areas lack adequate solid waste disposal facilities. Very few households have rubbish disposal pits. Most of the domestic waste is thrown away to sites where children will scavenge and rats, cockroaches, flies etc. proliferate and diseases can be spread easily.

In district centres solid waste collection is mostly done by District Councils. Usually there are no established landfill sites and wastes are dumped in open quarries, forest reserves, abandoned roads etc. Some uncontrolled burning of wastes at the disposal site is practised. This rudimentary solid waste collection and inadequate disposal methods give rise to serious environmental problems such as odour, dust, pests, scavengers/pollution of surface and groundwater sources, and smoke and fire hazards. It also brings about a deterioration of the aesthetic environment. There are no established solid waste disposal systems in the rural areas.

The three city councils (Blantyre, Lilongwe and Mzuzu) and Zomba Municipality as well as the eight town councils are faced with all types of solid wastes. Inadequacies are most severe regarding waste collection in traditional housing areas and squatter settlements and industrial waste, as described below.

4.3.6.6. *Manufacturing industry and mining*

Industrial activities are concentrated to the four major urban areas of the country, where these are regarded as main polluters. Most industries are situated in Blantyre, where 56% of industrial licences between 1987 - 1992 were issued and Lilongwe, for which the figure was 20%.

Every year thousands of tons of industrial wastes are discarded and the quantity, complexity and toxicity is increasing.

Industrial waste in liquid form is usually discharged into sewerage system or rivers. If in solid form, it is dumped on landfills and if in worse conditions, it is dumped on a tip within the factory premises. Emissions of gaseous pollutants from cement plants, foundries, power station boilers and chemical industries is a problem for the surrounding areas, but other sources and general extent of air pollution are yet to be identified.

The effect of mining on the environment in Malawi is mostly in respect to mineral exploration and extraction. The effects are quite localized including unfilled pits, quarry dust, disfigured hills, coal dust, subsidence, trenching and site clearing and dumping of refuse.

4.3.6.7 *Occupational health hazard*

Occupational diseases are those that workers get as a result of above safe levels exposure in their work-places. Although data on the exposure levels and prevalence of occupational diseases are not available, several diseases are known to occur as a consequence of hazardous work environments.

Workers in coal mines, who are exposed to concentrations of coal dusts over longer periods, are likely to get Coal Workers' Pneumoconiosis. In many industries workers who are exposed to toxic agents or environmental factors may get Occupational Dermatitis, which is an inflammation of the skin. A special type is Tobaccosis, which occurs in the tobacco industry when ventilation is inadequate. In sugar manufacturing workers are exposed to Bagassosis, which is caused by inhalation of dust from sugarcane fibers (bagasse) after sugar has been extracted. The disease is caused by fungus-like bacteria, which produces an allergic reaction in the lungs when inhaled. Byssinosis is a

respiratory disease workers may get in industries which use cotton as a raw material. Asbestosis is a disease of the lungs caused by the inhalation of fine airborne asbestos fibers in break bonding and lining and building industries. Silicosis is a disease of the lungs caused by the inhalation of crystalline silica in industries such as manufacture of pottery, foundry operations, mining and quarrying. Occupational cancer caused by exposure to chemical and physical agents called carcinogens occur in a wide range of industries where carcinogens are used. Finally, people working in contact with water may suffer enhanced risks of water related diseases such as schistosomiasis, trypanosomiasis (river blindness), cholera and diarrhoea.

The Factories Inspectorate Department in the Ministry of Labour (MOL) carries out routine factory inspection of all factory premises in Malawi with the aim to improve working conditions. However, the frequency of these inspections are hampered by lack of and inadequately trained personnel and financial resources. The MOL has recently established an Industrial Hygiene Unit which will be involved in the quantification and periodic monitoring of workers in industries:

4.3.6.8. *Transport*

The transport sector has two types of environmental impacts. First, there are the effects of opening up and constructing transport infrastructure, particularly roads. The effects are deforestation, erosion and siltation. The gravel pits left behind act as breeding grounds for mosquitos. Second, there are the negative effects from the operation of transport services, such as air, land and water pollution, with particular regard to spillage from transportation and storage of petroleum products.

4.3.6.9 *Institutional and legal constraints*

There are two sets of legislation addressing human habitat degradation: legislation pertaining to land use and physical planning and legislation pertaining to control of waste emissions and handling of waste.

Location of housing, industry, commercial activities, transport etc. is the responsibility of the Department of Housing and Physical Planning in conjunction with city, town and district councils.

Major problems pertaining to land use and physical planning are linked to lack of or non-compliance with siting regulations for industrial and tourist activities. Existing legislation on industrial site location lies in the hands of Housing and Physical Planning Department as per the Town and Country Planning

Act (Cap 23:01). But the environmental regulatory frame work has not yet been enacted by Parliament and the Act does not have a provision for environment protection matters by industries in zoned areas. With regard to tourism, the application of the Lakeshore Physical Development Plans is weak because there inadequate monitoring mechanism.

Pollution control comes under the Water Resources Act. The major deficiency of this law is its lack of procedures and specifications for disposal of toxic liquid industrial wastes. Furthermore, it does not prescribe strong penalties against those who contravene the laws and cause substantial water pollution by the discharge of effluent. The same constraint applies to the Refuse and Rubble Disposal By-Laws of the Local Government (Urban Areas) Act (Cap 22:01).

Although the Mines and Minerals Act (Cap 61:01) provides for the protection of the environment and regulations for its enforcement are in place, it is difficult to enforce the regulations for the small-scale operators due to lack of technical know-how and financial resources. This constraint also applies to the Petroleum Act which addresses storage and transportation of petroleum products. This is further weakened by the multiplicity of bodies involved.

There is limited information on sources of pollution and the kind, type, amount, frequency and degree at which the effluent contaminates the rivers. This is particularly -a problem regarding industrial emissions, where entrepreneurs consider pre-treatment of wastes too costly and are reluctant to undertake corrective measures before actual damage is identified. Industrial and municipal effluents are monitored by the Water Resources Board, which is hampered in its work by the fact that many industries may start without industrial licence.

All urban centres are faced with severe inadequate sewerage and waste collection and disposal systems and facilities and in some cases the facilities are non-existent.

4.3.7 *Air pollution*

Although this is not yet a big environmental problem, generally in major urban areas gaseous emissions from industries, car exhaust fumes as well as burning of old tyres pollute the air. In the rural areas, uncontrolled bush-fires also pollute the air apart from destroying vegetative cover. Air pollution also arises from quarrying and coal mining activities. With the increased scope of these activities, air pollution could be a serious problem especially in nearby areas.

4.3.8 *Climatic change*

The consequence of issues discussed in sections 3.3.2, ~~3.3.6.6~~ and ~~3.3.6.7~~ which are attributed directly and indirectly to human activities, result in the alteration in the composition of the atmosphere over Malawi and the globe in general, thereby causing climate change.

Climate change and climate variation (natural) have impacts on the environment and society in the following manner:

a) Environment:

(i) Hydrological systems through change in precipitation and soil moisture.
(ii) Ecosystems and vegetation changes vegetation zones and species mix thereby reduce biological diversity.

b) Society:

(i) Water resources increased floods and droughts.
(ii) Food and agriculture changes to growing seasons, yields, pest distribution and cultivated land, forestry and fisheries.

c) Economic activity: Change in energy requirements, effects on transport and industry.
d) Human settlement and health: Changes in disease patterns and effects on infrastructure, etc.

Although climate change and climate variations have not yet been assessed with absolute certainty in Malawi, and throughout the world in general, recent climate abnormalities such as droughts, floods etc bear witness to climate change.

4.3.9 *Criteria for prioritization of environmental issues*

Environmental issues are not of the same importance. Perceptions of urgencies and priorities depend on who is doing the rating. This was clearly demonstrated through the consultative district workshops, as may be appreciated in Volume 2 of the NEAP, where the proceedings from these workshops are presented. The same broad variations were also demonstrated in the National Workshop in May 1994, where the second draft of the NEAP was discussed. It is therefore acknowledged that all Key Environmental Issues are of importance; but their prioritization and that of the corresponding actions will be determined through

the decentralized NEAP implementation modality described in Chapter 6. For that prioritization different criteria may be applied, as further discussed below.

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a) Socio-economic importance of issues as a threat to sustainable development

Preliminary efforts co prioritize environmental problems based on comparison of social costs imposed by different types of environmental degradation shows that soil erosion imposes the highest social costs [3]. This is followed by deforestation, water pollution and lack of sanitation, and threat to fish resources. The social costs pertaining to these key environmental issues were estimated on annual basis as of April, 1994 market prices as follows:

- Soil erosion - MK1,155 million (US$165 million);
- Deforestation - MK385 million (US$5s million);
- water pollution and lack of sanitation MK105 million (US$15 million);
- Threat to fish resources - MK28 million (US$4 million).

However, in order to have a more representative and realistic prioritization of environmental issues, due consideration should also be given to non economic criteria as outlined below.

(b) Extent to which people are affected

Severity of effect of the environmental problem on people constitutes one of the key factors which should be considered in prioritizing environmental issues. Severity is a factor influenced by the nature of the problem in question. In some cases the problem is more pronounced and extensive whilst in other cases the problem is marginal. The extent to which people are affected by the problem is instrumental in investment decisions.

(c) Effects on vulnerable groups

Some environmental problems, for example air pollution, may be localized and affect a defined group of people. The effects which may range from health to non-health, economic to non-economic, and social to non-social, are equally important for consideration in prioritizing environmental problems.

(d) Spatial extent of degradation or depletion

Whilst certain key environmental problems cut across all regions, there are others, as explained above, which are localized. Geographical locality is critical in determining the gravity of the

problem vis-a-vis their impact on the population and sustainable development. Spatial nature of the problem i.e. whether nationally spread or localized, is a critical issue in prioritizing environmental issues.

(e) Extent to which degradation or depletion is irreversible

Whilst certain key environmental problems are reversible, some are irreversible. The permanent nature of the problems and associated effects are critical factors in the process of prioritizing environmental problems. They also influence decisions in preventive investments.

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Chapter 5: Actions to address Environmental Issues

5. Actions to address Environmental Issues

5.1 Methodology for identification of actions to address environmental issues

Recommendations on actions to address environmental issues were identified by both the 18 task forces in their reports and the local communities in the district workshops as presented in Volume 2 of the NEAP.

The methodology for identification of key environmental issues was explained in section 4.1 where recommended actions were also identified and ascribed to these key environmental issues. The actions were then organized in the following hierarchical structure, which is shown in detail in Appendix 4:

- Key environmental issues (defined in section 4.1.)
- Focal points of Intervention, representing a resource use, or a set of resource use practices, which may have to be partly or completely stopped, replaced with a sustainable alternative, or, modified by corrective environmental action.
- Strategy, which explains the nature of actions to be taken.
- Actions, which are concrete and specific measures to be undertaken by identified institutions or groups of people in order to implement the strategy.

This structure also allowed for cross references as certain actions may pertain to several strategies.

In the district workshops, the participants presented their recommendations in three groups:

a. actions the local population may undertake on their own;
b. actions which the local population may undertake, but which require government or non governmental assistance;
c. actions which Government should undertake.

The actions recommended in the different sections of this chapter follow this categorization.

Some of the proposed actions are already being implemented by various players. However, some weaknesses have been noted and

corrective actions suggested.

In the presentation of the various actions a prioritization of these is deliberately avoided because they are policy guidelines which are all important to address the complex nature of environmental issues in Malawi. -

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5.2 Soil Erosion

5.2 1 *Cultivation on marginal land (steep slopes and river banks)*

5.2.1.1 *Protection of steep slopes and river banks*

Government through the:

a. Department of Lands and Valuation (DLV) Department of Forestry (DOF) and the Land Resources and Conservation Branch (LRCB) of the Ministry of Agriculture, in collaboration with the Ministry of Justice (MOJ) will review and strengthen legislation to protect these environmentally fragile areas.
b. Ministry of Agriculture in conjunction with Local Authorities will promote use of appropriate technology for cultivation of steep slopes.
c. Local Authorities (LAB) will:
(i) stop cultivation on steep slopes and along river banks; and
(ii) rehabilitate all degraded areas through 'greenbelt' concept.

5.2.1.2 *Resettlement of people from marginal lands*

Government through DLV will repossess and allocate all idle estate land to the needy for agricultural purposes; and the Office of the President and Cabinet (OPC) will initiate a resettlement project moving people from marginal land to the repossessed land and any other land that may be identified as suitable for resettlement.

5.2.1.3 *Rehabilitation and utilization of vacated marginal lands*

1. Local communities, through the Village Development Committees (VDCs), will rehabilitate all degraded marginal areas left by the resettled people, and plant them with appropriate tree species, own and manage them as community forests.
2. The Department of Forestry (DOF) will provide technical assistance in identifying appropriate tree species and assist

in raising tree seedlings.

5.2.1.4 *Promotion of agro-forestry*

Government through Departments of Agricultural Research (Agroforestry Commodity Research Team), Forestry (Forestry Research Institute of Malawi) and LRCB in collaboration with non-governmental organizations (NGOs) and international organisations such as International Centre for Research on Agroforestry (ICRAF), will:

1. develop acceptable agroforestry packages;
2. train agricultural extension staff on agroforestry technologies for effective delivery of the packages;
3. strengthen farmer training to increase adoption rate of agroforestry packages;
4. establish tree seedling nurseries and ensure that the Rural Financing Bank will provide credit where necessary for agroforestry programmes.

5.2.1.5 *Construction of permanent physical conformation*

The Government through the LRCB in collaboration with Bunda College of Agriculture and appropriate NGOs will continue to:

a. develop labour-saving technologies for constructing storm water drains, terraces and bunds;
b. design and peg storm water drain, terraces and bunds in the fields (LRCB and NGOs);
c. design and peg drainage line in waterlogged areas (LRCB and Department of Irrigation - DOI);
d. train farmers in pegging marker ridges using "'A' Frame" (LRCB, NGOs); and
e. provide planting materials for stabilising conservation structures (LRCB).

Farmers will collectively:

(a) construct storm water drains, bunds and drainage lines; and
(b) stabilise the constructed structures with vetiver or napier grass.

Individual farmers will be assisted to construct and stabilise marker ridges, align planting ridges to the marker ridges and in low rainfall areas, box ridges will also be constructed in order to conserve water.

5.2.2. *Mono-culture, Noncontour row cropping (maize, tobacco and cotton)*

5.2.2.1. *Crop rotation*

The Government through:

The Department of Agricultural Extension and Training (DAET) will continue to:

a. promote crop rotation by farmers who are growing tobacco.
b. promote alternative high value cash crops other than tobacco;
c. the Ministry of Agriculture and DLV will continue to enforce the mandatory four-year rotation on tobacco estates;
d. the Ministry of Labour (MOLMD) will make tenancy system more secure by ensuring provision of formal tenant contracts.

5.2.2.2. *Contour planting of all crops*

(see 5.2.1.5.)

In addition, individual farmers or farmer groups, with LRCB assistance will establish vetiver and napier grass multiplication nurseries.

5.2.2.3 *Promote mixed and inter-cropping by smallholder farmers*

The Government through Department of Agriculture Research (DAR) (Adaptive Research) will:

a. conduct research on mixed cropped or inter-cropped system with special reference to type and optimum number of crops; and
b. promote mixed cropping and inter-cropping including legumes (to improve soil fertility) on all land-holdings of less than one hectare to raise productivity, income and food security.

5.2.3 *Overgrazing*

5.2.3.1 *Appropriate levels of stocking*

The Government through the Department of Animal Health and Industry (DAHI) will

a. review and increase floor prices of cattle at government markets regularly;
b. create awareness on environmental damages arising from

overstocking and make recommendation of optimum number of livestock per livestock holder; and

c. recommend Restocking in areas that are overstocked.

5.2.3.2 *Stall-feeding*

To derive maximum benefit from improved prices (section 5.2.3.1), farmers will stall-feed excess bulls, unproductive heifers and work oxen and poor animals before sale.

5.2.3.3 *Improvement of communal pastures*

Groups of livestock owners with technical and material assistance from DAHI will improve communal grazing land management while individual livestock owners will reduce dependence on crops and use part of their landholding to establish improved pastures and fodder trees.

5.2.3.4 *Expand communal grazing land*

After rehabilitating degraded marginal areas (section 5.2.1.3) chiefs, through VDCs, will:

(a) permit limited and controlled grazing; and

(b) identify additional land which may be converted into managed communal grazing land.

5.2.3.5 *Keep improved breeds*

The Government through the DAHI will continue to:

(a) promote keeping of improved breeds for both beef and milk production;

(b) increase the availability of improved animals; and

(c) encourage the Rural Financing Bank and other lending institutions to give soft loans to livestock owners to acquire improved breeds or multiply them for supply to other farmers.

5.2.3.6 *Promotion of small ruminants*

The Government through DAHI will:

(a) promote keeping of small ruminants e.g. goats, sheep and rabbits by smallholder farmers under cut and carry system; and

(b) identify sources of improved breeds of small ruminants for farmers to rear or multiply them for supply to other farmers.

5.2.4 *Conservation measures for civil works*

5.2.4.1 *Minimal tree destruction when constructing roads*

The government through DREA will:

(a) review and amend the relevant Acts to restrict tree felling during civil works.

The Department of Roads (DOR) will:

(b) stabilise all road cuts;

(c) construct mitre drains up to natural waterways or dig soak pits which should be maintained if and when necessary;

(d) rehabilitate all borrow sites e.g. gravel collecting sites;

(e) minimise constructing wooden bridges and instead concentrate on constructing concrete or steel bridges; and

(f) plant trees along bare highways.

5.2.4.2. *Appropriate allocation of settlement sites*

Chiefs will ensure that there is no:

(a) encroachment in protected areas.

(b) allocation of land in prescribed catchment areas, along river banks, and steep slopes.

The Government through the MFNR will ensure that there is no encroachment, and that local communities are sensitized on the importance of protected areas.

5.2.4.3 *Empower chiefs to sanction tree felling in settlement areas*

Chiefs will need to sanction felling of trees where dwelling units are to be constructed such that there is no unnecessary felling.

5.3 Deforestation

5.3.1 *Agricultural expansion*

5.3.1.1. *Improve land productivity*

The government through the Ministry of Agriculture (MOA) and appropriate NGOs will:

(a) Improve land productivity by sustainable land saving technologies;

(b) develop acceptable High Yield Varieties, (HYVs) for farmers to adopt;

(c) ensure availability of seed, fertilizer and other inputs at affordable prices;

(d) promote mixed and inter-cropping (section 5.2.2.3);

(e) promote agroforestry (section 5.2.1.4);

(f) promote construction of permanent physical conservation measures (section 5.2.1.5);

(g) train farmers to make and properly apply compost manure;

(h) encourage farmers to apply organic and inorganic fertilisers;

(i) intensify training of farmers in modern/improved farming practices; and

(j) promote modern farming methods for fingermillet thereby curbing the current slash-and-burn practice followed by farmers in some areas.

5.3.1.2 *Introduce and promote alternative high value crops*

The DAR will conduct research on alternative high value crops to tobacco, which do not require use of substantial forest products for processing.

The DAET will:

(a) promote production of alternative high value crops; and

(b) train farmers in cultural practices for the introduced alternative crops.

5.3.1.3 *Amend legislation on leased land for agricultural use*

The Government through DLV will:

(a) review and amend the legislation on leasing of land for agricultural use specifically to include the increase of mandatory afforestation hectarage beyond the current 10% and appropriate penalties for non-compliance; and enforce relevant covenants through increased inspectorate;

(b) restrict the size of land to be leased for agricultural use;

(c) acquire underutilised leased land in estates for redistribution to the land-less; and

(d) continue reviewing land rent towards achieving equitable levels.

5.3.1.4 *Diversify economic base*

Government through the Ministries of Energy and Mining (MEM), Commerce, Industry and Tourism (MCIT), Labour and Human Resource Development (MOLMD) and Finance (MOF) will:

(a) promote mining through adequate provision for geological exploration of mineral resources;

(b) promote industrial development (MCIT);

(c) promote small-scale industries in rural areas (MCIT);

(d) Intensify vocational training of school leavers to promote self-reliance (MOLMD);

(e) identify and encourage lending institutions to provide soft loans to enterprising Malawians for small-scale rural industries; (MCIT and MOLMD); and

(f) promote tourism (Tourism Department) including eco-tourism (National parks and forestry).

5.3.2. *Uncontrolled bushfires*

5.3.2.1 *Create awareness on the negative effect of bushfires.*

The Government through DOF will:

(a) intensify campaigns against uncontrolled bushfires through radio, newspapers, posters and video shows including establishment of fire breaks;

(b) formalize Chiefs responsibility on forest resources on customary land and assist them to institute communal policing of customary forests; and

(c) enact legislation against setting uncontrolled bushfires, with penalties clearly stipulated (OOF and MOJ).

5.3. 3. *Fuelwood extraction*

(A) For domestic use

5.3.3.1 *Plant multipurpose trees around homestead*

People will be encouraged to plant and tender multipurpose trees around their homestead with technical advice from DOF, DAET and (LRCB).

5.3.3.2 *Establish individual woodlot*

People with relatively large landholding will be encouraged to establish suitable woodlot and manage them.

5.3.3.3 *Establish village woodlot*

Chiefs will provide land for establishment of village and school woodlot which will be managed through VDCs and school committees.

5.3.3.4 *Improve management of forest resources on customary land*

Government through the DOF will:

(a) relinquish control of forest resources on customary land;

(b) empower Traditional Authorities (TAs) and Sub-Traditional Authorities (STAB) to manage and use the resource sustainably; and

(c) provide technical advice to TAs and STAs on proper management and utilisation of forest resources on customary land.

5.3.3.5 *Promote use of fuelwood saving stoves*

The government through the Department of Energy (DOE) in collaboration with other institutions and NGOs will:

(a) conduct more research on fuelwood saving mud stoves and portable stoves;

(b) identify local entrepreneurs for mass production of the portable stoves;

(c) create awareness on the advantage of mud stoves and potable stoves.

(d) train rural women on how to construct and use a mud stoves; and

5.3.3.6 *Diversify sources of energy*

The government through the DOE in conjunction with other institutions and some NGOs will:

(a) conduct more research on use of solar energy and biogas;

(b) promote use of coal;

(c) train people on how to use and maintain biogas and solar energy; and

(d) encourage education institutions and hospitals to use electricity, coal or solar energy for cooking or heating purposes.

5.3.3.7 *Reduce tariffs of electricity and paraffin*

The Government in conjunction with ESCOM and Petroleum Control Commission of Malawi will consider adjusting tariffs of electricity and paraffin in order to promote wider use of the commodities by low income groups;

The Government will reduce the taxes on electrical appliances to reduce prices of the items.

5.3.3.8 *Accelerate rural electrification programme*

The Government will: accelerate the rural electrification programme to cover more areas, and waive the cost of provision and installation of transformers. However, this would also require improvement in housing type to match electrification requirements.

(B) For commercial and industrial use

5.3.3.9 *Stop use of indigenous woodfuel in industries*

The Government through the DOF and DOE will encourage woodfuel-using industries to establish their own plantation or use of planted wood.

5.3.3.10 *Promote use of planted wood for fuel and charcoal*

The Government through DOF will:

(a) ensure that wood fuel and charcoal are available throughout the country by maintaining appropriate plantations

(b) train people with planted woodlot on how to make charcoal from planted trees;

(c) encourage efficient utilisation of wood.

5.3.3.11 *Establish demand driven woodlot*

NGOs will be encouraged to assist in the establishment of communal forests and Chiefs, through VDCs, will identify suitable land (sections 5.3.3.3 and 5.3.3.9).

5.3.4 *Conservation measures for civil works*

(see section 5.2.4.).

5.3.5 *Inadequate management of public and private forest and encroachment*

(A) Public forests

5.3.5.1 *Improve management skills*

The MFNR will:

(a) recruit and train more personnel in forest and wildlife management;

(b) provide material and human resources required

for proper management of forestry and wildlife resources.

5.3.5.2 *Promote participatory management of forest and wildlife reserves*

(a) The MFNR and Treasury should retain part of the revenue from forest and wildlife reserves to establish a revolving fund which shall be used to develop areas adjacent to these resources.

(b) MFNR will continue to promote the participation of local communities in the management of the resources.

5.3.5.3 *Create awareness on importance of forest and wildlife reserves*

The MFNR will:

(a) intensify public awareness campaigns through radio, newspapers, posters and video shows on the importance of forest and wildlife reserves; and

(b) introduce environmental education in primary and secondary schools and the University in conjunction with Ministry of Education.

(B) Private forests

5.3.5.4 *Improve management of private forests*

The Government through the DOF will:

(a) facilitate forestry management refresher courses; and

(b) provide technical bulletins and brochures on forest management.

5.4. Water resources degradation and depletion

5.4.1 *Waste production and disposal*

5.4.1.1 *Raise environmental awareness and legislate appropriate waste production*

Government will:

(a) encourage companies through DREA to raise awareness of their employees about the dangers of industrial waste materials;

(b) provide incentives through reduced taxation or import duties to companies investing in cleaner technologies through the Treasury;

(c) encourage companies to adopt waste minimization through recycling programmes; and

(d) promulgate legislation requiring companies to categorize and quantify the waste they generate and how to dispose of it;

(e) introduce "polluter pays principle";

(f) invest in conventional disposal facilities and provide infrastructure to improve service provision.

(g) through MOLMD implement proposals on disposal of waste through appropriate legislation.

The LAs should review their by-laws to take into account environmental problems that arise from development activities within their jurisdiction.

5.4.1.2 *Reduce contamination of water arising from the transportation and storage of wastes*

The Government through MCIT will:

(a) initiate research into problems of collection, storage and transportation of wastes, so as to come up with proper guidelines;

(b) introduce legislation for companies to provide warnings and labels on vehicles transporting their wastes.

5.4.1.3 *Reduce contamination of water due to improper disposal of industrial wastes.*

The Government will:

(a) initiate research into proper disposal for wastes not fit for land fills;

(b) through DREA in collaboration with LAs, raise awareness in villages on the dangers of accepting the

industrial wastes on their land;

(c) accede to the Basel Convention and seek financial and technical assistance on the country's waste management problems.

5.4.2 *Human and municipal waste disposal*

5.4.2.1 *Minimize waste at source:*

The LAs will:

(a) ensure that households which are not connected to a sewer network have septic tanks or pit latrines appropriately sited;

(b) ensure that households in areas not covered by a refuse collection service have rubbish pits;

(c) introduce the separation of different types of waste before disposal.

Local leaders should ensure that all households have pit latrines.

5.4.2.2 *Improve waste collection and transportation of municipal wastes.*

The LAs will:

(a) improve the solid waste collection services, by e.g. introducing rubbish banks in traditional housing areas including squatter areas;

(b) regularly maintain sewers to prevent overflowing;

(c) ensure that standards for sewer construction and maintenance are enforced;

(d) ensure that master plans for their sanitation programmes are developed;

(e) intensify public education on rubbish disposal.

5.4.2.3 *Improve conveyance and disposal of wastes.*

The LAs will:

(a) practice sanitary waste disposal methods at landfills;

(b) ensure that siting of landfills and sewage treatment plants should take into consideration hydrological and soil characteristics as well as proximity to human settlement;

(c) ensure that sewerage plants which have exceeded their designed capacities are improved by the responsible authorities;

(d) invest in affordable sewerage systems;

(e) introduce hazardous waste treatment and management centres.

(f) sensitize the general public on the dangers of scavenging at refuse pits.

The Government will undertake research to determine the proximity of pit latrines and septic tanks appropriate to water sources

since the recommended 50 metres seems to be inadequate. Such a study to be meaningful it should take into consideration the effect of hydrological and soil characteristics on the recommended siting distance.

5.4.3 *Agro-chemca1 run-off*

5.4.3.1 *Minimize. use and run-off of agro-chemicals.*

The Government through:

(a) the DAR and DAHI will conduct research and promote integrated pest management.

(b) the DAET will:

i. encourage farmers to use organic manure;

ii. continue training farmers on proper application of fertilisers and pesticides;

iii. encourage land conservation practices to impede runoff.

5.4.3.2 *Proper handling of agro-chemicals*

The Government through MCIT, MOA and MOLMD will:

(a) enforce legislation on the importation, sale, transportation, storage and use of pesticides;

(b) provide guidelines on the proper disposal of empty containers and expired agro-chemicals.

5.4.4 *Sedimentation and siltation*

(see sections 5.2 and 5.3).

5.4.5 *Oil spillage*

5.4.5.1 *Minimize oil spillage by vessels and tankers*

The Ministry of Transport and Communication will:

(a) not renew licences of oil tankers once it is established that they are discharging oil;

(b) regularly inspect vessels and motorised boats against oil spillage and impose appropriate penalties on anybody contravening any regulations.

5.4.5.2 *Halt water contamination by oil from garages:*

The Ministry of Local Government will ensure that LAs:

(a) regularly inspect garages and to ensure- that oil traps are operating efficiently.

(b) identify alternative disposal methods including possible recycling of engine oil.

5.4.6 *Water resources degradation and depletion*

5.4.6.1 *Arrest depletion of Malawi's water resources*

The Government, through the Water Resources Board, will ensure that every water abstraction has a water right.

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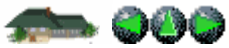

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Chapter 6: Institutional Framework for the Implementation of NEAP

6. Institutional Framework for the Implementation of NEAP

6.1. Introduction

Chapter 2 provides the description of the integrative and participatory NEAP process. The description of the current status, the identification of environmental degradation and the suggestion of interventions, were done through multi-sectoral task forces with broad representation of ministries, departments, public offices, the university and NGOs. Localized environmental problems, their causes and how they could be minimised or arrested were identified by local people at district workshops. The implementation of the NEAP will therefore require the same broad participation of all involved, but with specific roles and responsibilities for each, as specified in section 6.2 in accordance with the following principles:

a) Government guidance on NEAP implementation must be provided continuously to ensure its compliance with Government policies.

b) In the implementation of the NEAP, focus on key environmental issues and focal points of intervention, must be maintained. To ensure this, strengthening of DREA is urgently required.

c) The complexity of actions and projects and the implementation methods will vary. Some will be relatively simple and fall well within the purview of individual Government ministries, departments and other institutions. Others will be more complex requiring multi-sectoral solutions, while some will depend on the involvement and participation of local and traditional authorities. The actual implementation responsibilities will be specified accordingly.

d) While some actions and projects address one or few specific environmental issues, others are all encompassing. Important examples are systems for Environmental Impact Assessments (EIA), Environmental Information Systems (EIS), overall environmental legislation and public awareness. Such actions and projects must be implemented by

institutions with a global mandate (DREA).

6.2. Institutional responsibilities

While DREA will play the role of facilitating the implementation of NEAP, the responsibility to implement the actions will be with the respective implementing agencies. The implementing agencies will be expected to produce an annual report indicating the actions that have been undertaken towards the implementation of either stated actions or environmental investment projects.

It will be the responsibility of the different institutions to ensure that projects being undertaken by them are properly managed. DREA's role will be limited to drawing up stated objectives for monitoring purposes.

Individual responsibilities of some of these institutions are stated in the following sections.

6.2.1 *National Committee for the Environment (NCE)*

For NEAP to be properly implemented the NCE will need to provide the overall guidelines that will ensure a coherent and integrated structure of the NEAP. The NCE will need to be broadened to include NGO's and should report to the National Economic Council.

6.2.2. *DREA*

As Secretariat to the NCE, DREA will be central in ensuring that the objectives of NEAP are observed. DREA will therefore need to have capable officers to undertake the following responsibilities:

1. Facilitate the formulation of projects that will be part of the Environmental Investment Programme (EIP).
2. Agree on the main objectives of those projects and the time frame for their implementation.
3. Develop the key indicators for monitoring purposes with the implementing agencies and ensure the monitoring capabilities.
4. Assume the responsibility to oversee the enforcement of the environmental law.

In all this, DREA will co-ordinate the efforts of different but relevant institutions who will implement the different actions and projects aimed at protecting and managing the environment. DREA will specifically ensure that the following is put in place:

6.2.2.1 *Environmental impact assessments (EIA)*

DREA will facilitate and co-ordinate, where necessary, the provision of environmental impact assessments of projects that will require this. Initially DREA will draw up guidelines on the requirements in an environmental impact assessment for different types of projects. Developers and implementing organisations will have the responsibility to provide EIAs as part of the project preparation exercise. A technical committee under the NCE will review the EIA and either recommend its acceptance or the need for more information or modification of the project. Only when an EIA has been accepted will the project start. Minimum delay in examining EIAs will be exercised.

6.2.2.2 *Environmental monitoring and environmental information systems (EIS)*

The establishment of the environmental monitoring programme in DREA is the major effort towards improved natural resources conservation in Malawi. The multi-sectoral nature of most environmental and natural resource problems requires the coordinated development of digital data sets that can be subjected to integrated analysis through the use of Geographic Information Systems (GIS) and related environmental information technologies. It is therefore necessary that to support continued research and monitoring of environmental phenomenon, that a National Environmental Information System (EIS) is established.

The Environmental Information System is intended to provide timely information to support the inventory, investigation and monitoring of the environment. An organizational structure needs to be developed to provide a mechanism for the development, dissemination and the use of a National Environmental Informational Database. This database will consist initially of an off-line archive of coordinated data sets, developed through a distributed group of independent mapping activities within existing agencies, but accessed through a centralized body such as the Information and Documentation Centre at DREA. At a future date, an on-line network system can be considered. In the meantime, emphasis will be placed on the display and analysis of data through the use of independent software and hardware systems in a variety of contexts.

6.2.2.3 *Environmental framework laws*

In the preparation of NEAP it became evident that the scattered natural resources protection and management acts needed a major review. As this task would have taken a long time to accomplish, an environmental framework law has been proposed as the umbrella law for environmental protection and management. A draft act has been prepared by UNEP and is currently under

discussion. It generally provides for an agency to be responsible for environmental protection and management with powers to sue or be sued, sets out penalties for abuse of the environment after outlining the rights of individuals to a decent environment. The Act establishes the institutional set up, the actual procedures, the specific responsibilities of the agency, the different Ministries and Departments and private organisations. It also explicitly specifies how offenders would be prosecuted as well as the appeals mechanisms.

The draft Act should be fully discussed and considered for adoption by June 30 1994 or soon after.

6.2.2.4 *Environmental awareness campaigns*

DREA will play a leading role in mounting national environmental awareness campaigns and assist in their promotion by identifying those responsible for addressing different environmental concerns. The collaborating agencies will include schools, universities, the media, and the appropriate NGOs.

6.2.2.5 *International conventions*

The Government of Malawi has signed various international environmental conventions:

- The Convention on International Plant Protection ;
- The Convention on Wetland of Significant Importance;
- The Convention Concerning the Protection of the World Cultural and Natural Heritage;
- The Convention on the Conservation of Migratory Species of Wild Animals;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- The African Convention on Conservation of Nature and Natural Resources;
- The FAO International Undertaking on Plant and Genetic Resources;
- The United Nations Convention on the Law of the Sea;
- The Montreal Protocol for Protection of the Ozone Layer;
- The Convention on Biological Diversity;

The Department of Research and Environmental Affairs has a monitoring role to ensure compliance.

6.2.2.6. *Monitoring of implementation of NEAP*

Successful implementation of the NEAP requires continuous monitoring of all NEAP implementing institutions. In this regard DREA will have the task of monitoring the implementation

through an annual review of the NEAP. This will be in the form of DREA requiring all agencies implementing different parts of NEAP to provide annual reports of their achievement in both actions and EIP. These reports will be compiled by DREA for the attention of the NCE. The initial task will be to develop the alias that will require reporting on.

6.2.3. *The Land use and Planning Committee*

This committee, whose Secretariat is the Department of Lands and Valuation, and is chaired by the Secretary to the President and Cabinet (also the chairman of the National Committee on the Environment) will be reactivated. This committee acts as a forum where all public sector agencies involved in environmental resources management (and depletion) are members.

The membership includes the Ministry of Forestry and Natural Resources with its Departments of Forestry, Geological Surveys, -Fisheries and National Parks and Wildlife; the Ministry of Agriculture; the Ministry of Economic Planning and Development; the Department of Water in the Ministry of Works; the Office of the President and Cabinet; Departments of Lands and Valuation, District Administration and Rural Development; Housing and Physical Planning, Surveys and Research and Environmental Affairs; the Ministry of Finance and the Ministry of Local Government. The Committee which oversees the development proposals on land use, can be very useful and the Secretariat would develop a good land use data base.

6.2.4. *Ministries and departments*

It will be the responsibility of ministries and departments to further operationalise the Plan's strategies and actions and to implement these through their on-going activities, which will be re-oriented accordingly. They will have proposed EIP projects and it will be their responsibility to ensure implementation of these by providing counter part funding and staff to carry out the actual project execution. They will annually provide a report on the implementation of the NEAP actions and the projects under their purview.

6.2.5. *University*

The University has participated actively in the task forces and in accordance with NEAP strategies and actions, efforts will be made to strengthen their environmental curriculum and research. They will be responsible for the implementation of research projects under the EIP.

6.2.6. *Parastatals*

Parastatals carry out activities, which effect natural resources and the environment. As Government institutions they have special responsibilities to ensure that they do so in accordance with the NEAP. Furthermore, the EIP will include projects to be implemented by parastatals for which they will have the same responsibilities as ministries and departments.

6.2.7. *Private sector*

Private groups, with interests that have a bearing on natural resources either as users or protectors, should be encouraged to co-operate with DREA and other public offices involved in similar occupation. Their projects should be available to DREA for Environmental Impact Assessment and this can be done both as a result of public awareness or through an enacted law. Special efforts will be made by DREA to promote the participation of the pivotal sectors in order to implement strategies pertaining to management of industrial and agro-chemical waste.

6.2.8. *Non-governmental organisations*

Non-Governmental Organisations have been involved in the NEAP process. These NGOs will be encouraged to play an active role in both promoting NEAP strategies through awareness campaigns and also to be actively involved in the implementation of EIP projects, particularly at local level.

6.2.9. *Donors*

For the implementation of NEAP and the EIP the Government will seek financial and technical assistance from multilateral and bilateral donors as well as from international NGOs.

6.3 Capacity building

6.3.1 *Training*

There is need for training of personnel who work in institutions that deal with natural resources conservation, utilisation and monitoring. These institutions include Ministries of Forestry and Natural Resources, Agriculture, Department of Lands and Valuation, Surveys Department, Water Department, the University Colleges, the Malawi Bureau of Standards and Non-governmental organisations to ensure trained manpower in all aspects of environment for sustainable development. Provision of necessary equipment for better execution of their duties and proper career paths to ensure continuity should be provided. The scarce resources should be redistributed to allow conservation of nature in the development efforts by each sector of the economy in Malawi. More use should be made of the available resources in

natural resources to orient private sector and non-governmental organisations, and create environmental awareness in the implementation of development projects.

6.3.2 *DREA*

DREA needs manpower development to cope with its many tasks, which include co-ordination and advisory duties on environmental issues as well as monitoring of the implementation of NEAP and its Environmental Investment Programme. Even if a recruitment and training programme was undertaken, it could only begin to bear fruit in two to four years time. The NEAP Secretariat which was created in DREA, was entrusted with the task of producing the NEAP with this constraint in mind. With the manpower development within DREA the Secretariat should be able to integrate into the DREA establishment in three years time, thus further providing needed human resources. The evaluation of the Environmental Investment Programme will be co-ordinated by DREA through the Secretariat initially, but later on this role will be performed by the different implementing agencies or independent agencies.

The implementation of NEAP will, to a large extent, depend upon the active participation of local and traditional authorities as well as the local population. They will be supported by Regional Environmental Officers attached to the Regional Administrators

offices. These three officers should have sufficient resources and autonomy to be able to provide essential support to local and traditional authorities in the implementation of NEAP and the EIP and other local environmental activities, particularly the District Environmental Action Plans, as described in section 5.4. Eventually each district should have an environmental officer to co-ordinate the district environmental action plans.

6.4 District environmental action plans

The local population has actively contributed to the NEAP through the Consultative District Workshops, where all districts have participated. The local and traditional authorities not only played a pivotal role in identifying environmental problems but also proposed actions and projects to improve natural resource management end to combat environmental degradation. Implementation through local participation and awareness raising is critical for real headway to be made.

Arising from the District Consultative Workshops, it is expected that District Environmental Action Plans will be developed. Their implementation will be at three levels:

a. actions to be taken by the local communities on their own;
b. actions to be undertaken by the local communities with assistance from Government or any organization; and
c. actions to be undertaken by Government or non-governmental organisations (NGOs).

The District Environmental Action Plans will dovetail into the National Environmental Action Plan. Every project taking place in Malawi will be within the area of one or more Districts. Its activities will be communicated to the local communities through the District Development Committees and through District workshops. All leaders will be sensitized of the development projects to be carried out in their areas and they will be allowed to contribute ideas to the implementation of projects.

6.5 Malawi environmental investment programme (EIP)

A Malawi Environmental Investment Programme has been prepared grouping the project proposals that emanated from the NEAP process. The EIP is presented as ~~Volume 3~~.

The various proposals or interventions were subjected to tests in order to categories and prioritize them. Criteria for the categorization and prioritization of projects were agreed upon by all members of task forces and broadly followed the following principles:

(a) Categorization of projects

Before prioritizing the project ideas, due consideration was given to the need to group the PIs in each Key Environmental Issues. To facilitate this initial process, the project ideas were analyzed with special emphasis on their likely impact in addressing environmental degradation. To determine the direction of the approach, the process took into consideration all project objectives and goals, intended benefits and extent of beneficiary.

Within the seven Key Environmental Issues, the project ideas were either categorized as direct impact (approach) or indirect impact [4]. Project ideas falling under Indirect Impact were further de-categorized into the following groups: Institutional Building, Environmental Monitoring, and Environmental Research.

The preliminary results indicate that there are more project ideas falling under Environmental Research irrespective of the Key Environmental Issues. This, largely, reflects the high priority that is accorded to environmental research to finding ways of reversing environmental degradation, and the need for more

information on environmental issues.

(b) Prioritization of projects

The need for prioritizing projects arose to ensure allocations to the needy areas in consideration of the Government, variability in impact or approach, and differences in the expected benefits and extent of beneficiary. The process therefore accorded greater consideration to the environmental implication of project ideas, which would contribute to long-term sustainable growth.

It is important to note that, there is rarely any simple choice between development and environment. What is needed is a more comprehensive consideration of environmental implication of any future projects from the earliest stages of project preparation.

In order to prioritize the project ideas the Secretariat devised criteria ~~which is shown in Table 5.1.~~ The criteria advocates ranking projects by awarding points according to the following points:

a. Seriousness of the environmental problem: especially with respect to irreversible degradation.
b. expected Efficiency or Impact of Project cost in relation to capability to efficiently mitigate environmental problem.
c. element of uncertainty with respect to expected efficiency.
d. distributional effects related to income distribution or poverty alleviation.
e. bottleneck assessment : the extent of stumbling block towards achievement of environmental goals.

The criteria constitute. a starting point towards the formulation of bettor criteria and its strength lies in the simplicity Ah application.

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Chapter 7: Conclusion

7. Conclusion

Through the NEAP process nine issues threatening the environment and natural resource base of Malawi have been analyzed and documented. These are: soil erosion, deforestation, water resources degradation and depletion, depletion of fish stocks, loss of biodiversity, human habitat degradation, high population growth, climatic changes and air pollution.

For the first four issues calculations of their social costs have been made. The cost of soil erosion has been estimated at MK1, 155 million (US$ 165 million) annually, which corresponds to 8% of the country's 1994 Gross Domestic Product (GDP); while that of deforestation has been estimated at MK385 million (US$ 55 million), about 3% of GDP. Furthermore, the cost of the water pollution and lack of sanitation has been estimated at MK105 million (US$ 15 million) annually, which is almost 0.8% of GDP. A similar social cost of fishery resource depletion was estimated at MK36 million (US$8.4), approximating 0.2% of the GDP.

In the WRAP, actions addressing all environmental issues in Malawi have been listed and those responsible for implementing at central and local level identified. All institutions should undertake the actions identified in the NEAP whether they touch on changing policies or merely strengthen the execution of existing responsibilities. Central Government institutions will be accountable for the implementation of these actions for which an annual reporting system will be established.

In support of these individual actions the Government will put emphasis on creating the necessary conditions for their implementation, of which the most important ones the following:

a) Legislation

The ongoing revision of Pectoral legislation addressing specific environmental issues will be strengthened. Special effort will be made to review scope and content, proper identification of party or parties responsible for environmental damages and to ensure adequate penalty and enforcement mechanisms.

A draft act for an environmental framework law is presently under review. This act deals with such cross-sectoral issues as

overall environmental policy formulation, environmental planning, environmental quality criteria and standards, environmental impact assessment, pollution of environmental media, institutional co-ordination and conflict resolution, and the monitoring of implementation of environmental policies by sectoral agencies. As a follow-up of the NEAP, the Government will give special priority to ensuring that such an environmental framework law is enacted as soon as possible.

In order to ensure improved management of the country's environment special priority will be given to establishing the necessary legal basis for Environmental Impact Assessment as part of project preparation and appraisal.

b) Institutional framework and strengthening.

To ensure adequate institutional framework for the management of natural resources and the protection of the environment in general and the implementation of the NEAP and recommended actions in particular, the National Committee for the Environment (NCE) will be given a pivotal role. This committee will be broadened to include NGOs and will report to the National Economic Council. Priority will be given to strengthen both the central policy and coordination institution DREA as well as the environmental capacity of relevant ministries and departments. As a mechanism for improving institutional coordination and environmental management, an environmental monitoring and information system will be established.

c) Awareness raising

The implementation of the NEAP depends on the participation of the Malawian population and its institutions at all levels. The Government will therefore launch a major national environmental awareness campaign to prepare the ground for NEAP implementation.

d) Environmental Investment Programme (EIP)

As part and follow-up of the NEAP, an Environmental Investment Programme is prepared in support of the Action Plan. Implementation of these EIP projects requires both changed priorities in Government budget allocations and external financial support from donors. The EIP will therefore be closely coordinated with the Malawi Public Sector Investment Programme (PSIP), of which it will eventually be part. However, the project profiles provided in the preliminary EIP will need to be translated into actual project proposals, which will be formulated as a second stage.

e) Review of NEAP

The NEAP document should be reviewed after three or five years.

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Appendix 1: List of Task Forces Reports

A List of Task Forces Reports	
1.	Chikuni A.C., Kalindekafe M.P. and Thengo-Kumpumula M. *(1993) An Issues Paper on Malawi Forestry Sector (Task Force No. 3).*
2.	Chokazinga (1993) *Issues Paper on Industry, (Task Force No.*7).
3.	Chuma, J. (1993) *Education and Public Information (Task Force No. 17*).
4.	Dolozi, M.B. (1993) *National Context of the National Environmental Action Plan (Task Force No. 1).*
5.	Guta, C.W. (1993) *Environmental Research Priorities (Task Force No. 16).*
6.	Jere, G.S.Z. (1993) *Energy and Mineral Resources Development and Environment (Task Force No. 6).*
7.	Kalemba, E. (1993) *Natural Hasards, (Task Force No. 12).*
8.	Kasweswe-Mwafongo, W.M. (1993) *Land Use Planning and Management in Malawi, (Task Force No. 11).*
9.	Kazombo, J. (1993) *Issues Paper on Pollution Control and Waste Management (Task Force No. 18).*
10.	Khonga, E.B. (1993) A *Report on Biological Conservation in Malawi (Task Force No. 14).*
11.	Kululanga, G.K. and Chavula, G.M.S. (1993) *A report on Water Resources of Nalawi (Task Force No. 4).*
12.	Kwapata M., Mwendera E.J.and Kanyama-Phiri G. (1993) *Agriculture (Task Force No. 5).*
13.	M'mangisa Eta.R. (1993) *An issues paper on Transport and Communications (Task Force No. 9) .*

14.	Munthali, A.C. and Tembo, K. (1993) *Issues Paper on Health (Task Force No. 10)* .
15.	Ngwira, T.N. (1993) *Task Force of Fisheries (Task Force No.* 2).
16.	Phiri, S.B. (1993) *Issues Paper on Legislation Policies and Institutional Framework, (Task Force No. 15).*
17.	Sefu, A.C. (1993, *A report of the Task Force on Tourism (TF No. 8).*
18.	Shawa, Mary (1993) *Population and Human Settlement Issues Paper (Task Force No. 13).*

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Appendix 2: LIST OF INSTITUTIONS INVOLVED IN NEAP

LIST OF INSTITUTIONS INVOLVED IN NEAP

Ministries

1. Agriculture and Livestock Development
2. Commerce, Industry and Tourist
3. Community Services
4. Economic Planning and Development
5. Education Science and Technology
6. Energy and mining
7. Finance
8. Forestry and Natural Resources
9. Health and Environmental Affairs
10. Information and Broadcasting
11. Justice
12. Labour and Manpower Development
13. Lands and Housing
14. Local Government and Rural Development
15. Physical Planning and Surveys
16. Transport and Communication
17. Works, Supplies and Water Development
18. Women and Children Affairs

Departments

19. Agricultural Extension and Training
20. Agricultural Research
21. Animal Health and Industries
22. Building
23. Defence
24. District Administration
25. Energy
26. Fisheries
27. Forestry
28. Housing and Physical Planning
29. Information
30. Lands and Valuation
31. Meteorology
32. Mining
33. National Parks and Wildlife
34. National Statistical Office
35. Posts and Telecommunications

36. Police
37. Roads
38. Road Traffic
39. Surveys
40. Tourism
41. Water Services

Parastatals

42. Agricultural Development and Marketing **Corporation**
43. Blantyre Water Board
44. Electricity Supply Commission of Malawi
45. Kasungu Flue Cured Tobacco Authority
46. Lilongwe Water Board
47. Malawi Broadcasting Corporation
48. Malawi Bureau of Standards
49. Malawi Development Corporation
50. Malawi Institute of Education
51. Malawi National Commission for UNESCO
52. Malawi National Examination Board
53. Malawi Railways
54. Mining Investment and Development Corporation
55. National Herbarium and Botanic Gardens of Malawi
56. National Road Safety Council of Malawi
57. Petroleum Commission
58. Smallholder Coffee Authority
59. Smallholder Sugar Authority
60. Smallholder Tea Authority
61. Tobacco Control Commission
62. Tobacco Research Institute of Malawi
63. University of Malawi
63. Viphya Corporation

Other Organisations

64. Action Aid
65. Blantyre City Council
66. Blantyre Newspapers
67. Caritas
68. Centre for Social Research
69 Christian Service Committee
70. Council for Non-governmental Organization of Malawi
71. District Administration
72. District Councils
73. Donor Community
74. Estate Extension Service Trust
75. International Centre for Research in Agro-forestry (ICRAF)
76. Journalist Association of Malawi

77. Lilongwe City Council
78. Malawi Development Corporation
79. Malawi Industrial Research and Technology **Development Centre**
80. Malawi News Agency
81. Malawi Tourism and Development Investment Corporation
82. Mzuzu City Council
83. National Association for Business Women
84. OXFAM
85. Wildlife Society of Malawi
86. World Vision International
87. Zomba Municipality.

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Appendix 3: Variety of Crops

. *Appendix 3: Range of Crops and Some Varieties Grown by Smallholder farmers*

	Name of Crop	Varieties
1	Maize	local, ukiriguru composite A (UCA), NSCM41, tuxpeno I, MH12, MH15, MH16, MH17, MH18, chitedze composite A (CCA), chitedze composite C (CCC)
2	Rice	local, faya 14-M-49, blue bonnet, senga (IET), changu (IR156-250-22)
3	Wheat	Kenya nyati, TORIM 73, limpopo, jupateco, lourie, gamtoos
4	Barley	cabin, trumph, CA 737606, CA710404
5	Sorghu	local, PN3
6	Finger mille	local, Cultivars 516, 366, dopalopa, mavoli
7	Pearl millet	local, nigerian composite
8	Groundnuts	Chalimbana, manipintar, marimba, Chitembana, RG1, mawanga, chitedae groundnut 7 (c67)
9	**Beans**	
10	dwarf	nasaka (253/1), bwenzilawana (373), kamtsilo (4991/l), sapelekedwa (600/1)
11	climbing	kanzema (97/1), namajengo (336)
12	Soya beans	davis, bossier, impala, kudu
13	Ground beans	local
14	Guar beans	local, khanpur
15	Cowpeas	local
16	Pigeon peas	local, ICP9145
17	Chick peas	local
18	Sunflower	local, SO 323, PNR 7232
19	Cotton	A637MB3, makoka 72, makoka 78 (ALA54), rasm 17, ezam 6, IRM 81
20	**Tobacco**	
21	Flue-cured	kutsaga E-1, kutsaga 51E, kutsaga 110, coker 347, speight G-28
22	Fire-cured	Malawi western
23	Sun-air-cured	Malawi western
24	Oriental	samsun
25	Burley	banket A-1, barnett's special, burley37,

		harwin
26	**Coffee**	S. Agaro 56, NTEG 1, NTEG II
27	**Macademia**	not indicated
28	Tea	SFS 150, SFS 180, SFS 204, SFS 210, PC 1, PC 79, PC 80, PC 81, PC 105, PC 108, PC 110
29	Tung	not indicated
30	**Sugar cane**	**NCO** 376, NCO 310, N52/219, Co 1001, N14
31	**Vegetables**	
32	**asparagus**	mary Washington, California 500, beet root crimson globe, dedroot, dark red cabbage drumhead, golden acre, Copenhagen market new jersey, gloria hybrid, sugar loaf
33	**Chinese cabbage**	wong bok, Re-Tsai
34	**mustard** (leaf	local
35	**rape**	local
36	**cauliflower**	**snow** drift, snow ball, snow cap
37	**brussels sprout**	jade cross (Fl)
38	**broccoli**	green atlantic
39	**carrot**	chantenay, early cape market, nates
40	**lettuce**	new York, great lakes, london white, webb's wonderful, butter crunch
41	**Cucumber**	local, stone, marketer, gemini
42	**Pumpkin**	local, flat boer
43	**Melon**	
44	sweet melon	charleston grey
45	**water melon**	local
46	Squash	Queensland blue
47	**Onion**	local, dewildth, white lisbon, early texas grano, pod creole
48	Leek	Italian giant, musselburgh
49	Egg plant	florida high bush, black beauty, pompano pride
50	**Tomato**	money maker, homestead, roma, local
51	Potato	roslin eburu (B53), roslin castle, roslin tsangano, roslin bvumbwe, 853/1 (van der plank), 890/20 desires pimpernel, ARKA, spartan up-to-date, pentland crown
52	Okra	Clemson spineless, local
53	Rhubarb	myatt's Victoria, prince albert
54	Peas	green feast, onward, alderman, earlicrop, W.F. massey
55	Turnip	white, golden ball
56	Radish	trench breakfast, sparkler, icircle

57	Spinach	fordhooke giant, new Zealand, malabar
58	Sweet corn	stowells evergreen, golden bantam, Yukon
59	Celery	not indicated
60	**Spices**	
61	ginger	local
62	turmeric	local
63	cardamon	malabar, mysore,
64	sweet pepper	California wonder, bullnose
65	chilies	birds eye, red cayeme
66	cinnamon	not indicated
67	garlic	local
68	coriander	not indicated
69	sesame	not indicated
70	**Root crops**	
71	cassava	chitembwere, mbundumali, yasungwi, gomani
72	sweet potato	kamchiputu, babache, kenya, lunyangwa(LRS407)
73	yams	local
74	grams	green grams, black grams
75	**Fruits**	
76	apples	tropical beauty, rome beauty, R.E.99
77	avocadoes	fuerte, mayapan, anahem, collinson
78	bananas	kabuthu, sukali, zomba
79	**Citrus**	
80	oranges	sweet orange, valencia
81	tangerines	local
82	grapefruit	local
83	lemon	rough lemon, local
84	lime	not indicated
85	mangoes	local, haden, zill, fascell, kens, tommy anderson, davis-haden, palmer Irwin
86	peaches	killiekranke, florida red, earlibelle,
87	pear	hood, floridahome
88	granadillar	purple, golden, giant
89	plums	satsuma, methley
90	pineapple	smooth cayene queen
91	strawberries	Cambridge favourite, nankhunda red gauntlet
92	tung	not indicated
93	macadamia	not indicated
94	cashew-nut	local
95	coconut	local
96	papaya	waimanalo, sunrise, local
97	guava	lucknow 49, safeda, allahbad, chittidar,

		local

(Source: Department of Agricultural Research, 1991; and Ministry of Agriculture, 1992/93).

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Appendix 4: Environmental Issues and Strategies

Appendix 4: Environmental Issue, Focal Points of Intervention and Strategies	
Focal Point of Intervention	**Strategies**
Environmental Issue: Soil Erosion	
Cultivation on marginal land steep slopes river banks	• Protection of Steep Slopes and River Banks • Resettlement of People from Marginal Lands • Rehabilitation of vacated marginal lands • Promotion of Agro-forestry • Construction of Permanent Physical Conservation structures
Mono-culture, Non-contour row cropping	• Crop Rotation • Contour Planting of all crops • Promote Mixed and Inter-cropping by smallholder farmers
Over-grazing	• De-stocking • Stall feeding • Improvement of Communal pastures • expand communal grazing land • keep improved breeds • Promotion of small ruminants
Infrastructure Development	• Minimal Tree. Destruction when constructing roads • Appropriate allocation of settlementsites • Empower Chiefs to regulate tree felling in settlement areas
Environmental Issue: Deforestation	
Agricultural Expansion	• Improve land productivity • Introduce and promote alternative high value crops • Amend legislation on leased land for agricultural use • Diversify Economic Base
Uncontrolled Bush fires	• Create awareness on the negative effect of bushfires
Fuelwood Extraction	• Plant multipurpose trees around homestead • Establish individual woodlots • Establish Village woodlots • Improve management of forest resources on customary land • Promote use of fuelwood saving stoves • Diversify sources of energy • Reduce tariffs on electricity and paraffin

	• Accelerate rural electrification programme • Stop use of indigenous fuelwood in industries • Promote use of softwood for fuel and charcoal • Establish demand driven woodlots
Environmental Issue: Deforestation	
Inadequate management of Public and Private Forests and Encroachment	• Improve management skills • Promote participatory management of forests and game Reserves • Create awareness on importance of forest/game reserves • Improve management of private forests
Infrastructure Development	• (See 4~2.4 on Soil Erosion)
Environmental Issue: Degradation of Surface and Ground Water	
Waste Production and disposal ·	• Raise environmental awareness and legislate appropriate laws governing waste production and disposal • Reduce contamination of water arising from transportation and storage of waste • Reduce contamination of water due to improper disposal of industrial waste
Human and Municipal Waste Disposal	• Minimize waste at source • Improve waste collection and transportation of municipal wastes • Improve conveyance and disposal of wastes
Agrochemical Runoff	• Minimize use and run off of agro-chemicals • Proper handling of agro-chemicals
Environmental Issue: Degradation of Surface and Ground Water	
Sedimentation / Siltation ·	• See paragraphs 4.2 and 4.3 on soil erosion and deforestation
Oil spillage	• Minimize oil spillage by vessels and tankers • Halt water contamination by oil from garages • Arrest depletion of Malawi's water resources
Depletion of Surface and Groundwater Resources	
Environmental Issue: Depletion of Fish Stock	
Destruction of Breeding Grounds	• Reduce sediment load in both river and lake water • Combat water pollution • Improve information on fish species, fish stocks and regeneration capacities • Halt spreading of non-indigenous fish and weeds • Increase local knowledge on fish breeding and biology in general
Over fishing	• Control and monitor number of current fishermen and those entering the fishing industry • Halt use of non-sustainable fishing technology

	• Enforce 'off-season' regulation • Promote fish farming technology
Environmental Issue: Depletion of Fish Stock	
Obstruction of fish migration in rivers	• Reduce sediment load in rivers and halt use of non-sustainable fishing practices
Environmental Issue: Threat to Biodiversity	
High Population Growth	• This is addressed in paragraph 4.9
Habitat Loss	• Control of agricultural expansion • Halt Encroachment into protected areas • Destruction of important, fragile but unprotected ecosystems • Stop bush fires • Promote Economy Diversification • Address low agricultural productivity • Prevent loss of land races • Empower local leaders in biodiversity conservation
Policy Failures	• Diversification of the economy (refer to section 4.3.1.4) • Improve agricultural productivity refer to section 4.3.1 • Reduce loss of land races • Involve local leaders in biodiversity conservation
Environmental Issue: Threat to Biodiversity	
Illegal Exploitation of Forestry and Wildlife Resources	• Eliminate poaching • Legalize access to protected areas
Loss of Freshwater Biodiversity	• Actions to address this problem are covered in paragraph 4.5
Environmental Issue: Human habitat degradation	
Planning and Provision of Housing and Basic Services	• Promote low cost housing scheme in both urban and rural areas • Speed up allocation of plots for both traditional housing areas and medium to low density areas • Review development charges to create incentive framework for plot development and provide basic services to facilitate speedy plot development • Review ground and property rents
Water Supply	• Improved provision of water supply • This is addressed in section 4.4.2
Waste Disposal	
Environmental Issue: High Population Growth	
Fertility Rate	• Promote intensive female education • Introduce sex education and family planning subjects into the regular curriculum at all levels

	of education • Increase the general literacy rates • Empower women in decision-making • Promote population/family planning programmes • Control unplanned, unwanted pregnancies
Immigration and Migration	• Control of immigration • Create rural off-farm employment opportunities
Environmental Issue: Air Pollution	
Gas Emissions from the transport sector	• Reduce gas emissions from the transport sector
Emission of Pollutants and Particulate matter from industries and mines	• Improve ambient air quality in industrial establishments • Improve air quality in the work environment
Bush fires	
Air quality pollution	• Discourage deliberate bushfires • Control air quality pollution
Environmental Issue: Environmental Education and Public Information	
Environmental Information Centres	• Establishment of environmental information centres
Environmental Education	• Enhancing environmental subjects in the regular curriculum • Disseminate public information and raise awareness on the environment

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Fig 2.1 Malawi NEAP Structure

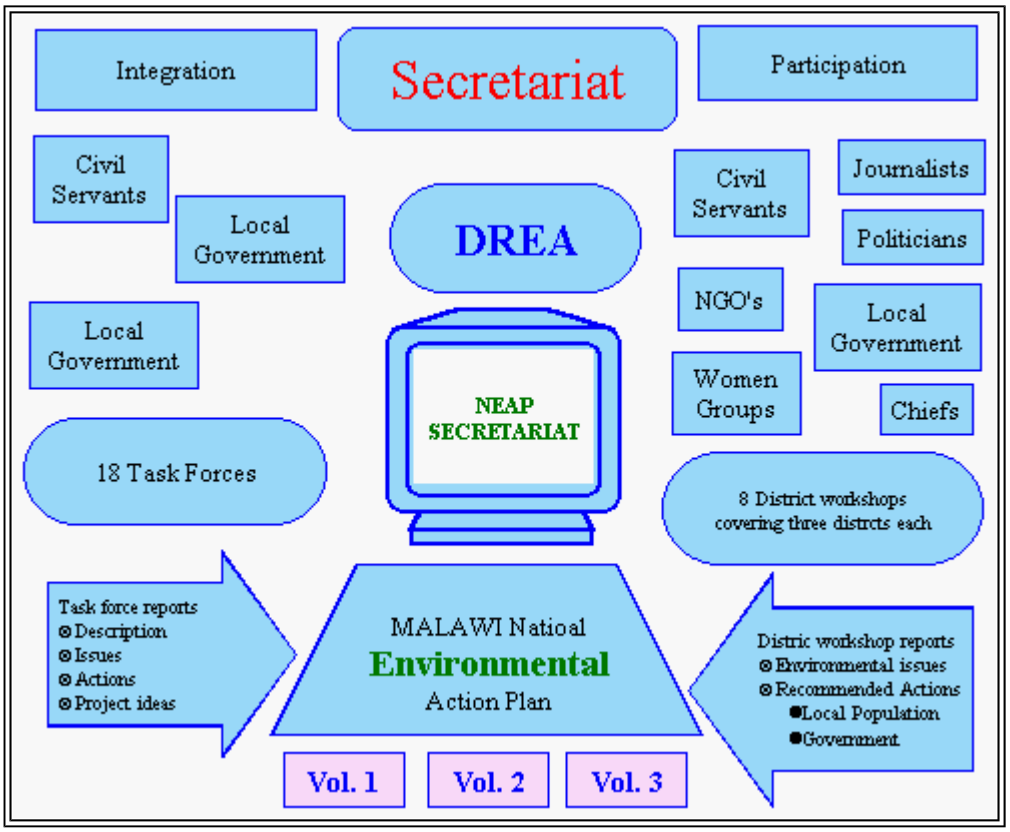

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Fig 2.2: Malawi NEAP Process

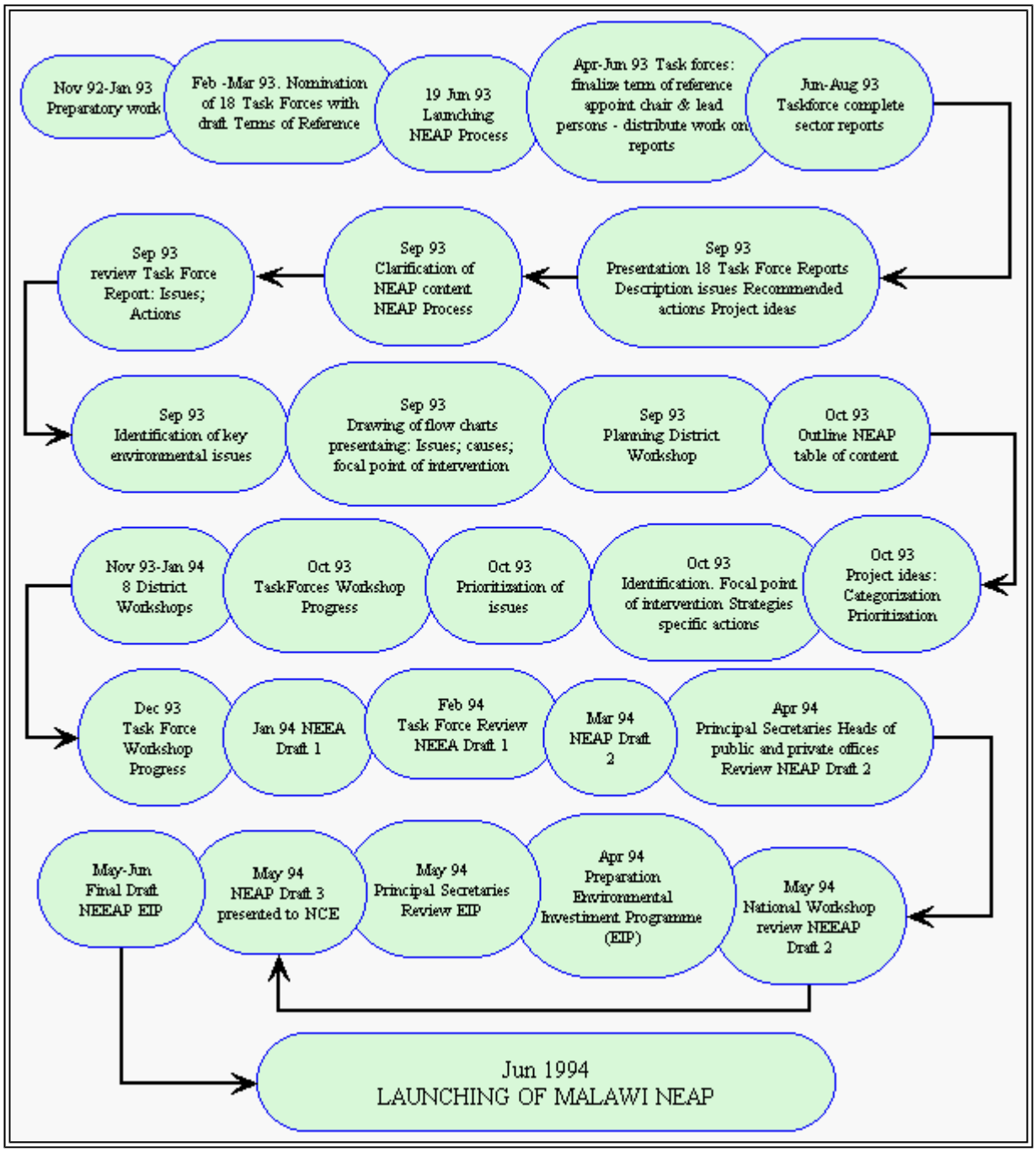

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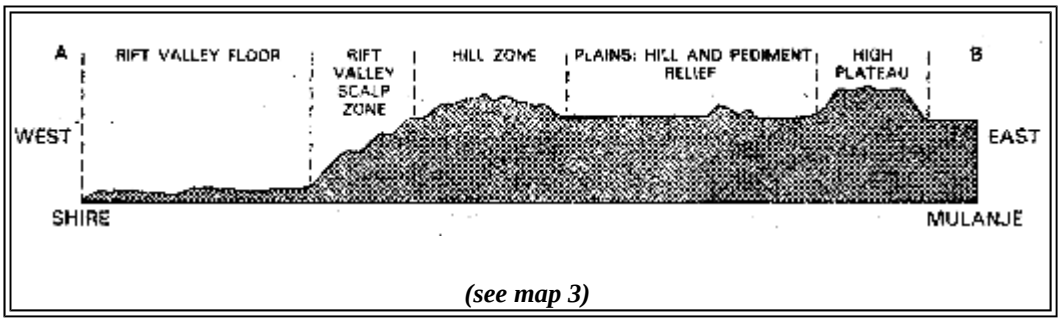
Fig 3.1: A cross-section of Physiographic units from Shire River to Mulanje Mountain



(see map 3)

Source: the National atlas of Malawi

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Fig 4.1: Factors contributing to deforestation, loss of biodiversity and land degradation

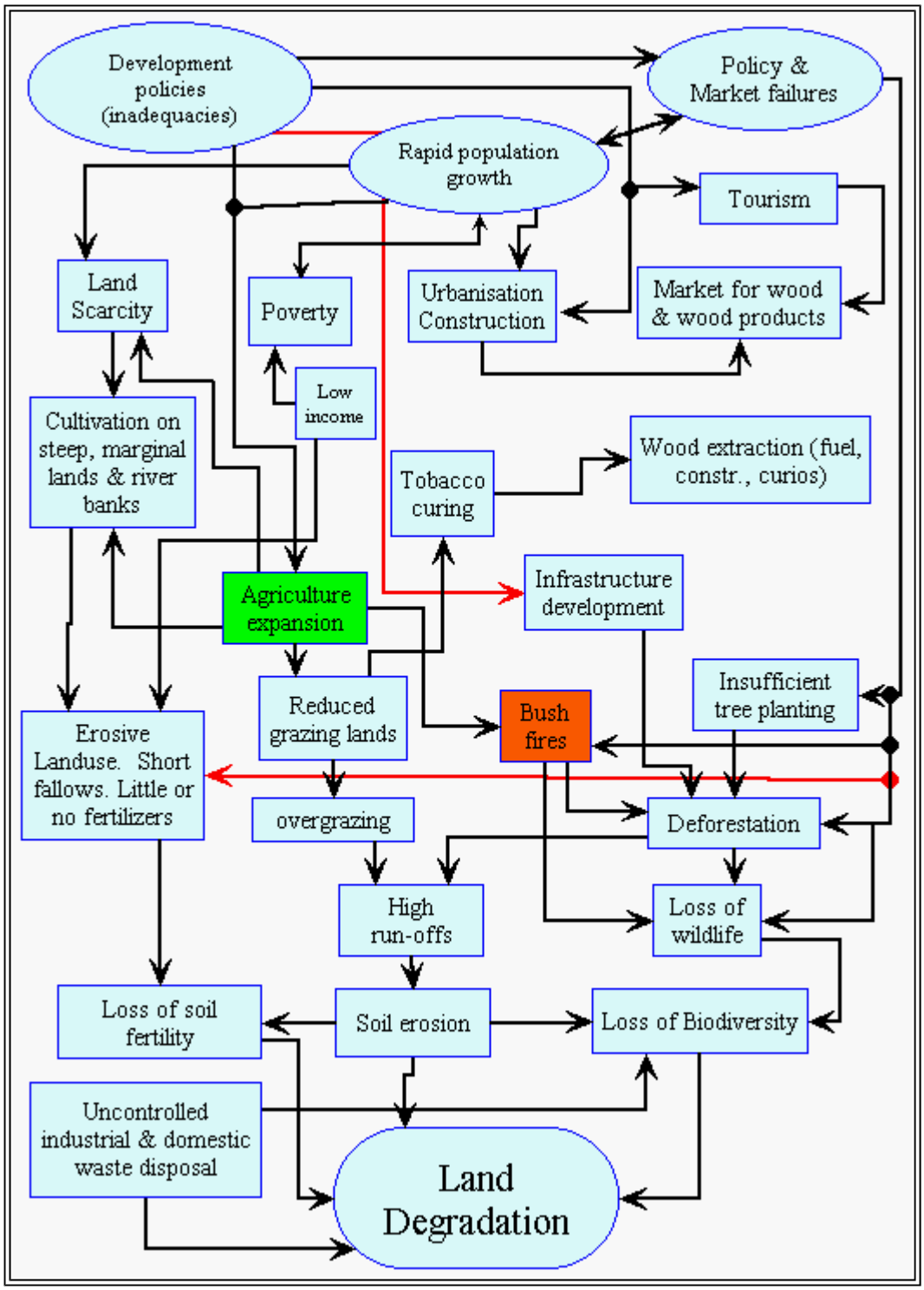

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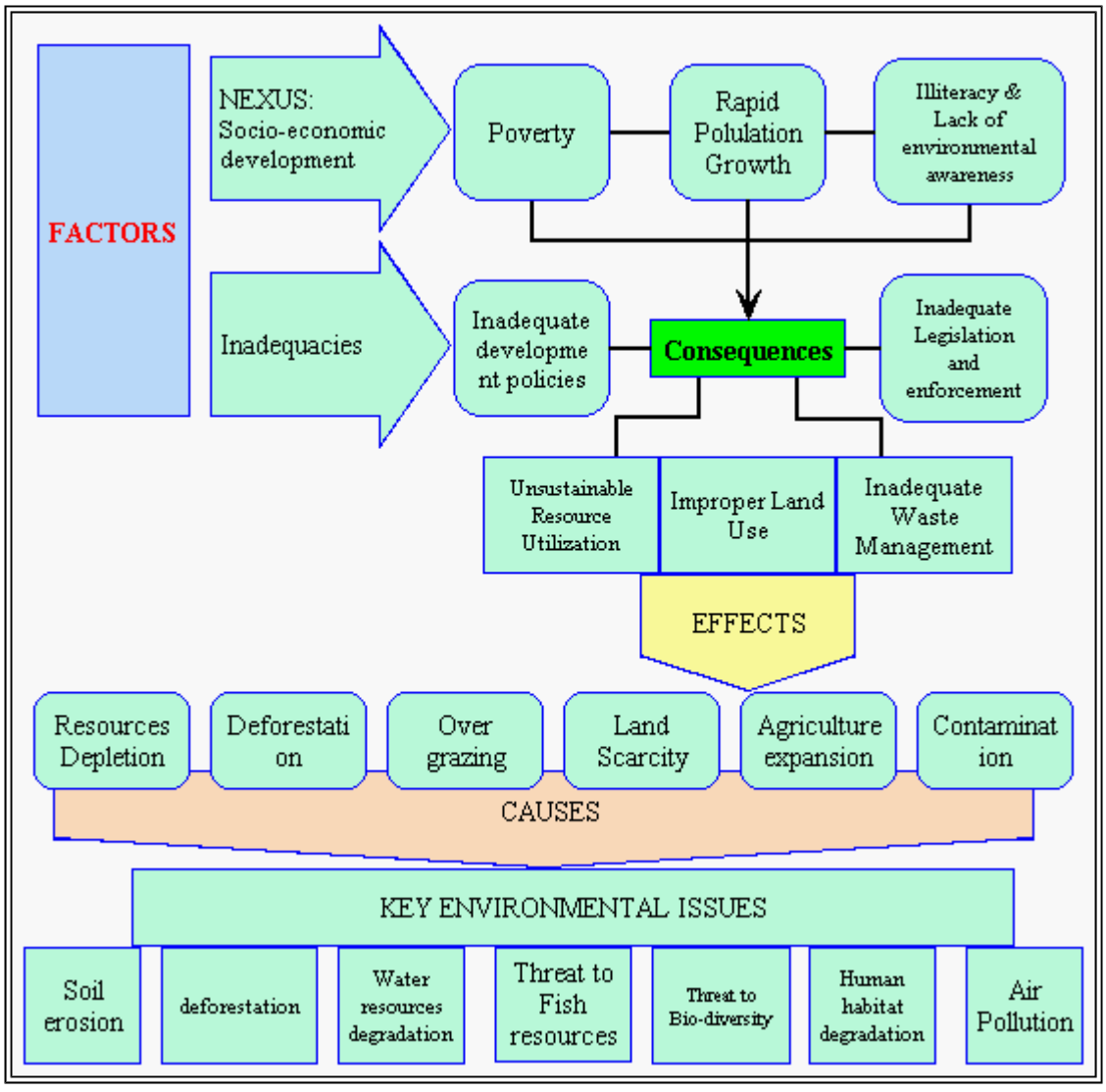
Fig 4.3: Model for Environmental Degradation in Malawi



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