



REPUBLIC OF MALAWI

MALAWI'S NATIONAL ADAPTATION PROGRAMMES OF ACTION (NAPA)

UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

FIRST EDITION



Ministry of Mines, Natural Resources and Environment
Environmental Affairs Department

March 2006

Fig. 1: Map of Africa showing the position of Malawi

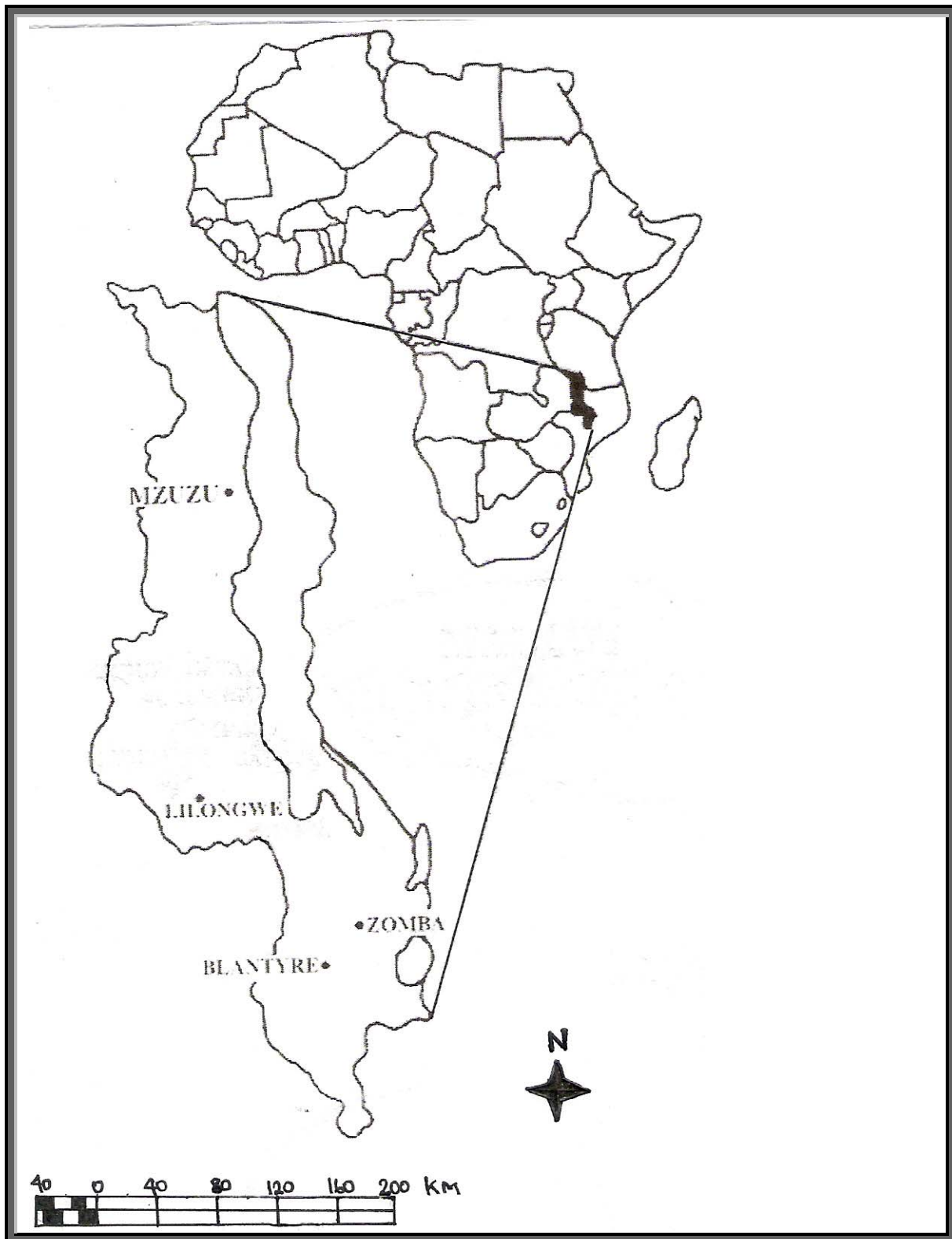
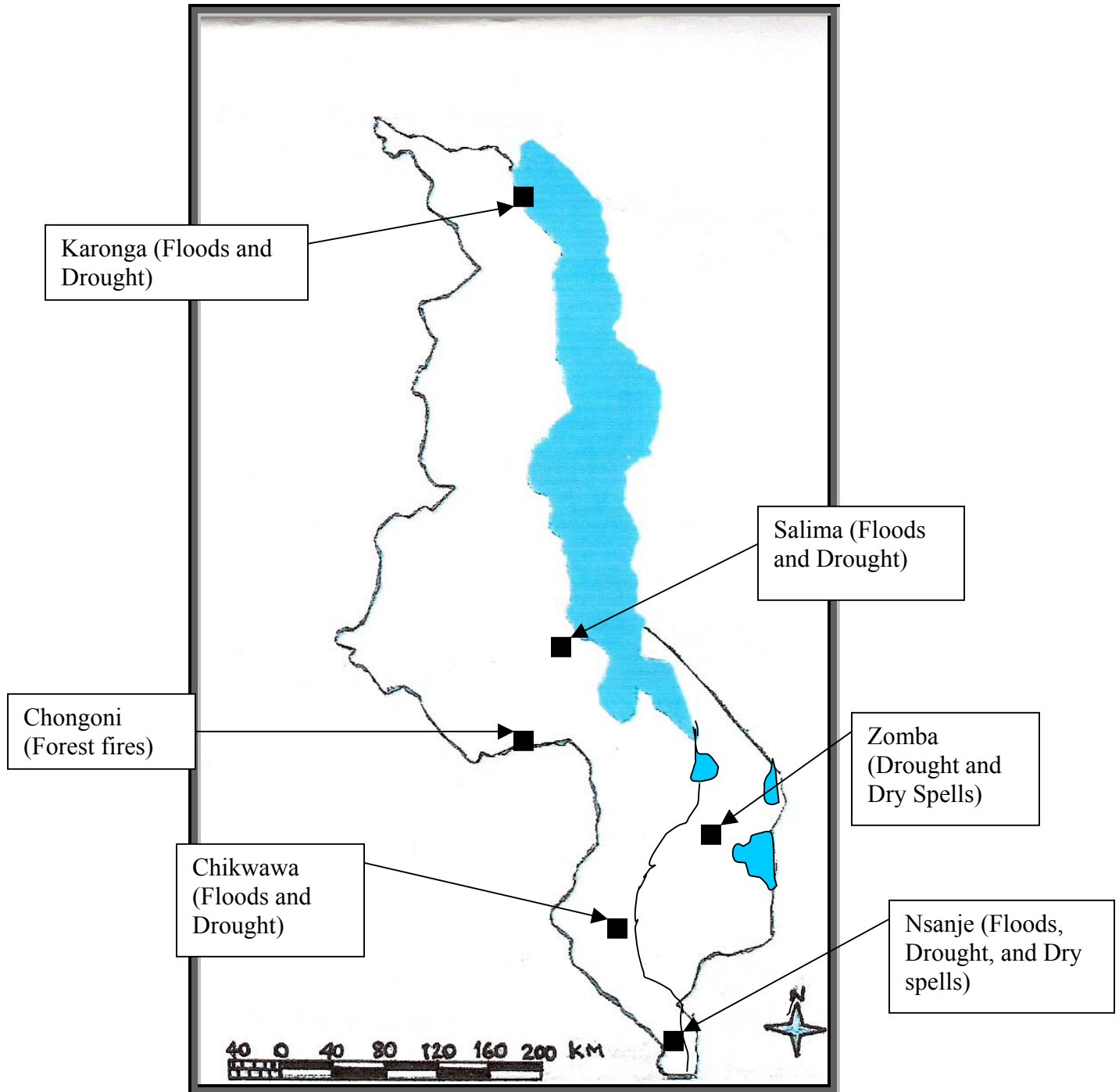


Fig. 2: Map of Malawi Showing Vulnerable Communities and Areas Where Sectoral Assessment Studies Were Done



ENVIRONMENTAL AFFAIRS DEPARTMENT
PRIVATE BAG 394
LILONGWE 3.
MALAWI.

Tel: (265) 1 771 111/773 660

Fax: (265) 1 773 379

Email: eadinfo@sdp.org.mw

Copyright © February 2006 Environmental Affairs Department

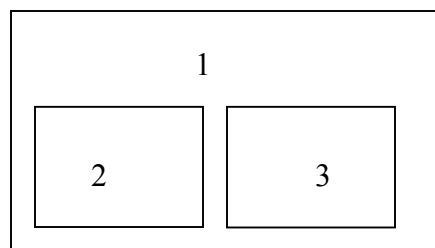
ISBN 99908-26-52-2

All rights reserved

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical photocopying, recording, or otherwise, without prior permission of the Environmental Affairs Department.

Printed by.....

Front cover shows:



1. View of Lake Malawi in Mangochi with canoes and cages for fish farming on the lake
2. Children carrying Firewood as a Source of Energy
3. A Maize Garden Vulnerable to Floods in the Lower Shire (This shows loss of crop due to the submerging of the garden in water. The smallholder farmer has eventually lost crop harvest and hence income).

Table of Contents

| | |
|---|------|
| Foreword | iv |
| Acknowledgements | v |
| NAPA Coordination Team..... | vi |
| Acronyms and Abbreviations | vii |
| Executive Summary | viii |
| | |
| 1.0 Introduction and Setting | 1 |
| 1.1 Background | 1 |
| 1.2 Economic situation | 1 |
| 1.3 Major cash and food crops..... | 1 |
| 1.4 Vulnerability to climate change | 2 |
| 1.5 Rationale for developing the NAPA document | 2 |
| 1.6 Objectives of the NAPA document | 3 |
| 2.0 Framework for Adaptation | 3 |
| 2.1 National vision | 3 |
| 2.2 National plans | 3 |
| 2.3 Assessment of main vulnerabilities | 4 |
| 2.4 Potential barriers to implementation | 4 |
| 3.0 Identification of Key Adaptation Needs | 5 |
| 3.1 Need for adaptation | 6 |
| 3.2 Key adaptation needs | 7 |
| 4.0 Criteria for Selecting Priority Activities | 7 |
| 4.1 Selecting priority activities | 7 |
| 4.2 Methodology for scoring an option against a criterion | 8 |
| 4.3 Standardization of scores | 8 |
| 4.4 Weighting of criteria | 8 |
| 4.5 Sensitivity analysis | 8 |
| 5.0 Identification of Priority and Urgent Needs for Adaptation | 8 |
| 5.1 Ranking adaptation options | 8 |
| 5.2 Identification of priority activities for urgent and immediate adaptation | 10 |
| 5.3 Implementation Strategy | 12 |
| 6.0 NAPA Preparation Process | 28 |
| 6.1 The consultative process | 28 |
| 6.2 Country drivenness | 28 |
| 6.3 Contribution to overall sustainable development goals, objectives and strategies | 28 |
| 6.4 Government's endorsement and commitment | 28 |
| 6.5 Transparency | 29 |
| 7.0 Concluding Remarks and the Way Forward | 29 |
| 7.1 Concluding Remarks | 29 |
| 7.2 The way forward | 30 |
| 8.0 Bibliography | 30 |
| | |
| Appendix: Evaluation Criteria for Each Adaptation Option for Malawi | 32 |

Foreword

The Malawi Government signed the United Nations Framework Convention on Climate Change (UNFCCC) during the United Nations Conference on Environment and Development (UNCED) that was held at Rio de Janeiro, Brazil in 1992. Malawi ratified the UNFCCC on 21st April 1994. Recognizing the threats caused by climate change, especially the adverse impacts of droughts and floods on the economy, Malawi developed the National Environmental Action Plan in 1994 as an operational tool for Agenda 21.

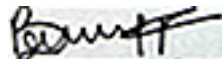
Currently, Malawi has developed policies and strategies to stimulate economic growth and development. This is being done through reducing poverty to ensure food and water security, empowering vulnerable rural communities, ensuring sustainable utilization of Malawi's natural resources, and protecting the environment, as articulated in Vision 2020 (2000), the Malawi Poverty Reduction Strategy (MPRS 2002), the Malawi Economic Growth Strategy (MEGS, 2003) and the National Environmental Action Plan (NEAP, 1994).

With its narrow economic base, limited agro-processing industries, over-dependency on rain-fed agriculture and biomass for household energy, Malawi is highly vulnerable to the adverse impacts of climate change and extreme weather events. This situation is exacerbated by increasing poverty among rural communities, increasing population pressure on a limited land resource base, land degradation arising from agricultural expansion and the cultivation of marginal lands, and increasing deforestation to meet the increasing demands for energy, food and construction purposes.

The loss of human, natural, financial, social and physical capital, caused by the adverse impacts of climate change, especially floods, drought and landslides, among many other natural disasters and calamities, is of great concern to the Malawi Government, as it strives to ensure sustainable livelihoods for all its citizens. The threat posed by extreme climatic events to food, health, water and energy has been the driving force for the preparation of Malawi's National Adaptation Programme of Action (NAPA).

This document has been prepared with the primary objective of identifying and promoting activities that address urgent and immediate needs for adapting to the adverse impacts of climate change among rural communities in vulnerable areas of the country. This will initially focus on the adaptation needs in the agriculture, water, energy, fisheries, land use change and forestry, wildlife, human health and gender sectors.

It is with great pleasure for Malawi, as a Least Developed Country, to submit this document to the United Nations Framework Convention on Climate Change (UNFCCC) for funding, realizing the urgency and importance of addressing adverse impacts of climate change on vulnerable rural communities and areas. It is my sincere hope that other donors too will assist Malawi to implement the identified priority adaptation needs with the urgency that they deserve.



**H. F. Chimunthu Banda, M.P.,
MINISTER OF MINES, NATURAL RESOURCES AND ENVIRONMENT**

Acknowledgements

The process of developing the National Adaptation Programmes of Action (NAPA) for Malawi involved a wide cross-section of consultations with many stakeholders in the public and private sectors, including non-governmental organizations (NGOs) and vulnerable rural communities. A multi-disciplinary team of consultants in the agriculture, water, fisheries, human health, energy, forestry, wildlife and gender sectors prepared sectoral reports, which have formed the basis of this plan.

The Environmental Affairs Department (EAD) is, therefore, very grateful to the multidisciplinary team of consultants, and to all those who contributed in one way or another during the preparatory process of the NAPA.

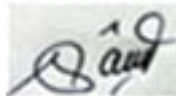
The EAD wishes to specifically acknowledge the contributions made by the NAPA Document Preparation Team and the NAPA Editorial Team. Mr. S.O Mandala chaired the NAPA Document Preparation Team that synthesized all the eight sectoral reports and prioritized the adaptation options. The NAPA Editorial Team, chaired by Professor R.K.D. Phoya, developed the project profiles and the logical frameworks, as well as producing Malawi's final NAPA document.

The EAD is also greatly indebted to Dr. Alex R. Saka and Mr. Kenneth J. Gondwe for peer-reviewing the document, and to Dr Paul V. Desanker, the International Advisor, for reviewing, critiquing and advising at various stages of the NAPA preparation.

The Technical Committee on the Environment (TCE) and the National Council for the Environment (NCE), reviewed the document prior to its submission to government for approval and endorsement. Their contributions are greatly appreciated.

The Environmental Affairs Department would also like to recognize the contributions made by the NAPA Project Manager, the late Mr. Hillary E. Dandaula. His leadership, commitment and dedication to climate change activities in Malawi will be greatly missed, and hope the enthusiasm he initiated will continue to flourish. May his soul rest in eternal peace.

Last, but not least, EAD wishes to extend its gratitude to the Global Environment Facility (GEF) and the United Nations Development Programme (UNDP) for providing financial and technical support, respectively, that made the preparation of this plan a reality.



R.P. Kabwaza
DIRECTOR OF ENVIRONMENTAL AFFAIRS

NAPA Coordination Team

Project Management Unit

| | |
|--------------------------|--|
| Mr. Ralph P. Kabwaza | Director of Environmental Affairs |
| Mr. Donald R. Kamdonyo | Chairperson of NAPA Project Steering Committee |
| Mr. Hillary E. Dandaula | NAPA Project Manager |
| Mr. Hamilton A.R. Sosola | NAPA Project Assistant |
| Mr. Evans D. Njewa | NAPA Project Desk Officer |

NAPA Document Preparation Team

| | |
|-----------------------|------------------|
| Mr. Symon O. Mandala | Chairperson |
| Mr. Jolamu L. Nkhokwe | Vice Chairperson |
| Mr. Wilfred Kadewa | Team Member |
| Mr. Esau C. Chirwa | Team Member |
| Mrs. Chilimampungu | Team Member |
| Dr. Gift Banda | Team Member |
| Mr. E. Nangoma | Team Member |

NAPA Editorial Team

| | |
|-------------------------------|------------------|
| Professor Richard K. D. Phoya | Chairperson |
| Dr. Roy Bhima | Vice Chairperson |
| Mr. W.P.C. Chipeta | Team Member |
| Mr. Hamilton A.R. Sosola | Team Member |
| Mr. Evans D. Njewa | Team Member |

NAPA National Peer Review Team

| |
|-----------------------|
| Dr. Alex R. Saka |
| Mr. Kenneth J. Gondwe |

NAPA International Advisor

| |
|----------------------|
| Dr. Paul V. Desanker |
|----------------------|

Acronyms and Abbreviations

| | | |
|---------|---|---|
| AIDS | : | Acquired Immune Deficiency Syndrome |
| ALDSP | : | Agricultural and Livestock Development Strategy Plan |
| CBD | : | Convention on Biological Diversity |
| CBO | : | Community Based Organization |
| COP | : | Conference Of Parties |
| EAD | : | Environmental Affairs Department |
| EIA | : | Environmental Impact Assessment |
| ENDA | : | Environmental Development Action in the Third World |
| ESCOM | : | Electricity Supply Corporation of Malawi |
| EWS | : | Early Warning System |
| FEW | : | Forecasting Early Warning |
| GDP | : | Gross Domestic Product |
| GEF | : | Global Environment Facility |
| GIS | : | Geographic Information System |
| HDI | : | Human Development Index |
| HEP | : | Hydroelectric Power |
| HIV | : | Human Immune Deficiency Virus |
| ITK | : | Indigenous Technical Knowledge |
| ITN | : | Insect Treated Nets |
| LDCs | : | Least Developed Countries |
| LEG | : | Least Developed Countries Expert Group |
| MCA | : | Multi-Criteria Analysis |
| MEAs | : | Multilateral Environmental Agreements |
| MEGS | : | Malawi Economic Growth Strategy |
| MG | : | Malawi Government |
| MoA | : | Ministry of Agriculture |
| MOALD | : | Ministry of Agriculture and Livestock Development |
| MoMnr&E | : | Ministry of Mines, Natural Resources and Environment |
| MPRSP | : | Malawi Poverty Reduction Strategy Paper |
| NAPA | : | National Adaptation Programmes of Action |
| NCCC | : | National Climate Change Committee |
| NCE | : | National Council on the Environment |
| NEAP | : | National Environmental Action Plan |
| NGO | : | Non-Governmental Organization |
| NSO | : | National Statistical Office |
| OVI | : | Objectively Verifiable Indicators |
| PAR | : | Participatory Action Research |
| PRA | : | Participatory Rural Appraisal |
| PRSP | : | Poverty Reduction Strategy Paper |
| PSC | : | Project Steering Committee |
| SADC | : | Southern African Development Community |
| SMV | : | Sources and Means of Verification |
| TCE | : | Technical Committee on the Environment |
| UNCSD | : | United Nations Commission on Sustainable Development |
| UNDP | : | United Nations Development Programme |
| UNEP | : | United Nations Environment Programme |
| UNFCCC | : | United Nations Framework Convention on Climate Change |
| UNITAR | : | United Nations Institute of Training and Research |
| WSSD | : | World Summit on Sustainable Development |

Executive Summary

1.0 Introduction

Malawi has experienced a number of adverse climatic hazards over the last several decades. The most serious have been dry spells, seasonal droughts, intense rainfall, riverine floods and flush floods. Some of these, especially droughts and floods, have increased in frequency, intensity and magnitude over the last two decades, and have adversely impacted on food and water security, water quality, energy and the sustainable livelihoods of rural communities.

Malawi has developed its National Adaptation Programmes of Action (NAPA) by evaluating the impacts of adverse climatic conditions in eight important sectors of economic growth, and ranked the identified activities using multi-criteria analysis to arrive at a list of fifteen urgent and immediate priority needs for adaptation. The sectors that were analyzed are agriculture, water, human health, energy, fisheries, wildlife, forestry and gender. What follows is a brief overview of the findings from the eight sectors.

2.0 Impacts of Climate Change in Different Sectors

2.1 Agricultural sector

Malawi relies on rain-fed agriculture, and the current droughts have resulted in poor crop yields or total crop failure, leading to serious food shortages, hunger and malnutrition. Flooding has also severely disrupted food production in several districts of the country. The most vulnerable groups are rural communities, especially women, children, female-headed households and the elderly. The proposed interventions include: (i) improved early warning systems (ii) recommended improved crop varieties, (iii) recommended improved livestock breeds, and (iv) improved crop and livestock management practices.

2.2 Human health sector

The human health sector is directly affected by climate change, and is especially linked to infant malnutrition and chronic ailments associated with malaria, cholera and diarrhoea as a result of droughts and floods. For example, malaria is expected to increase and spread to previous cool zones as temperatures increase due to global warming. The proposed interventions include: (i) improved nutrition for infants and other vulnerable groups, (ii) prevention of diseases, such as malaria through increased distribution of insect treated bed-nets (ITNs), and diarrhoea, (iii) water treatment, (iv) crop diversification and food supplementations for the under-fives.

2.3 Energy sector

The energy sector primarily derives the hydro-electric power from the Shire river. The hydro-electric power generation has been negatively affected by the droughts and floods. The water flow disruptions in rivers have been exacerbated by siltation caused by poor and unsustainable agricultural practices, deforestation, and noxious weeds, such as water hyacinth. The proposed interventions include: (i) diversification of energy sources, (ii) reforestation of the Upper, Middle and Lower Shire Valleys catchments, (iii) arresting

siltation, (iv) reducing dependence on wood fuel, and (v) efficient use of charcoal and expanded use of ethanol stoves.

2.4 Fisheries sector

Droughts and floods are the major climatic hazards affecting the fisheries sector, and have been responsible for the declining, or even drying up, of water bodies resulting in low fish production and loss of biodiversity. Floods have been responsible for the destruction of fish ponds, such as in 2000/01, while droughts have been responsible for drying of lakes, such as Lake Chilwa in 1995 which resulted in total loss of fish stocks. The proposed interventions include: (i) fish breeding to restock the lakes, rivers and dams, (ii) improving knowledge and understanding on how temperature profiles in the lake disrupt fish breeding and survival, (iii) establishing climate observations or monitoring systems on Lake Malawi, and (iv) mainstreaming climate change into fisheries strategies.

2.5 Wildlife sector

The major climatic hazard that affects the wildlife sector is drought. Drought affects animal reproduction systems and migratory habits. For example, the 1979/80 drought resulted in the deaths of Nyala in Lengwe National Park in Chikwawa and the migration of most animals from the game reserve. The proposed adaptation measures include: (i) improved fire management in game reserves, (ii) construction of watering points, (iii) a Nyala breeding programme in Lengwe National Park, (iv) ability to translocate animals as needed, and (v) community based ranching.

2.6 Water sector

Water is a critical resource for human and industrial use, and for the maintenance of ecosystems. Increasing droughts and floods seriously disrupt water availability, in both quantity and quality. The proposed interventions include: (i) demand side management through water allocation, (ii) construction of boreholes, (iii) water harvesting, (iv) water resource management, and (v) flood management.

2.7 Forestry sector

The major climatic hazards that threaten the forestry sector are extended droughts, which lead to land degradation and loss of soil fertility, as well as forest fires. For example, during the drought of 1995, some 5,550 ha (or 36%) of Chongoni forest were destroyed by forest fires caused by human activities such as hunting resulting in smoke haze, pollution, loss of seedlings and biodiversity. The proposed interventions include: (i) improved extension services to ensure sustainable land and forest management, (ii) forest fire management at the community level, and (iii) periodic monitoring of plant development to identify species that may be in danger of dying back or are facing serious reproductive ability with diurnal and seasonal climate changes.

2.8 Gender

Women bear most of the burden in activities that are most impacted by adverse climate, including collection of water, firewood and ensuring daily access to food. In addition, the changing demographics as a result of the impacts of the HIV/AIDS epidemic, are leading to women taking up greater responsibilities as sole heads of households and taking care

of the sick and orphans. Several interventions are proposed that target women in highly vulnerable situations, including: (i) empowerment of women through access to microfinance to diversify earning potential, (ii) ensuring easier access to water and energy sources by drilling boreholes and planting trees in woodlots, and (iii) use of electricity provided through the rural electrification programme.

3.0 The Need for Adaptation to Climate Change and Variability

It is against the background of rural communities' vulnerability to the adverse impacts of climate change and extreme weather events that Malawi decided to develop a NAPA, with the overall goal of addressing urgent and immediate needs for adaptation.

As experienced over the last decade or two, climate change, through changes in climatic patterns and an increase in extremes, has resulted in serious impacts on Malawi, including loss of life during famines after crops failed due to drought, loss of life due to flooding and landslides, and serious economic hardships when substantial resources were diverted to address climate-related disasters. Given Malawi's extremely low economic capacity to cope with climate change, there is a pressing need to plan and implement urgent interventions immediately, so future adverse effects of climate change will be minimized.

4.0 Prioritized Adaptation Options

Through a consultative process involving public and private sector organizations, including NGOs and civil society, thirty-one adaptation options were identified from the eight sectors to address the urgent adaptation needs, with emphasis on vulnerable rural communities of Malawi. This list was further analyzed and ranked using multi criteria analysis, resulting in a shorter list of fifteen priority adaptation options. These were further ranked and prioritized for urgency, and categorized either as high, medium or low. These prioritized options are as follows

- 1) Sustaining life and livelihoods for the most vulnerable communities,
- 2) Enhancing food security and developing community based storage systems for seed and food,
- 3) Improving crop production through the use of appropriate technologies,
- 4) Increasing resilience of food production systems to erratic rains by promoting sustainable dimba production of maize and vegetables in dambos, wetlands and along river valleys,
- 5) Targeting afforestation and re-afforestation programmes to control siltation and the provision of fuel wood, and for their benefits, such as sources of alternative cash income,
- 6) Improving energy access and security in rural areas (e.g., through extension of the rural electrification programme, energy-efficient stoves and development of ethanol-based stoves),
- 7) Improving nutrition among rural communities (e.g., through the promotion of fish farming, rearing of small ruminants and nutritional supplements for children and the sick),
- 8) Disseminating bed nets in high incidence malaria areas,
- 9) Developing food and water reserves for disaster preparedness and response,
- 10) Developing community based wildlife ranching and a breeding programme for Nyala,

- 11) Developing and implementing strategies for drought preparedness, flood zoning and mitigation works,
- 12) Developing technologies to mitigate climate change,
- 13) Providing standby power generation facilities,
- 14) Managing forest fires in collaboration with communities, and
- 15) Developing small dams, and other storage facilities, to mitigate flooding, to harvest water and to initiate community based fish farming and breeding.

Urgent activities rated High from the above list of priorities were combined into project clusters for the purposes of developing a short list of five project profiles. Each project profile contains a number of related adaptation activities, and identifies the required inputs, outputs, institutional arrangements and a proposed budget. It is worth noting here that the component activities within each project cluster can also be implemented separately depending on funding opportunities. The list of the proposed project profiles is as follows:

- (a) Improving community resilience to climate change through the development of sustainable rural livelihoods,
- (b) Restoring forests in the Upper and Lower Shire Valleys catchments to reduce siltation and associated water flow problems,
- (c) Improving agricultural production under erratic rains and changing climatic conditions,
- (d) Improving Malawi's preparedness to cope with droughts and floods, and
- (e) Improving climate monitoring to enhance Malawi's early warning capability and decision making and sustainable utilization of Lake Malawi and lakeshore areas resources.

These are the proposed projects that Malawi needs to implement urgently and immediately to enable vulnerable rural communities and groups in targeted areas to adapt to the adverse impacts of climate change. Malawi will require US \$ 22.43 million to implement these priority projects.

5.0 Concluding Remarks

Climatic hazards, caused by climate change and extreme weather events, are a threat to economic growth and development of Malawi. Droughts and floods, in particular, adversely impact on food, water, health, energy, and the sustainable livelihoods of rural communities. With about 65% of the population living below the poverty line, Malawi's vulnerable communities do not have sufficient capacity to cope with, or adapt to, the adverse impacts of extreme weather events. Thus, the need to develop adaptation measures for urgently adapting to climate change is of high priority for the Malawi nation.

This document presents a minimum number of activities that must be implemented with urgency in order to enable vulnerable rural communities cope with the adverse effects of climate change. The implementation of these activities will significantly reduce the negative impacts of climatic hazards on vulnerable rural communities and areas, and will ensure sustainable livelihoods for the vulnerable Malawians .

1.0 Introduction and Setting

1.1 Background

Malawi is a land-locked country located in south-east Africa lying along a sector of the East African Rift Valley between latitudes 9° and 18° S, and longitudes 33° and 36° E. It is boarded by Tanzania in the north and north-east, Zambia in the west, and Mozambique in the south and east. It has a population of about 10.0 million people (NSO, 2002), the majority of whom (>85%) reside in rural areas and are poor, deriving their livelihoods from small land holdings of between 1.0 and 2.0 ha per farm family of an average of five people (MOALD, 1987).

1.2 Economic situation

Malawi is classified as one of the least developed countries in the world, with an estimated annual per capita income of US \$2,000 in 1999 (UNICEF, 1993; EAD, 2002a; Malawi Government, 2000, 2002a). The National Human Development Report of 2001 ranks Malawi as one of the lowest in terms of Human Development Index (HDI), placing it at number 163 out of 173 countries in the world (United Nations Development Programme (UNDP)/Malawi Government (MG), 2001). It is one of the poorest countries in Africa, with about 65% of its population living below the poverty line in 1998, and 29% living in extreme poverty (MG, 1995, 2000; MoA, 2005). Health and social indicators are also among the lowest in Africa. Infant mortality is estimated at 134 per 1,000 compared with 92 per 1,000 for sub-Saharan Africa, whereas the average life expectancy at birth is now 37 years, down from 43 years some ten years ago, mainly as a result of various factors including poor living conditions, food and water insecurity, poverty, and diseases, such as malaria, cholera, tuberculosis and HIV/AIDS. The HIV/AIDS epidemic affected 16% of the adult population and 31% of women in the antenatal care category in 1999 (MG, 2002b).

More than 90% of the people, mainly comprising resource-poor rural communities, are predominantly engaged in subsistence rain-fed agriculture, 60% of whom are food insecure on a year-round-basis. Female- and children-headed households, the elderly and women are the most vulnerable, a situation that has been exacerbated by increasing poverty and population pressures on a limited land resource base, low economic productivity of the land, labour and capital, and extreme weather events due to climate variability, and low capacity to adapt to the adverse impacts of climate change. These have been compounded by rapid environmental degradation as a result of agricultural expansion to marginal lands and deforestation, inadequate knowledge and skills in the productive use and management of land and natural resources, inadequate access to land and credit, poor health services, and gender inequalities.

1.3 Major cash and food crops

The major cash crops are: (i) tobacco which contributes 71% of the foreign exchange earnings (MOALD, 1987), (ii) sugar cane grown under irrigation and delivered to markets by road transport, (iii) tea grown under-rain-fed conditions, but supplemented with irrigation during drought years, (iv) cotton, (v) horticultural crops (e.g., vegetables and chilies grown throughout the country), and (vi) groundnuts, beans, soybeans and other legume crops (grown throughout the country). The major food crops are maize,

sorghum, millets, cassava, sweet potatoes, bananas, rice, beans, groundnuts and various pulses, which are produced throughout Malawi.

1.4 Vulnerability to climate change

Malawi is heavily dependent on natural resources, mainly soils, water, fisheries from inland lakes and fuel wood from forests. The biggest lake, Lake Malawi, drains freely into the Indian Ocean through the Shire River then the Zambezi. The Shire River is of great economic importance to Malawi. The Shire River generates more than 98% of Malawi's electricity, supports abundant fisheries, and provides freshwater for irrigation in Malawi's plantations such as Illovo Sugar at Nchalo; as well as other domestic and industrial uses. There are also several regionally important wetlands and marshes in the Shire basin, which include important breeding sites for migratory birds, and are home to several key wildlife conservation areas. The Upper, Middle and Lower Shire River basins are important areas for the production of crops and for the preservation and conservation of forests and wildlife. However, the Lower Shire Valley is vulnerable to floods and droughts. Extensive land use, including the wanton cutting down of trees on the Middle and Upper Shire Valleys, has resulted in severe land degradation and soil erosion, leading to siltation of the Shire River and its tributaries, seriously affecting hydro-electric power generation, human health and fisheries.

In addition, some tributaries of the Shire River pass through heavily cultivated areas, townships and cities, resulting in water pollution from human and industrial wastes, and agricultural chemicals, which have serious impacts on human health, food, environment and fisheries, and sustainable rural livelihoods. Further, floods have resulted in severe crop loss, infrastructure destruction, including roads and the only rail line that links the south to the center, resulting in serious socio-economic disruptions, food insecurity, and diseases, such as diarrhea, cholera and malaria.

Specifically, the flood plains, wetlands and forests of the Lower Shire Valley are an important habitat for wildlife and for crop production (rice, cotton, beans, sorghum, millets and sugar cane). More than half a million people living in the Lower Shire Valley are directly vulnerable to climatic extremes such as droughts and floods. National disasters have been declared every few years in this valley. For example, over the last ten years the Shire Valley has experienced some of the worst droughts (1991/92) and floods (2000/01) in living memory. These resulted in low agricultural output, hence hunger, malnutrition and loss of human and animal life, disruption of electricity, and many other socio-economic and industrial activities.

1.5 Rationale for developing the NAPA

It is against this background that Malawi decided to develop its National Adaptation Programmes of Action (NAPA). This was done by synthesizing the vulnerabilities of eight major economic sectors in relation to several international, national and local development policies and strategies, which included Agenda 21, Multilateral Environmental Agreements (MEAs), SADC Biodiversity Strategy, National Biodiversity Strategy and Action Plan (NBSAP), Vision 2020, Malawi Poverty Reduction Strategy (MPRS), Malawi Economic Growth Strategy (MEGS) and the National Environmental Action Plan (NEAP) (UNEP, 2003; UNFCCC, 2003; SADC, 2005; MG, 1998, 2002b). Further, sectoral environmental action plans and disaster preparedness and emergency

response plans were also consulted. This process involved a wide consultation with various stakeholders in the public and private sector organizations, including local leaders, religious and faith groups, academicians, non-governmental organizations (NGOs), civil society, and highly vulnerable rural communities throughout the country, (OPC, 1997; SADC, 2002; EAD, 2002a, 2002b).

The identified short list of urgent and immediate needs for adaptation were ranked using multi-criteria analysis (MCA) to arrive at priority adaptation options that require urgent attention in the following sectors: agriculture, water, human health, energy, fisheries, wildlife, gender and forestry. There is need to urgently implement these priority activities so as to reduce the vulnerability of rural communities to the adverse impacts of extreme weather events caused by climate change, a situation that will enable rural communities adapt to climate change, and attain food security, reduce poverty, reduce environmental degradation and achieve sustainable rural livelihoods.

1.6 Objectives of the NAPA

The NAPA document has been developed to enable Malawi address her urgent and immediate adaptation needs caused by climate change and extreme weather events. Specifically, the document aims at: (i) identifying a list of priority activities, (ii) formulating priority adaptation options, (iii) building capacity for adapting to longer-term climate change and variability, and (iv) raising public awareness on the urgency to adapt to the adverse effects of extreme weather events.

2.0 Framework for Adaptation

2.1 National vision

In 1998, Malawi launched Vision 2020, a document that articulates the country's aspirations for sustainable economic growth and development, and for the sustainable utilization of natural resources and the environment (EAD, 1998). This was followed by the Malawi Poverty Reduction Strategy Paper (MPRSP) in 2002 (MG, 2002b), aimed at reducing poverty through socio-economic and political empowerment of the poor. It is built around four pillars, which are the strategic components grouping various activities, policies and strategies, into a coherent framework for poverty reduction. These pillars are: (i) rapid sustainable pro-poor economic growth and structural transformation, (ii) human capital development, (iii) improving the quality of life of the most vulnerable, and (iv) good governance. This document also mainstreams cross-cutting issues, such as HIV/AIDS, gender, science and technology and the environment, including climate change, which are all very relevant to the development of this NAPA document. In order to stimulate pro-poor economic growth of at least 6% per annum necessary to reduce poverty by half by the year 2015, the Government of Malawi developed a Malawi Economic Growth Strategy (MEG) in 2003. The strategy provides an approach for implementing income poverty reduction interventions stipulated under pillar one of MPRS.

2.2 National plans

After the Earth Summit in Rio de Janeiro, Brazil in 1992, Malawi launched its National Environmental Action Plan (NEAP) in 1994 (EAD, 1994; 1995). NEAP, which is Malawi's operational tool for the implementation of Agenda 21, identifies and highlights several environmental issues including: high soil erosion, low soil fertility, deforestation, overgrazing, over-fishing, loss of biodiversity, water resources degradation and depletion, human habitat degradation, air pollution, and climate change.

The Malawi National Strategy for Sustainable Development (MNSSD), which was completed and launched in November 2004 (EAD, 2004). The MNSSD sets out to manage the environment responsibly, provide healthy life for all, protect the rights of the future generations, and conserve and enhance biological diversity in order to meet the Millennium Development Goals (MDGs).

Thus, based on the above policy frameworks, several strategic goals and objectives were used to guide in the preparation of the NAPA report, which include: (i) achieving food security, (ii) reducing poverty, (iii) attaining and maintaining positive economic growth, (iii) improving the welfare of women, the elderly, children and the physically challenged, and their access to production resources, (iv) addressing the special needs of orphans, and recognizing the role of women, female- and children-headed households, (v) safeguarding hydro-electric power generation, and (vi) minimizing the loss of life and sustainable livelihoods owing to natural disasters and calamities, such as droughts, floods and mudslides.

2.3 Assessment of main vulnerabilities

Malawi is vulnerable to climate change and extreme weather events (EAD, 1998, 2002a, 2004). The Vulnerability and Adaptation Assessment Report of 2001 (EAD, 2002b) has clearly indicated that Malawi is experiencing a variety of climatic hazards, which include intense rainfall, floods, seasonal droughts, multi-year droughts, dry spells, cold spells, strong winds, thunderstorms, landslides, hailstorms, mudslides and heat waves, among many others.

Currently, the majority of rural communities are experiencing chronic food deficits in many parts of the country on a year-round-basis owing to the effects of floods and droughts. This situation has been compounded by the high prevalence of HIV/AIDS that has created a large number of dependant orphans, and has also adversely impacted on rural household food production systems, as well as the quality of life and sustainable livelihoods.

The increasing prevalence of the recurrent floods and droughts is of major concern to the Government of Malawi because of their far-reaching consequences on food, water, health and energy. Erratic rains have resulted in acute crop failure, despite concerted efforts to improve seasonal weather forecasting at the beginning of the rainy season. Crop failure has resulted in food insecurity and malnutrition, especially among vulnerable rural communities. On the other hand, floods have resulted in the disruption of hydroelectric power generation, water pollution, and increased incidences of diseases, such as malaria, cholera and diarrhea. It is against this background that the government has put in place several policies and strategies to address the adverse impacts of climate change on food,

water, health and energy, as articulated in Vision 2020, MPRSP, and the Malawi Economic Growth Strategy (MEGS), among many other documents.

2.4 Potential barriers to implementation

Malawi recognizes the importance and urgency of addressing the problems associated with climate change because these affect the sustainable livelihoods of all Malawians. Hence the need to urgently implement the proposed adaptation options listed in the NAPA document. However, there are several barriers that may hamper the implementation of these activities. There is need to address these for the smooth implementation of the proposed activities.

Apart from limited internal capacity to fund adaptation activities, Malawi is also constrained by several other factors, including: (i) extreme poverty of the most vulnerable groups, who are also illiterate, making it difficult to transfer new technologies and conduct meaningful long-term planning, (ii) poor infrastructure, especially poor roads and bridges, making it difficult to access rural areas, hence difficulties in delivering farm inputs (e.g., fertilizers and seeds), and accessing markets, (iii) limited credit opportunities for rural communities, to allow family households easily access farm inputs, (iv) food insecurity in the Southern Africa Development Community (SADC) that would make it difficult for Malawi to acquire food from neighbouring countries, further aggravating the costs of coping with current droughts and floods, (v) existence of a large number of HIV/AIDS orphans, creating a major drain on family energy, cash and food, a situation that is more critical in rural areas among the poor, with limited capacity to produce enough food and are easily attacked by diseases, (vi) poor health conditions of resource-poor rural communities, leading to high rates of malnutrition, especially in children and the elderly, limiting the ability of the people to effectively respond to opportunities for work, and (vii) limited analytical capability of local personnel to effectively analyze the threats and potential impacts of climate change, so as to develop viable adaptation solutions.

3.0 Identification of Key Adaptation Needs

3.1 Need for adaptation

Adequate food, good health, access to clean and safe drinking water, and sufficient energy for home and industrial use are critical factors for sustaining livelihoods. The recent extreme weather events have led to critical food shortages leading to food insecurity, hunger and malnutrition. Floods and other natural disasters have led to the displacement of people, a situation that is compounded by extreme poverty in rural areas that is making it difficult for rural family households to purchase food and farm inputs to enhance crop production.

Thus, a major effort is required to achieve food security at national and household levels, and also to enable rural communities generate cash from farming activities. The challenge is to understand the circumstances of the rural communities, so as to better provide them with user-friendly and production-increasing agricultural technologies that can be adopted and utilized. This means that the developed technologies are community based and are demanded by the people themselves.

Therefore, to ensure that the proposed adaptation options are adopted and utilized by the targeted vulnerable communities, these will have to: (i) address the plight of the most vulnerable and the poor of the poorest in rural communities, (ii) ensure geographic balance and regional equity, (iii) ensure synergies with Non-Governmental Organizations (NGOs) efforts in addressing the critical issues related to food, water, health and energy, as well as critical commercial enterprises, (iv) have potential to reduce long-term food shortages and food aid dependency, and (v) use a criteria that effectively combines the number of people who are helped out of food insecurity and the geographic distribution of the targeted rural communities. In a nutshell, the adaptation options will have to be both community- and country-driven.

3.2 Key adaptation needs

The most vulnerable areas to floods are the lakeshore plains and lower Shire valley whereas droughts affect all parts of Malawi. Severe droughts occurred in 1915, 1948, 1992 and 1995, whereas recent floods occurred in 2000 and 2001. People living near riverbanks are the most vulnerable to floods, which results in untimely deaths, disease outbreaks, and the destruction of crops and property. During drought years, many people, especially children and the elderly, suffer from malnutrition and are easily attacked by various types of diseases. Livestock and wild animals are equally adversely affected by droughts.

In most parts of Malawi, rural communities have tried to devise ingenious ways to cope with and adapt to the adverse impacts of extreme weather events, including shifting homes to higher ground, storing grain in local granaries, hunting small animals, gathering and eating wild fruits and vegetables, sinking boreholes, and using traditional medicines to cure various ailments and diseases. However, some of these are not very effective. A list of actual and proposed adaptive measures in the agriculture, water, forestry, fisheries, and wildlife sectors are given in Malawi's Initial National Communication to the Conference of Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) (EAD, 2002a).

Presently, adaptation needs have been identified for the agriculture, water, forestry, wildlife, fisheries, human health, energy and gender sectors, as follows:

- (a) Sustaining life and livelihoods for the most vulnerable communities,
- (b) Enhancing food security and developing community based storage systems for seed and food,
- (c) Improving crop production through the use of appropriate technologies,
- (d) Increasing resilience of food production systems to erratic rains by promoting sustainable dimba production of maize and vegetables in dambos, wetlands and along river valleys,
- (e) Targeting afforestation and reforestation programmes to control siltation and the provision of fuel wood, and for their benefits, such as sources of alternative cash income,
- (f) Improving energy access and security in rural areas (e.g., through extension of the rural electrification programme, improved stoves and development of ethanol-based stoves),
- (g) Improving nutrition among rural communities (e.g., through the promotion of fish farming, rearing of small stock, and nutritional supplements for children and the sick),
- (h) Disseminating bed nets in high incidence malaria areas,
- (i) Developing food and water reserves for disaster preparedness and response,
- (j) Developing community based wildlife ranching and a breeding programme for Nyala,
- (k) Developing and implementing strategies for drought preparedness, flood zoning and mitigation measures,
- (l) Developing technologies to mitigate climate change,
- (m) Providing stand-by power generation facilities,
- (n) Managing forest fires in collaboration with communities, and
- (o) Developing small dams, and other storage facilities, to mitigate flooding, to harvest water and to initiate community-based fish farming and breeding.

4.0 Criteria for Selecting Priority Activities

4.1 Selecting priority activities

The criteria used in prioritizing priority activities were based on the generic criteria as proposed by the Least Developed Countries Expert Group (LEG) and outlined in the Annotated Guidelines for the Preparation of NAPA (UNFCCC, 2002), as well as those generated through consultations with stakeholders. The NAPA Project Steering Committee endorsed the developed criteria before the prioritization process was started. The list of criteria, arranged in descending order of priority, is as follows:

- (a) Technical feasibility,
- (b) Economic growth (income levels of communities or target groups),
- (c) Synergies (with ongoing policies, programmes and multilateral environmental agreements),
- (d) Magnitude of impact of the option on vulnerable groups,
- (e) Cost of the project,
- (f) Stakeholder level of participation,

- (g) Losses that can be avoided by vulnerable communities upon introducing the option,
- (h) Livelihood sustainability, and
- (i) Cross-cutting issues.

Each adaptation option was scored based on a scale of 1 (very low), 2 (low), 3 (medium), 4 (high) to 5 (very high), against each criterion. The scoring process proceeded as outlined below.

4.2 Methodology for scoring an option against a criterion

The methodology chosen for scoring options against the criteria was in line with the guidelines provided by UNFCCC, United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) and the United Nations Institute of Training and Research (UNITAR) (UNFCCC, 2002). This was also agreed upon by the National Climate Change Committee (NCCC), various stakeholders, and was endorsed by the NAPA Project Steering Committee.

A total of forty-four adaptation options were proposed from the eight sectoral reports. As a first step in the prioritization process, each sectoral team was asked to submit a maximum of four highest-ranking adaptation options for multi-criteria analysis (MCA), resulting in a list of 31 adaptation options that were scored. The average raw scores were computed and recorded as shown in Appendix (Table A1).

4.3 Standardization of scores

The scores in Table A1 (Appendix) were then standardized using the following formula:

$1 - \frac{H - X_i}{H - L}$, where, with reference to a particular column, **H** is the highest value, **L** is the

lowest value, and **X_i** represents any value in the column. The standardized scores fall between 0 and 1. For each option, an average score (MCA 1) was obtained by summing up and averaging the score in a row. Based on the values of MCA1's, the options were ranked as shown in Table A2 (Appendix). At this level of prioritization, it is assumed that each criterion has a weighting factor of one.

4.4 Weighting of criteria

In a participatory manner, the NAPA Document Preparation Team agreed on the weighting factor for each criterion in relation to its importance. The standardized scores in Table A2 were then weighted with appropriate factors in each column. The scores in a row were then added to give MCA2, and further ranked to prioritize the options (Appendix, Table A3). The lowest three adaptation options were dropped leaving the top twenty-eight. The ranking process and computations were repeated on the remaining adaptation options, resulting in MCA3 (Appendix, Table A4). The bottom four adaptation options were then dropped, and the computation and ranking process was repeated to arrive at MCA4 (Appendix, Table A5).

4.5 Sensitivity analysis

After the NAPA Document Preparation Team reached a consensus in the consistency of the rankings of the top fifteen options (Appendix, Table A5), the team agreed to drop the lowest nine adaptation options, and subjected the remaining top fifteen options to three sensitivity analyses with different criteria weights as shown in Tables A6 and A7

(Appendix). The final outlay of results from the multi-criteria analysis (MCA1-MCA7) is given in Table 1. The next step was to identify priority and urgent needs for adaptation, which is the discussion for the Section 5 below.

5.0 Identification of Priority and Urgent Needs for Adaptation

5.1 Ranking adaptation options

The priority adaptation activities were further assessed in the context of their urgency, and the need for immediate action. This helped to separate activities that could be implemented under the NAPA Project and those requiring implementation in the medium and longer-term horizons.

To rank for urgency, the criteria recommended by LEG, as listed below, was used:

- (a) Costs, in terms of human impact (and loss of life) that would increase if the option is not addressed immediately,
- (b) Likelihood of irreversible change and damage,
- (c) Imminence of threat on critical components of development and livelihood,
- (d) Removal of triggers for environmental, social and economic deterioration and degradation, and
- (e) Enhancement of system properties (such as coping ability) to improve threshold of adverse effects.

The members of the NAPA Document Preparation Team, and some members of LEG, assisted in ranking the adaptation needs for urgency using the letters H, M and L, where H=high, M=medium, and L=low. These ranks refer to urgent and immediate need for adaptation under the NAPA implementation paradigm, as given below.

- (a) Sustaining life and livelihoods for the most vulnerable communities [H],
- (b) Enhancing food security and developing community based storage systems for seed and food [M],
- (c) Improving crop production through the use of appropriate technologies [M],
- (d) Increasing resilience of food production systems to erratic rains by promoting sustainable dimba production of maize and vegetables in dambos , wetlands and river valleys [H],
- (e) Targeting afforestation and re-afforestation programmes to control siltation, and the provision of fuel wood, and for their benefits, such as sources of alternative cash income [H],
- (f) Improving energy access and security in rural areas (e.g., through extension of rural electrification programme, improved stoves and development of ethanol-based stoves), [M],
- (g) Improving rural nutrition (e.g., through the promotion of fish farming, rearing of small stock, and nutritional supplements for children and the sick) [M]
- (h) Disseminating bed nets to high malaria incidence areas [M],
- (i) Developing food and water reserves for disaster preparedness and response [H],
- (j) Developing community based wildlife ranching and a breeding programme for Nyala [M/L],

- (k) Developing and implementing strategies for drought preparedness, flood zoning and mitigation measures [M],
- (l) Developing technologies to mitigate climate change [M]
- (m) Providing standby power generation [L],
- (n) Managing forest fires in collaboration with communities [L], and
- (f) Developing small dams, and other storage facilities to mitigate flooding, to harvest water, and initiating community based fish farming and breeding [H].

Table 1: Final outlay of results of multi-criteria analysis (MCA1-MCA7)
 Table 1: Final outlay of results of multi-criteria analysis simulations
 (MCA1-MCA7)

| Adaptation option | MCA1 | MCA2 | MCA3 | MCA4 | MCA5 | MCA6 | MCA7 |
|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | Ranking (Score) | Ranking (Score) | Ranking (Score) | Ranking (Score) | Ranking (Score) | Ranking (Score) | Ranking (Score) |
| a) Sustaining life and livelihoods for the most vulnerable communities | 1 (0.88) | 1 (0.86) | 1 (0.83) | 1 (0.82) | 1 (0.81) | 2 (0.83) | 1 (0.85) |
| b) Enhancing food security and developing community based storage systems for seed and food | 2 (0.86) | 2 (0.85) | 2 (0.82) | 2 (0.82) | 2 (0.81) | 1 (0.85) | 2 (0.83) |
| c) Improving crop production through the use of appropriate technologies | 3 (0.80) | 3 (0.81) | 3 (0.76) | 3 (0.76) | 3 (0.75) | 3 (0.74) | 3 (0.78) |
| d) Increasing resilience of food production systems to erratic rains by promoting sustainable dimba production of maize and vegetables in dambos, wetlands and river valleys | 4 (0.76) | 4 (0.76) | 5 (0.72) | 5 (0.69) | 5 (0.67) | 5 (0.65) | 4 (0.71) |
| e) Targeting afforestation and re-forestation programmes to control siltation and the provision of fuel wood, for their benefits, such as sources of alternative cash and income | 5 (0.75) | 5 (0.74) | 4 (0.73) | 4 (0.72) | 4 (0.71) | 4 (0.69) | 5 (0.69) |
| f) Improving energy access and security in rural areas (e.g., through extension of rural electrification programme, improved stoves and development of ethanol-based stoves) | 6 (0.71) | 6 (0.72) | 6 (0.68) | 6 (0.66) | 6 (0.64) | 6 (0.58) | 6 (0.66) |
| g) Improving nutrition among rural communities (through the promotion of fish farming, rearing of small stock, and nutritional supplements for children and the sick) | 8 (0.62) | 7 (0.63) | 7 (0.56) | 7 (0.54) | 8 (0.51) | 9 (0.48) | 7 (0.58) |
| h) Disseminating bed nets in high incidence malaria areas | 7 (0.64) | 9 (0.59) | 9 (0.53) | 8 (0.53) | 7 (0.51) | 6 (0.58) | 8 (0.50) |
| i) Developing food and water reserves for disaster preparedness and response | 11 (0.56) | 13 (0.53) | 11 (0.46) | 11 (0.43) | 10 (0.40) | 12 (0.42) | 9 (0.46) |
| j) Developing community based wildlife ranching and a breeding programme for Nyala | 12 (0.55) | 10 (0.53) | 10 (0.46) | 10 (0.43) | 11 (0.39) | 11 (0.42) | 10 (0.46) |
| k) Developing and implementing strategies for drought preparedness, flood zoning and mitigation measures | 9 (0.62) | 8 (0.63) | 8 (0.55) | 9 (0.51) | 9 (0.49) | 8 (0.51) | 11 (0.43) |
| l) Developing technologies to mitigate climate change | 13 (0.53) | 14 (0.41) | 14 (0.41) | 14 (0.37) | 14 (0.33) | 14 (0.36) | 12 (0.42) |
| m) Providing stand-by power generation facilities | 14 (0.53) | 11 (0.53) | 13 (0.44) | 13 (0.40) | 13 (0.36) | 13 (0.39) | 13 (0.42) |
| n) Managing forest fires in collaboration with communities | 10 (0.56) | 15 (0.48) | 15 (0.41) | 15 (0.37) | 15 (0.32) | 10 (0.43) | 14 (0.40) |
| o) Developing small dams, and other storage facilities, to mitigate floods, to harvest water and to initiate community based fish farming and breeding | 15 (0.51) | 12 (0.53) | 12 (0.44) | 12 (0.41) | 12 (0.38) | 15 (0.35) | 15 (0.35) |

5.2 Identification of priority activities for urgent and immediate adaptation

Based on the above list of priority adaptation options, five urgent activities were identified, and developed into project concepts or activities. These are given in order of priority as follows:

(a) Improving community resilience to climate change through the development of sustainable rural livelihoods:

- Improving access to water, including water treatment works,
- Improving water management to withstand erratic rains through water harvesting, water conservation, and small-scale irrigation,
- Improving community storage systems for seed and food reserves,
- Promoting sustainable utilization of dambos, wetlands and river valleys under sustainable dimba cultivation,
- Diversifying crops and livestock to improve nutrition and food security,
- Promoting low-cost nutrition supplements, and
- Raising and improving awareness.

This project is targeted at vulnerable rural communities to enhance food and water security and improve nutrition and sustainable livelihoods of rural communities in areas prone to droughts and floods throughout the country.

(b) Restoring forests in the Upper, Middle and Lower Shire Valleys catchments to reduce siltation and the associated water flow problems:

- Creating buffers along the Shire River, and other rivers, such as the Ruo, to reduce siltation and the transfer of chemicals and other pollutants in water ways,
- Planting fast growing tree species in catchments, and
- Building capacity, especially training, of rural communities.

(c) Improving agricultural production under erratic rains and changing climatic conditions:

- Improving the choice of crop varieties to accommodate the increasing incidence of droughts and aridity,
- Developing improved crop varieties and providing adequate seed,
- Improving early warning and climate observational systems to improve extension delivery systems to the farming communities, and
- Improving extension services to improve information flow to farmers.

(d) Improving Malawi's preparedness to cope with droughts and floods:

- Conducting rapid assessment of drought and flood risk by producing zoning maps,
- Designing and testing appropriate strategies, policies and laws to facilitate urgent efforts in dealing with climate disasters,
- Preparing drought and flood preparedness plans,
- Integrating climate change plans into land use planning,
- Constructing and rehabilitating dams and other flood mitigation measures in key areas, including climate proof critical bridges, and
- Building multi-purpose dams.

- (e) Improving climate monitoring to enhance Malawi's early warning capability and decision making and sustainable utilization of Lake Malawi and lakeshore areas resources:
- Enhancing the capacity of monitoring stations in terms of data collecting, retrieval and distribution,
 - Building capacity,
 - Developing fish breeding facilities in Lake Malawi, rivers and fish ponds to help restock fish in the lake and rivers,
 - Developing a fish farming enterprise.

5.3 Implementation Strategy

The five priority activities were developed into project profiles, highlighting the rationale or justification, objectives, inputs, short-term outputs, potential long-term outcomes, institutional arrangements, risks and barriers, monitoring and evaluation, and a proposed budget. These project profiles are briefly described below.

(a) Improving community resilience to climate change through the development of sustainable rural livelihoods

Rationale

Poverty in Malawi is widespread and deep, with 65% of the population living below poverty. Over 85% of Malawians live in rural areas, with the majority depending on subsistence rain-fed agriculture, and relying on a single maize harvest for their livelihoods. As such, they are very vulnerable to climate-related natural calamities and disasters, such as floods and droughts, which directly affect agricultural productivity. For example, the 1991/1992 drought and the 2001/2002 floods had devastating effects on crops, livestock, wild animals, vegetation and the environment, which adversely affected many Malawians, especially those living in the Rift Valley areas, such as the Shire Valley, Salima and Karonga. Combined with the impacts of HIV/AIDS, which is killing the productive age groups, orphaned children and the aged are the most vulnerable groups. The poorer segments of the population are affected the most since they have little or no means to cope and adapt in times of disaster or need.

The integrated sustainable livelihood project would enhance people's capacity to cope with and adapt to these natural calamities in vulnerable areas. The major sustainable livelihood interventions for coping with these natural calamities include the promotion of the following: (i) water management, purification and utilization, (ii) crop and livestock production, (iii) growing a diversity of crop varieties and fruit trees and rearing of animal breeds that are drought tolerant; (iv) domestication of indigenous fruit trees, and small animals, such as rabbits and guinea fowls; (v) using agroforestry practices; (vi) fish farming and processing; (vii) agro-processing; (viii) market access; and (ix) cross cutting issues: HIV/AIDS, gender and the environment.

Information and knowledge sharing are necessary for enabling various stakeholders make informed choices and decisions. The stakeholders include policy makers, vulnerable groups, research and extension workers, civil society and the mass media. The implementation of these sustainable livelihood strategies will complement existing programme and projects which the Government of Malawi/UNDP and NGOs, such as

Concern Universal, World Vision International and the Miombo Network are doing in some districts of the country. The projects will improve the livelihoods of rural communities, save lives, minimize economic losses, ensure food security, reduce poverty, increase choices and reduce the vulnerability of the rural communities.

This is a project that will require a multi-sectoral approach. The key sectors include agriculture, water, fisheries, wildlife and human health, and private sector organizations, including civil society, non-governmental organizations (NGOs) and community based organizations (CBOs).

Description

Objective. The main objective of this project is to develop and promote user-friendly sustainable livelihood strategies to target communities in areas that are vulnerable to climate change, such as the Shire Valley in southern Malawi.

(a) **Activities.** The main activities to be conducted include:

- Conducting baseline and resource mapping surveys,
- Using participatory approaches and joint planning activities with rural communities to identify sustainable livelihoods,
- Developing and implementing strategies using a sectoral approach,
- Implementation of project activities through:
 - Demonstrations and technology marketing,
 - Capacity building:
 - Technical skills,
 - Equipment; and
 - Resources.
- Executing the project in collaboration with rural communities,
- Mounting monitoring and evaluation exercises,
- Reporting; and
- Applying the lessons to other areas.

Inputs. The project will require human, financial and physical resources, which will be detailed out in the final project proposal.

Short-term outputs. Sustainable livelihood strategies developed, communities' capacity enhanced, interventions adopted and utilized by rural communities that will enable them adapt and cope with climate-related natural calamities and disasters.

Potential long-term outcomes. Improved quality of life of the peoples, reduced economic losses, and improved access to food and water, increased number of alternative livelihoods (in addition to farming) and enhanced protection of natural resources and the environment.

Implementation

Institutional arrangements. The lead implementing agency will be the Ministry of Agriculture and Food Security. The key stakeholders include: Ministry of Local Government, Ministry, of Lands, Physical Planning and Surveys, Department of Relief

and Disaster Preparedness, Ministry of Health and Population Ministry of Water Development, Fisheries Department, academic and research institutions, Department of Meteorological Services, donor agencies, District Assemblies and NGOs.

Risks and barriers. The major risks and barriers include:

- Viability of the developed sustainable livelihood strategies,
- Willingness of local community based organizations (CBOs), NGOs and other institutions to support the initiatives,
- Willingness of the communities to adopt the developed technologies, and
- Local beliefs in implementing the developed technologies.

Monitoring and evaluation. There will be a continuous monitoring exercise by the Ministry of Agriculture and other implementing agencies, while the evaluation exercise will be done by the EAD. Both mid-term and the final monitoring and evaluation reports will be produced.

Financial resources. The total cost for developing and implementing the sustainable livelihoods strategies for vulnerable communities in the Shire Valley is estimated at US\$ 4.5 million for a period of three years.

Budget Breakdown

| | Year 1 | Year 2 | Year 3 |
|---|------------------|------------------|------------------|
| Baseline and resource mapping survey | 300,000 | | |
| Participatory planning for sustainable livelihood | 320,000 | | |
| Development of implementation strategies (based on sectors) | 200,000 | | |
| Project implementation | | | |
| • Demonstration/technology marketing | 600,000 | 600,000 | 600,000 |
| • Capacity building | | | |
| ○ Technical skills | 150,000 | 150,000 | 150,000 |
| ○ Equipment (windmills) | 600,000 | 600,000 | 600,000 |
| ○ Resources (dams) | 200,000 | 200,000 | 200,000 |
| • Implementation | 150,000 | 150,000 | 150,000 |
| • Monitoring and evaluation | 100,000 | 100,000 | 150,000 |
| General project management | | | |
| • Operational expenses | 100,000 | 100,000 | 100,000 |
| • Equipment | 75,000 | 75,000 | 75,000 |
| • Reporting | 25,000 | 25,000 | 25,000 |
| • Stakeholder consultations/workshops | 100,000 | 100,000 | 100,000 |
| • Public awareness/disseminations of findings for replication and application | 50,000 | 100,000 | 100,000 |
| Total Cost of the Project | 1,800,000 | 1,350,000 | 1,350,000 |

(b) Table 2: Log frame for improving community resilience to climate change through the development of sustainable rural livelihoods

| | Narrative of the Intervention Logic | Objectively Verifiable Indicators (OVIs) of Achievement Source and Means of Verification (SMV) |
|-------------------|--|---|
| Overall objective | <ul style="list-style-type: none"> Enabling communities to cope with climate change to ensure food security, reduce poverty and ensure proper utilization of natural resources through the development and implementation of sustainable livelihood strategies | Alternative sustainable livelihood strategies available to rural communities |
| Project purpose | <ul style="list-style-type: none"> To develop and promote user-friendly and sustainable livelihood strategies by growing crop varieties and rearing animal breeds that are drought and disease tolerant, domestication of indigenous fruit trees and animals, agro-processing, market access, flood control management and the proper utilization of residual soil moisture in dambos, wetlands and low lying river valleys, as well as mainstreaming cross cutting issues of HIV/AIDS, gender and environment. | <ul style="list-style-type: none"> Number and quantity of new crop varieties in use, Number and quantity of animal breeds in use, Number and availability of indigenous fruit trees, Number of people growing “winter” crops, i.e., during the dry season using residual soil moisture, Number of fish farms established, Range and number of processed products available, Number/age/ gender of beneficiaries trained, Types and number of skills attained, Number of enterprises developed, and Number of new markets established. |
| Expected results | <p>Awareness of targeted communities on:</p> <ul style="list-style-type: none"> Growing crop varieties that are drought and disease tolerant, Rearing animal breeds that are drought and disease tolerant, Domesticating indigenous fruit trees, Controlling and managing rainwater and floods, Managing residual soil moisture, and Utilizing residual soil moisture in an effective and efficient manner. | <ul style="list-style-type: none"> Increased adoption and utilization of new and improved crop varieties and animal breeds, Increased utilization of dambos for crop production, Improved nutrition through the eating of indigenous fruits, meat, milk and their products, Reduced flooding and proper use of conserved rain-water for irrigation and domestic purposes, and Increased availability of irrigated crop varieties. |
| Activities | <ul style="list-style-type: none"> Conducting surveys to establish baseline data, Developing and/or enhancing appropriate sustainable livelihood strategies in collaboration with rural communities using PRA approaches, Developing and transferring new/improved technologies, and Popularizing new and improved technologies through field days, demonstrations, mass and print media, and the training of rural communities and field extension staff | Detailed budget (US\$4.5 million) compared with expenditure reports, and project reports (monthly, quarterly and annual). |

(b) Restoring forests in the Shire River Basin to reduce siltation and the associated water flow problems**Rationale**

The Shire River, which derives its source from Lake Malawi, is probably the river that has the greatest economic significance to Malawi. Apart from being a source of water and livelihoods to the communities living along its long stretch as it winds to the Indian Ocean, it also provides over 285 megawatts of the 304 total installed capacities of hydroelectric power, and provides water for irrigating sugar cane fields at Nchalo in Chikwawa. The Upper and Middle Shire Valleys catchments, and the riverbanks, are an important source of forests products (timber, poles and firewood) for the rural communities for home use and for sale in adjacent urban centres of Blantyre and other towns. Recently, the Upper and Middle Shire Valleys have been heavily deforested, resulting in heavy siltation and trash accumulation at the water intake dam at the hydro electric power (HEP) plant on the Shire River. Frequent power outages are a burden to the electricity supplier, industry and households. Power outages are also seen as major concern of, and a barrier to, foreign investors.

Description

Objectives. The objectives of the project are to reduce siltation and enhance water flows through the re-afforestation of the Upper, Middle and Lower Shire Valleys catchments by adopting co-management strategies at community level. In addition, this would provide the much sought after firewood.

Activities. The activities to be conducted will include the following:

- Conducting baseline surveys and mapping,
- Carrying out surveys to demarcate areas that will be under tree plantation,
- Training communities and other stakeholders in nursery establishment and management,
- Developing nurseries among rural communities,
- Re-afforesting affected areas,
- Imparting hands-on knowledge and skills on rural communities on how to establish and manage seedlings,
- Monitoring the levels of siltation and trash accumulation at the water intake point of the HEP generators on the Shire River,
- Bee-keeping, and
- Sales of fruits and derived fruit products such as juices.

Inputs. The inputs will include Forest Inventory Kit; various farm tools and implements, and training materials, among many others.

Short-term outputs. These will include:

- Increased ground cover,
- Reduced run-off and soil erosion,
- Increased human resource with technical know-how and improved skills on tree establishment and management,
- Increased supply of trees that can be sustainably harvested for firewood, poles, timber and other construction materials,

- Reduced siltation and trash loads at HEP intake, hence more reliable supply of electricity for industrial, institutional and household use, and
- Steady water flow rates in the Shire River, including dry months.

Potential long-term outcomes. These will include:

- Increased availability of wood and wood products for local use and for sale,
- Increased ground cover and enhanced CO₂ sinks,
- Increased revenue from the sale of forest and forest products,
- Long-term flooding in Lower Shire reduced, and
- Steady water flow rates in the Shire River.

Implementation

Institutional arrangements. The project will be executed by the Department of Forestry as the lead agency in collaboration with vulnerable rural communities. The other stakeholders will include: Department of Meteorological Services, Electricity Supply Corporation of Malawi (ESCOM), Wood Industries Corporation, Non-Governmental Organizations, Community-Based Organizations, Bunda College of Agriculture, University of Mzuzu, Japanese International Cooperation Agency (JICA), SANYU and Wildlife and Environmental Society in Malawi (WESM).

Risks and barriers. The main barriers include the following:

- Little participation by communities, as tree planting may not be their number one priority,
- Participation of other institutions and CBOs may not be guaranteed,
- Rains may not be sufficient in some years, so that the establishment of community woodlots, and the plantations themselves, would be adversely affected, and
- Lack of capacity on woodlot management by rural communities.
- Customery land tenure lacking ownership.

Monitoring and evaluation. Monitoring and evaluation will be done by the Department of Forestry, whereas evaluation of activities will be done by EAD. Evaluation will be through monthly, quarterly and annual reports.

Financial resources. The project is estimated to a cost of US\$ 2.0 million

Budget breakdown

| | Year 1 | Year 2 | Year 3 |
|--|---------|---------|---------|
| Baseline surveys and mapping | 100,000 | | |
| Train communities and other stakeholders in nursery establishment and management | 125,000 | 50,000 | 50,000 |
| Develop nurseries in the communities | 50,000 | 50,000 | 50,000 |
| Re-afforest the selected the affected areas | 100,000 | 100,000 | 100,000 |
| impart hands-on knowledge and skills on woodlot establishment and management | 125,000 | 50,000 | 50,000 |
| Monitor levels of siltation and trash at water intake point of HEP generators | 150,000 | 150,000 | 150,000 |
| Project management | 200,000 | 175,000 | 175,000 |

| | | | |
|--|---------|---------|---------|
| Operations Equipment Other resources | | | |
| Total Cost of the Project | 850,000 | 575,000 | 575,000 |

Table 3: Log frame for restoring forests in the Upper, Middle and Lower Shire Valleys catchments to reduce siltation and the associated water flow problems

| | Narrative of the Intervention Logic | OVI of Achievement; and Source and Means of Verification |
|-------------------|---|--|
| Overall objective | The objectives of this project are to reduce siltation and to enhance water flows through re-afforestation of the Upper, Middle and Lower Shire Valleys catchments by adopting co-management strategies. | Availability of alternative sources of attaining and achieving sustainable rural livelihoods. |
| Project purpose | <ul style="list-style-type: none"> To impart knowledge and skills to rural communities on woodlot establishment and management, To re-afforest Shire Valley catchments, and To train communities and forestry extension staff in the management of forestry plantations, including fire breaks | <ul style="list-style-type: none"> Number, age and gender of people trained, Number of seedlings planted and area covered, Number of woodlots established and properly managed, Number of rural communities and extension staff trained, Levels of siltation attained, Levels of trash accumulated, Flow rates on the Shire determined, and Frequency of power outages and water shortages determined. |
| Expected results | <ul style="list-style-type: none"> Increased supply of firewood and forest products, Improved skills in fire and forestry management by forestry staff and rural communities, and Increased skills and knowledge in the management of nurseries and woodlots by rural communities. | <ul style="list-style-type: none"> Resource maps produced, Monthly and quarterly reports on firewood and on forestry products used by rural communities, Number of staff trained, and Number of household trained in woodlot management. |
| Activities | <ul style="list-style-type: none"> Conducting baseline surveys and mapping, Surveying and demarcating areas to be planted with trees, Training communities and other stakeholders in nursery establishment and management, Developing nurseries in rural communities, Re-afforesting selected areas, Imparting hands-on knowledge and skills on woodlot, establishment and management; and Monitoring the levels of siltation and trash accumulation at water intake point of HEP generators on the Shire River. | Detailed budget (US\$2,000 million) versus expenditure reports, and monthly, quarterly and annual reports. |

(c) Improving agricultural production under erratic rains and changing climatic conditions

Rationale

The agriculture sector is the driver of Malawi's economy. It contributes 35 to 40% of Gross Domestic Product (GDP), provides employment to 85% of the workforce, and contributes 85 to 90% of foreign exchange earnings and 60 to 70% of raw materials for the manufacturing sector. Any adverse event that affects agricultural production impacts directly on the life of every Malawian. Over 85% of Malawians live in the rural areas deriving their livelihoods from rain-fed subsistence agriculture. Rain-fed agriculture is vulnerable to climate-related natural calamities and disasters, especially extensive dry spells and droughts.

Malawi has experienced changing rainfall patterns in recent years, including changes in the on-set of rains, irregular and uneven rainfall distribution, dry spells, and torrential rains. Some areas, such as Karonga, have sometimes experienced prolonged dry spells and torrential rains resulting in droughts and floods in the same season. The extreme weather events often result in total loss or marked reduction in crop and livestock production. This situation has been worsened by the fact that there are a few initiatives that are specifically targeted at promoting crop and livestock diversification, or the growing of crop varieties or rearing livestock species, that are tolerant to the erratic rainfall and drought.

In the past, the general policy had been to promote maize as the main staple food crop for the whole country, despite the fact that people in some communities, eat sorghum, cassava or bananas as their main staples, and not maize. This approach perpetuated the problem of food insecurity. To improve food security, the government is currently promoting crop diversification, as well as the eating of a wide the range of different foods, such as cassava, sorghum, millets, sweet potatoes, small stock (goats, pigs and sheep), with the overall objective of improving agricultural productivity to ensure food security, improved nutrition, and increased incomes.

Description

Objective. The main objective is to improve agricultural productivity in areas characterized by erratic rainfall so as to improve the living standards and sustainable livelihoods of vulnerable rural communities.

Activities. The activities will include the following:

- Mapping out vulnerable areas and identifying drought tolerant crops such as cassava, millet, sweet potatoes and animals,
- Multiplying and distributing appropriate crop and animal varieties,
- Training farmers and field extension staff on agricultural husbandry practices,
- Disseminating extension messages on the crops and animal varieties,
- Irrigation Farming
- Training farmers on storage, utilization and value-adding to their crops and animals products, and
- Monitoring and evaluation of the programmes.

Inputs. The inputs include equipment, human, physical and financial resource.

Short-term outputs. The short-term outputs include:

- Communities in target areas will be growing crops and rearing livestock that are drought tolerant,
- Reduced malnutrition among children and vulnerable groups,
- Increased production of crops and livestock for home use and market sale, and
- Communities in target areas will be processing their produce to add value.

Potential long-term outputs. In the long-term, the living standards of rural communities will be improved through the use and sale of excess crops, meat, milk and other processed products.

Implementation

Institutional arrangements. The project will be implemented by the Ministry of Agriculture in collaboration with rural communities, and civil society, including NGOs and CBOs, Bunda College of Agriculture, and other relevant stakeholders.

Risks and barriers. The main risks and barriers include:

- Destruction of crops, such as cassava, by livestock and wild animals
- Accelerated erosion due to overgrazing and poor crop and livestock husbandry practices,
- Potential for further disease and insect pest outbreaks if appropriate control measures are not put in place, and
- Inadequate land for grazing, due to more land being put to crops, and many animals.

Monitoring and evaluation. This will be done through the following:

- Monthly and quarterly narrative reports,
- Financial reports, and
- Feedback from the communities implementing projects.

MoA will conduct the monitoring exercise on a continuous basis, whereas EAD will coordinate all evaluation activities.

Financial resources. The project cost is estimated at US \$3.00 million.

Budget breakdown

| | Year 1 | Year 2 | Year 3 |
|---|---------|---------|---------|
| Baseline surveys and zoning areas/crops | 400,000 | | |
| Seed multiplication | 170,000 | 170,000 | 170,000 |
| Capacity building | 275,000 | 275,000 | 275,000 |
| <ul style="list-style-type: none"> • Crop and animal husbandry • Agro-processing/ value adding • Equipment | 300000 | 300000 | 300000 |
| Extension services | 105,000 | 105,000 | 105,000 |
| Project management & M&E | 350,000 | 300,000 | 300,000 |
| Operations | | | |
| Equipment | | | |

| | | | |
|----------------------------------|-----------|----------|----------|
| Consultative workshop | | | |
| Total Cost of the Project | 1,600,000 | 1150,000 | 1150,000 |

Table 4: Log frame for Improving agricultural production under erratic rains and changing climatic conditions

| | <u>Narrative of the Intervention Logic</u> | <u>OVI of Achievement; and Sources and Means of Verification</u> |
|-------------------|---|--|
| Overall objective | The main objective of this project is to improve agricultural productivity in areas of erratic rainfall, thereby enhancing the living standards of rural communities | Availability of reliable sources of food and cash/income from crops and animals and/or their products |
| Project purpose | <ul style="list-style-type: none"> To introduce improved drought tolerant crop varieties and animal breeds, To multiply and distribute improved crop varieties and animal breeds, To train farmers on improved crop and animal husbandry practices, and To train farmers on value adding initiatives. | <ul style="list-style-type: none"> Number of improved crop varieties and animal breeds with the communities, Availability of seed and animal multiplication programmes in the communities, Number of trained extension staff and rural communities in the management of improved crop and animal husbandry practices, Number of animals sold or slaughtered for meat, Amount of milk produced by the communities, and Types and amount of other processed products produced, |
| Expected results | <ul style="list-style-type: none"> Communities in targeted areas are growing drought tolerant crops and rearing small stock (goats and sheep), Reduced malnutrition among children and vulnerable groups, Communities are producing excess produce for sale, and Communities are processing produce for sale. | <ul style="list-style-type: none"> Number of people in the community growing or rearing improved crop varieties or improved animal breeds, Number of malnourished children and vulnerable groups, Number of available crop and animal products, and Number of trained people in proper management of improved crop and animal husbandry practices. |
| Activities | <ul style="list-style-type: none"> Mapping out vulnerable areas and identifying suitable crops and animals for the areas, Multiplying and distributing appropriate crop varieties and animal breeds, Training farmers on appropriate crop and animal husbandry practices, Disseminating extension messages on crop varieties and animal breeds, Training farmers on storage, utilization and value-adding of the outputs from crops and animals; and Monitoring and evaluate .. | Detailed budget (US \$ 3.00 million) versus expenditure report, and project reports (monthly, quarterly and annual). |

(d) Improving Malawi's preparedness to cope with droughts and floods**Rationale**

Malawi receives an average of 850 mm of rainfall per year. This amount is adequate for rain-fed crop production, and for recharging underground aquifers. However, the distribution and consistency of the rainfall is very erratic and uneven, so that the whole of Malawi is prone to hydrological droughts. The worst affected areas are central-southern Karonga, the Bwanje Valley and the Shire Valley.

Droughts result in reduced river flow rates, and the complete drying up of rivers. The water table also recedes, thereby affecting boreholes and wells which are major sources of potable water in rural areas. Thus, alternative ways of ensuring adequate water supply for rural communities need to be explored and implemented.

The interventions are likely to be site-specific, depending on terrain, soil type, and methods of water extraction and delivery, among many others. Some of the potential interventions include the construction of medium to large scale dams, and small rainfall harvesting structures, such as water troughs, small dams and infiltration gullies. In addition, deep wells can also be constructed for the provision of water for domestic purposes, irrigation, as well as for animal use.

Floods in Malawi have been associated with heavy upstream rainfall resulting in too much water down stream that leads to the breaking-up of river banks. For example, this is a common feature on the North Rukuru in Karonga, Likangala in Zomba, and the Ruo/Shire Rivers in Chikwawa/Nsanje. An interesting phenomenon around the Ruo/Shire confluence is that the intense flow from the Ruo River tends to block the Shire River, which results in the Shire River swelling up stream. Malawi has also experienced flush floods due to prolonged torrential rains, such as the Phalombe flush floods in 1991 that killed over 1,000 people, and wiped out villages, crops, livestock and property.

Potential interventions include flood protection structures such as levees, dykes, canals, dams, and in the case of Ruo River, diverting the river to meet the Shire at an angle downstream.

Description

Objective. The main objective of the project is to enhance the country's preparedness in swiftly responding to emergencies caused by floods and/or droughts so as to reduce the negative impacts on vulnerable communities.

Activities. The activities will include the following:

- Conducting rapid assessment of drought and flood risks, resulting in flood delineation and zoning maps,
- Establishing flood forecasting and warning systems,
- Developing and implementing flood mitigation measures,
- Establishing drought forecasting and warning systems, and
- Developing and implementing drought mitigation measures.
- Capacity building for rapid response to extreme climate change events.

Inputs: The inputs include small equipment, human, physical and financial resources, including vehicles, computers and accessories.

Short-term outputs. These will include the following:

- Flood delineation and zoning maps produced,
- Flood control works established,
- Staff trained to operate and maintain advanced FEW system in place
- Drought mitigation works established and commissioned, and
- Forecasting and early warning systems put in place.

Potential long-term outputs. These will include the following:

- Appropriate legal framework on climate change and potential disasters developed,
- Flood and drought preparedness plans developed, and
- Multipurpose dams along the Shire River to control flood, conserve water and HEP generation, constructed.

Implementation

Institutional arrangements. The lead institution in the implementation of this project will be the Department of Meteorology in collaboration with the Ministry of Water Development, Ministry of Agriculture, NGOs, CBOs, local communities and The Malawi Polytechnic (Civil Engineering Department).

Risks and barriers. The main risks include the security of structures against vandalism, and the possibility of lack of interest to participate by the targeted rural communities.

Monitoring and evaluation. Monitoring will be done by the Department of Meteorology, whereas EAD will coordinate the evaluation exercise on quarterly basis based on various types of reports. Monitoring will be done monthly through inspection, meetings and expenditure returns.

Financial resources. Funds for the project are estimated at **US\$ 8.00 million.**

Budget breakdown

| | Year 1 | Year 2 | Year 3 |
|--------------------------------------|------------------|-----------------|-----------------|
| Rapid assessment and zoning | 450,000 | | |
| Forecasting and Early Warning system | 1,000,000 | 1,000,000 | 1,000,000 |
| Capacity building | 70,000 | 70,000 | 70,000 |
| • Train staff to man the systems | | | |
| Flood Mitigation works | 800,000 | 800,000 | 800,000 |
| Drought mitigation works | 400,000 | 400,000 | 400,000 |
| Project management & M&E | 250,000 | 245,000 | 245,000 |
| Operations | | | |
| Equipment | | | |
| Consultative workshop | | | |
| Total Cost of the Project | 2,970,000 | 2515,000 | 2515,000 |

Table 5: Log frame for Improving Malawi's preparedness to cope with droughts and floods

| | Narrative of the Intervention Logic | OVI's of Achievement; and Sources and Means of Verification |
|-------------------|--|---|
| Overall objective | The main objective is to enhance the country's preparedness to respond to the emergencies of floods and/or droughts so as to reduce the negative impacts on vulnerable rural communities. | Capacity to quickly and urgently respond to disasters from floods and/or droughts |
| Project purpose | <ul style="list-style-type: none"> • To identify and map vulnerable areas, • To develop forecasting and early warning systems, and • To build and install adaptation measures for floods and droughts. | <ul style="list-style-type: none"> • Numbers of FEWS monitoring stations installed, • Number flood mitigation structures constructed, • Number of members of staff trained and the types of skills, • Number of drought mitigation structures constructed, • Volume of water stored, • Number of dykes or canals (and their lengths) constructed, • Number of rural households trained in the management of water supply structures/systems, and • Number of people benefiting/ served. |
| Expected outputs | <ul style="list-style-type: none"> • Flood zoning maps delineated, • Flood control works developed, • Staff to operate and maintain advanced FEWS systems trained, • Drought adaptation and mitigation works developed, and • Forecasting and early warning systems put in place. | <ul style="list-style-type: none"> • Reports giving details on the number of structures constructed, and the number of people involved and/or affected, • Report on the number of household members, and • Number of FEWS monitoring stations that are in operations. |
| Activities | <ul style="list-style-type: none"> • Conducting rapid assessment of drought and flood risks, and delineating zoning maps, • Establishing flood forecasting and warning systems, • Developing and implementing flood mitigation measures, • Establishing drought forecasting and warning systems, and • Developing and implementing drought mitigation measures. | Detailed budgeted (US \$8.00 million), and project reports (monthly, quarterly and annual). |

(e) Improving climate monitoring to enhance Malawi's early warning capability and decision making and sustainable utilization of Lake Malawi and lakeshore areas resources

Rationale

Lake Malawi is one of the world's most important fresh water bodies because of its unique and endemic flora and fauna. Lake Malawi has an estimated 700 to 1000 fish species. It is the largest source of fresh water fish, which constitute about 60-70% of animal protein intake in Malawi, and provides employment to over 300,000 people as fishermen, processors and in primary and secondary marketing and distribution activities. The fisheries sector contributes 4% of the GDP. The lake is the source of Shire River, which produces about 95% of hydroelectric power, and a major source of potable water for the cities of Blantyre and neighbouring towns, such as Chiradzulu. Lake transport is also becoming an increasingly important and cost effective way of linking lakeshore town centres and townships across the border with Mozambique and Tanzania.

The fisheries sector has been experiencing a number of vulnerabilities such as floods and droughts that have led to loss of habitats. These factors have contributed to the decline in fish catches from 60,000 tonnes in the 1980s, to about 40,000 tonnes per year currently. The disappearance of some species, such as Mbuna, whose habitats are threatened by declining water levels and other environmental factors, is a real threat to the fishing industry in Malawi. If the current trends are not reversed, the loss of biodiversity will be inevitable and irreversible. In addition, the short-term fluctuations in wind pattern that have become more variable in recent times due to climate change pose a challenge to fishers; the noted increased temperature may have likely contributed to the decline in fish production as has occurred in Lake Tanganyika. A monitoring and observation system could provide for an early warning system in conjunction with other national and regional systems. This will promote pre-disaster preparedness and formulation of mitigation strategies while adaptation measures are urgently needed to respond to the declined fish catches.

The water levels in Lake Malawi and the Shire River affect water flow rates downstream. For example, the droughts of 1991/92-crop season reduced the hydro-electric power (HEP) generation from 240 megawatts (MW) down to 80 MW. The worst-case scenario occurred between 1915 and 1937 when there was no water outflow from the lake due to lowered lake level, so that during this period the Shire River stopped flowing. There is, therefore, need to monitor the weather, and lake levels on Lake Malawi, so as to develop systems for weather forecasting and for advising stakeholders on possible steps to be taken in the event that droughts and floods strike.

Description

Objectives: The main objective of the project is to establish a climate monitoring and early warning system on Lake Malawi and lakeshore areas for timely provision of accurate information for pre-disaster preparedness to rural fishing and farming communities and to promote short and long-term adaptation livelihood skills to riparian communities in the face of dwindling fish catches.

Activities. The activities to be conducted will include the following:

- Identifying potential sites to install early warning systems in collaboration with the local fishing communities and other stakeholders,
- Procuring, installing and commissioning of equipment,
- Training local staff in the operation and maintenance of the system,
- Collecting, processing, storing, updating, packaging and/or disseminating data and information to various stakeholders,
- Establishing a website for information dissemination and sharing,
- Undertaking research to assess the productivity of fish under erratic rainfall and changing climatic conditions,
- Undertaking mitigation measures based on the above findings,
- Establishing a fish gene bank to maintain genetic diversity of the freshwater fish resources, and
- Establishing fish breeding and fish farming sites for restocking, food security and income generation.

Inputs: The project will require human, financial and physical resources, which will be detailed out in the final project proposal.

Short-term outputs. These will include:

- Improved climate monitoring on Lake Malawi and lakeshore areas to improve decision making and provide early warning systems for the fisheries, transport, tourism, water and HEP energy sectors,
- Climate database on Lake Malawi and its shores developed and disseminated,
- Fish breeding and fish farming to safeguard fisheries and to conserve biodiversity developed,
- Fish breeding facilities on Lake Malawi to help restock the fish in the lake and rivers established, and
- Fish farming enterprises established.

Implementation

Institutional arrangements. The Project will be executed by the Meteorological Services and Fisheries Departments as lead institutions, in collaboration with the local fishing and farming communities living along the lakeshore districts. Other stakeholders will include ESCOM, Department of Marine Engineering, Department of Tourism, NGOs, CBOs, Mzuzu University and Bunda College. Ministry of Agriculture and Food Security, Department of Parks and Wildlife.

Risks and barriers. Some of the pertinent barriers include:

- Low participation by local fishing and farming communities,
- Resources to undertake the planned activities may not be inadequate, and
- Lack of cooperation from other stakeholders.

Monitoring and evaluation. Monitoring will be done by the Meteorological and Fisheries Departments. The EAD will coordinate the evaluation exercises to assess the impact of the project.

Financial resources. The project is estimated to a cost of US\$ 5.43 million

Budget breakdown

| | Year 1 | Year 2 | Year 3 |
|----------------------------------|------------------|------------------|------------------|
| Site identification | 180,000 | 50,000 | 50,000 |
| Procure equipment | 1,500,000 | 100,000 | 100,000 |
| Train staff | 75,000 | 75,000 | 75,000 |
| Install and commission equipment | 100,000 | 100,000 | 100,000 |
| Fisheries research | 500,000 | 350,000 | 300,000 |
| Fisheries gene bank | 275,000 | 250,000 | 250,000 |
| Project management | 350,000 | 300,000 | 300,000 |
| Total Cost of the Project | 2,980,000 | 1,225,000 | 1,225,000 |

Table 6: Log frame for improving climate monitoring to enhance Malawi’s early warning capability and decision making and the sustainable utilization of Lake Malawi and lakeshore areas resources

| | Narrative of the Intervention Logic | OVI of Achievement; and Sources and Means of Verification |
|-------------------|---|---|
| Overall objective | To establish a climate monitoring and early warning system in order to provide timely and accurate information for the sustainable utilization of the Lake Malawi and lakeshore resources. | Availability of decision support systems in support of communities living along lakeshore areas |
| Project purpose | <ul style="list-style-type: none"> • To install a climate monitoring and early warning system for Lake Malawi and lakeshore areas, • To process, package and disseminate timely data to all stakeholders, and • To promote conservation and fish biodiversity, • To promote fish farming along the Lake Shore areas. | <ul style="list-style-type: none"> • Number of monitoring stations, • Number of stakeholder connected, and • Number or variety of species in the fish gene bank • Number of fish farming sites along the lakeshore. |
| Expected outputs | <ul style="list-style-type: none"> • Improved climate monitoring for Lake Malawi and lakeshore areas to improve decision making for the fisheries, transport, tourism, water and HEP energy sectors, • Climate database for Lake Malawi and its shores developed, • Fish breeding and fish farming programmes to safeguard fisheries and to conserve biodiversity established, • Fish breeding facilities on the Lake Malawi to help restock fish into the lake and rivers established, and • Fish farming enterprises established. | <ul style="list-style-type: none"> • Number of climate-monitoring stations established, • Number of sectors or stakeholders benefiting, • Database and network connectivity established, • Number of enterprises established, • Number, age and gender of entrepreneurs involved, • Number of breeding sites established, • Number of fish farming enterprises established, and • Number of rivers restocked with fish. |
| Activities | <ul style="list-style-type: none"> • Identifying potential sites to install early warning systems in collaboration with local communities and other stakeholders, • Procuring, installing and commissioning equipment, • Training local staff on how to operate and maintain the system, • Training of local staff on predictive capability and modeling, • Collecting, processing, storing, updating, packaging and/or disseminating data to various stakeholders, • Establishing a website for information sharing and dissemination, • Undertaking research to assess the productivity of fish under changing climatic conditions, • Undertaking mitigation works based on the findings above, and • Establishing a fish gene bank to maintain the genetic diversity of fish. | Detailed budgeted (US \$5.43 million) versus expenditure report, and project reports (monthly, quarterly and annual). |

6.0 NAPA Preparation Process

6.1 The consultative process

During the preparation of the NAPA document, many consultative workshops, which involved the participation of various stakeholders from the public and private sector organizations, such as government ministries and departments, the universities of Malawi and Mzuzu, NGOs, faith groups, traditional leaders, and the mass media, were conducted. The main objective of the consultative process was to publicize the project activities, and solicit inputs and feedback from all stakeholders, including rural communities, who would be involved in project implementation.

Through the use of the participatory rural appraisal (PRAs) methodology, the multi-disciplinary teams of consultants were able to obtain the communities' perception and views regarding the adverse impacts of climatic change on sustainable rural livelihoods, and a range of coping and adaptation measures, that have evolved through the use of indigenous technical knowledge (ITK), and modern science and technology initiatives. In the final analysis, through this consultative process, a large number of Malawians participated in the development of this NAPA document, and are now aware of what the project intends to do and achieve for vulnerable rural communities.

6.2 Country drivenness

As a result of the adverse impacts of climate change on the Malawi economy, especially over the last ten years, Malawi Government has created the Department of Disaster, Relief and Preparedness, as its commitment to specifically deal with natural disasters and calamities, especially droughts, floods, landslides and insect pests outbreaks (such as locusts).

This highlights the importance that the Malawi government attaches to initiatives aimed at dealing with climate-related disasters and calamities among the most vulnerable communities in rural areas. Thus, the NAPA report is actually addressing the priority needs of all Malawians, especially in the needs of rural communities, and complementing existing government initiatives.

6.3 Contribution to overall sustainable development goals, objectives and strategies

Vision 2020 and the Malawi Poverty Reduction Strategy Paper (MPRSP) were launched to realize the aspirations of all Malawians through poverty reduction, changing unsustainable consumption habits and production patterns, protecting the environment, and sustainable utilization of the natural resource base for social and economic growth and development.

The NAPA Project, which assessed the impacts of climate change on eight sectors, and identified fifteen urgent adaptation needs, seeks to effectively and efficiently address these critical issues in the short-term, focusing on the most vulnerable resource-poor rural communities in targeted vulnerable areas throughout the country.

6.4 Government's endorsement and commitment

The NAPA document seeks to address Malawi's urgent and immediate adaptation needs to climate change and extreme weather events for vulnerable communities in vulnerable areas of Malawi. This document has been endorsed by the Minister of Mines, Natural Resources and Environment, hence government endorsement and approval. This has been possible because policy makers, including members of Technical Committee on the Environment (TCE), the National Council on the Environment (NCE), and the Parliamentary Committee on Agriculture and Natural Resources, were fully involved during the preparatory process of the NAPA Project, through participation at meetings and consultative workshops.

6.5 Transparency

The NAPA preparatory process involved the participation of many stakeholders. The multi-disciplinary teams used participatory approaches to ensure that Malawi's strategies and plans are integrated in the document. This approach ensured that the NAPA document was developed in a transparent and participatory manner, a feature that would further ensure that the proposed activities are implemented and adopted by target vulnerable rural communities.

7.0 Concluding Remarks and the Way Forward

7.1 Concluding Remarks

Malawi has in the last decade experienced various adverse impacts of climatic change, climate variability, and extreme weather events. The major climatic events include: dry spells, droughts, floods and heat waves. These have had devastating effects on food, water, health and energy, negatively impacting on the sustainable livelihoods of vulnerable rural communities. Some of these events have increased in frequency, magnitude and geographical coverage, thereby negatively affecting the socio-economic well being of all Malawians.

As a coping strategy, Malawi has undertaken to prepare this NAPA document so as to respond to the urgent and immediate needs for adaptation to climate change. The NAPA document has been developed through a participatory and consultative process involving the agriculture, human health, energy, fisheries, wildlife, water, forestry and gender sectors.

The synthesis of the eight sectors resulted in thirty-one adaptation options. This list was analyzed and ranked using MCA to arrive at fifteen priority adaptation options. These fifteen adaptation options were further ranked for urgency. Based on these, a total of five project profiles have been developed, which require urgent funding so as to address the urgent and immediate adaptation needs articulated by vulnerable communities in Malawi, especially the Shire Valley. These, in order of priority, are:

- (a) Improving community resilience to climate change through the development of sustainable rural livelihoods,
- (b) Restoring forests in the Shire River Basin to reduce siltation and associated water flow problems,
- (c) Improving agricultural production under erratic rains and changing climatic conditions,
- (d) Improving Malawi's preparedness to cope with droughts and floods, and
- (e) Improving climate monitoring to enhance Malawi's early warning capability and decision making and sustainable utilization of Lake Malawi and lakeshore areas resources

These project proposals cut across all the eight sectors that were evaluated for adaptation to the adverse impacts of climate change. However, there is a tilt towards food and water security interventions.

7.2 The way forward

In order to assist vulnerable rural communities to cope with the adverse impacts of adverse climate change, the proposed project activities should be urgently funded so that they are implemented with the urgency they deserve. The remaining eight adaptation options will also be ranked for urgency, and project proposals developed and submitted for funding at a later date in the future.

Once the projects have been funded, there is need for close monitoring and evaluation. This will be done through: (i) quarterly reports, (ii) quarterly Project steering committee meetings, (iii) tripartite review meetings, (iv) annual project reports, and (v) strategic evaluation missions.

8.0 Bibliography

Environmental Affairs Department (EAD), 1994. National Environmental Action Plan, EAD, Lilongwe, Malawi.

Environmental Affairs Department (EAD), 1995. Environmental Management Policy. EAD, Lilongwe, Malawi.

Environmental Affairs Department (EAD), 1998. State of the Environment Report for Malawi. EAD, Lilongwe, Malawi.

Environmental Affairs Department (EAD), 2002a. Initial National Communication under the United Nations Framework Convention on Climate Change. Ministry of Natural Resources and Environmental Affairs, Lilongwe, Malawi.

Environmental Affairs Department (EAD), 2002b. National Environmental Action Plan. EAD, Lilongwe, Malawi.

Environmental Affairs Department (EAD), 2004. Malawi National Strategy for Sustainable Development. Ministry of Mines, Natural Resources, and Environment, Environmental Affairs Department (EAD), Lilongwe, Malawi.

GIS Unit, 1999. Estimated Population of Malawi, 1999. Chitedze Agricultural Research Station, Lilongwe, Malawi

Malawi Government (MG), 1995. Policy Framework for Poverty Alleviation. Ministry of Economic Planning and Development, Lilongwe, Malawi.

Malawi Government (MG), 1998. Vision 2020. National Economic Council, Office of the President and Cabinet, Lilongwe, Malawi

Malawi Government (MG), 2000. Profile of Poverty in Malawi: Poverty analysis of the integrated household survey, 1998. Lilongwe, Malawi.

Malawi Government (MG), 2002a. Economic Report 2002. National Economic Council, OPC, Lilongwe, Malawi.

Malawi Government (MG), 2002b. Malawi Poverty Reduction Strategy Paper. Ministry of Finance and Economic Planning, Lilongwe, Malawi.

Ministry of Agriculture (MoA), 2005. Food and Nutrition Security Policy. MoA, Lilongwe, Malawi.

Ministry of Agriculture and Livestock Development (MOALD), 1987. The Agriculture and Livestock Development Strategy and Action Plan. MOALD, Lilongwe, Malawi.

National Statistical Office (NSO), 2000. Malawi Demographic Health Survey. National Statistical Office, Zomba, Malawi.

Office of the President and Cabinet (OPC), 1997. National Disaster Management Plan for Malawi. OPC, Lilongwe, Malawi.

Southern Africa Development Community (SADC), 2005. SADC Regional Biodiversity Strategy. SADC Secretariat, Gaborone, Botswana.

Southern Africa Development Community(SADC), 2002. Malawi: Emergency Food Security Assessment Report. Malawi National Vulnerability Assessment Committee and SADC FANR, Lilongwe, Malawi.

United Nations Development Programme (UNDP)/Malawi Government (MG), 2001. Malawi National Development Report 2001, UNDP/MG, Lilongwe, Malawi.

United Nations Environmental Programme (UNEP), 2003. Action Plan for the Environment Initiative for the New Partnership for Africa's Development (NEPAD). NEPAD Secretariat, Johannesburg, South Africa.

United Nations Framework Convention on Climate Change (UNFCCC), 2002. Annotated Guidelines for the Preparation of National Adaptation Programme of Action, Least Developed Countries Expert Group, Bonn, Germany.

United Nations International Children's Fund (UNICEF),1993. Situation Analysis of Poverty in Malawi, Lilongwe, Malawi.

ANNEX 1: EVALUATION OF THE CRITERIA FOR EACH ADAPTATION OPTION FOR MALAWI

TABLE 1: FIRST SCORING OF CRITERIA

| OPTIONS UNIT | Tech. Feasibility | Econ. Growth | Synergies | Impact | Cost | Participation | Losses avoided | L/hood. Sustainability | Cross cutting |
|---|-------------------|--------------|-----------|--------|---------------|---------------|----------------|------------------------|---------------|
| | (1-5) | (1-5) | (1-5) | (1-5) | (Million USD) | (1-5) | (1-5) | (1-5) | (1-5) |
| 1 AFFORESTATION PROJECT FOR CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 4.33 | 2.92 | 3.92 | 3.75 | 2.00 | 3.83 | 3.08 | 3.17 | 3.00 |
| 2 APPROPRIATE CROP PRODUCTION TECHNOLOGIES | 4.00 | 4.09 | 3.36 | 3.91 | 0.50 | 3.36 | 3.36 | 3.36 | 3.18 |
| 3 COMMUNITY BASED FOREST FIRES MANAGEMENT | 3.83 | 2.50 | 3.08 | 3.08 | 2.00 | 3.25 | 3.50 | 3.25 | 3.00 |
| 4 COMMUNITY BASED WILDLIFE RANCH AND NYALA BREEDING | 3.83 | 3.00 | 3.17 | 3.25 | 1.00 | 3.25 | 2.83 | 3.33 | 2.83 |
| 5 DEVELOPMENT AND IMPLEMENTATION OF DAMS | 3.55 | 3.27 | 2.91 | 3.73 | 6.00 | 3.00 | 2.73 | 3.18 | 2.73 |
| 6 DEVELOPMENT OF COMMUNITY BASED STORAGE SYSTEMS FOR SEED AND FOOD | 4.25 | 3.33 | 3.25 | 3.83 | 0.40 | 3.83 | 3.58 | 3.92 | 3.17 |
| 7 DEVELOPMENT OF LOW COST FOOD SUPPLEMENTS | 3.67 | 2.83 | 3.33 | 3.50 | 0.15 | 3.17 | 2.83 | 3.00 | 3.00 |
| 8 DEVELOPMENT OF SUSTAINABLE LIVELIHOODS STRATEGIES FOR VULNERABLE COMMUNITIES | 3.92 | 3.67 | 3.50 | 3.75 | 1.00 | 3.83 | 3.58 | 4.08 | 3.25 |
| 9 DISSEMINATION OF BEDNETS TO HIGH MALARIA AREAS | 4.33 | 2.33 | 3.25 | 3.83 | 0.50 | 3.08 | 3.58 | 2.58 | 3.08 |
| 10 DISSEMINATION OF BIOGAS TECHNOLOGY TO RURAL HOUSEHOLDS | 3.42 | 2.92 | 3.33 | 2.75 | 0.30 | 3.08 | 2.42 | 3.00 | 2.83 |
| 11 DISSEMINATION OF LOW COST IMPROVED INSTITUTIONAL COOKSTOVES | 3.75 | 2.67 | 3.08 | 3.08 | 0.10 | 3.17 | 2.75 | 3.08 | 3.00 |
| 12 DROUGHT MITIGATION WORKS | 3.50 | 3.33 | 3.17 | 3.75 | 9.00 | 3.17 | 3.75 | 3.50 | 2.92 |
| 13 ELEPHANT RESEARCH AND MONITORING PROJECT FOR LIWONDE AND KASUNGU | 3.50 | 2.42 | 3.00 | 2.67 | 1.00 | 2.50 | 3.42 | 2.75 | 2.33 |
| 14 ENHANCEMENT OF RELIANCE OF CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 3.92 | 2.83 | 3.08 | 3.17 | 2.50 | 3.33 | 2.75 | 2.50 | 2.50 |
| 15 EXTENSION OF MALAWI RURAL ELECTRIFICATION PROGRAMME | 4.08 | 3.75 | 4.00 | 3.67 | 0.80 | 3.08 | 2.75 | 3.08 | 3.17 |
| 16 FENCE INSTALLATION AROUND LENGWE NATIONAL PARK | 3.58 | 2.50 | 3.25 | 3.08 | 2.50 | 2.92 | 3.17 | 2.58 | 2.25 |
| 17 FLOOD DELINEATIONS AND ZONING | 3.50 | 2.75 | 3.08 | 3.17 | 0.30 | 2.91 | 3.64 | 2.73 | 2.55 |
| 18 FLOODS MITIGATION WORKS | 3.17 | 3.00 | 3.00 | 3.33 | 12.90 | 2.92 | 3.58 | 2.92 | 2.33 |
| 19 IEC/BEHAVIOURAL CHANGE STRATEGY; INCREASED RATE OF MEN CARING FOR THE SICK | 3.45 | 2.45 | 2.64 | 2.91 | 0.20 | 2.64 | 2.64 | 2.45 | 3.18 |
| 20 IMPACT OF DEFORESTATION AND DEGRADATION ON RIVER SYSTEMS AND FOREST ECOSYSTEMS | 3.58 | 2.58 | 3.50 | 3.17 | 3.00 | 2.92 | 3.08 | 2.83 | 2.83 |
| 21 IMPROVE ROAD INFRASTRUCTURE/ CONSTRUCTION OF SCHOOLS WITHIN VILLAGES | 3.73 | 2.82 | 3.18 | 3.27 | 3.00 | 3.18 | 2.55 | 2.55 | 2.73 |
| 22 INTEGRATING CLIMATE INTO FISHERIES | 3.33 | 3.25 | 3.08 | 2.92 | 0.70 | 2.92 | 2.75 | 2.92 | 2.67 |
| 23 LAKESHORE AQUACULTURE | 3.58 | 3.17 | 2.83 | 3.17 | 0.50 | 3.08 | 2.42 | 3.08 | 2.67 |
| 24 PROMOTION OF DIMBA PRODUCTION OF MAIZE AND VEGETABLES | 3.75 | 3.83 | 3.42 | 3.67 | 4.00 | 3.67 | 3.17 | 3.67 | 3.25 |
| 25 PROMOTION OF REARING OF SMALL RUMINANTS TO IMPROVE NUTRITION AMONG RURAL COMMUNITIES | 3.92 | 3.58 | 3.08 | 3.50 | 1.50 | 3.17 | 2.50 | 3.33 | 3.25 |
| 26 RECONSTRUCTION AND RESETTLEMENTS PROGRAMMES | 2.82 | 2.27 | 2.27 | 2.82 | 0.50 | 2.55 | 3.00 | 2.45 | 2.64 |
| 27 SEASONAL DIFFERENCE OF MALARIA IN DIFFERENT AGROECOLOGICAL ZONES | 3.58 | 2.75 | 3.17 | 3.25 | 0.28 | 3.25 | 3.17 | 2.75 | 2.83 |
| 28 SEASONAL VARIATION IN INCIDENCE AND PREVALENCE OF MALNUTRITION | 3.58 | 3.08 | 3.17 | 3.33 | 0.75 | 3.08 | 2.92 | 2.67 | 2.33 |
| 29 STANDBY POWER GENERATION | 3.33 | 3.83 | 3.00 | 3.50 | 2.00 | 3.00 | 3.25 | 3.00 | 2.50 |
| 30 TECHNOLOGIES TO MITIGATE CLIMATE CHANGE | 3.33 | 3.42 | 3.00 | 3.33 | 1.00 | 2.92 | 3.00 | 3.33 | 2.92 |
| 31 WOMEN IN FISHERIES | 3.36 | 3.45 | 3.18 | 2.91 | 0.40 | 3.09 | 2.73 | 3.00 | 3.00 |

TABLE 2: STANDARDISED SCORES AND INITIAL RANKING OF OPTIONS (Multi Criteria Analysis 1)

| OPTIONS | Tech. Feasibility | Econ. Growth | Synergies | Impact | Cost | Participation | Losses avoided | L/hood. Sustainability | Cross cutting |
|--|-------------------|--------------|-------------|-------------|----------|---------------|----------------|------------------------|---------------|
| UNITS | Scale (1-5) | Scale (1-5) | Scale (1-5) | Scale (1-5) | (Ratios) | Scale (1-5) | Scale (1-5) | Scale (1-5) | Scale (1-5) |
| DEVELOPMENT OF SUSTAINABLE LIVELIHOODS STRATEGIES FOR VULNERABLE COMMUNITIES | 0.73 | 0.77 | 0.71 | 0.87 | 0.93 | 1.00 | 0.88 | 1.00 | 1.00 |
| DEVELOPMENT OF COMMUNITY BASED STORAGE SYSTEMS FOR SEED AND FOOD | 0.95 | 0.58 | 0.57 | 0.94 | 0.98 | 1.00 | 0.88 | 0.90 | 0.92 |
| APPROPRIATE CROP PRODUCTION TECHNOLOGIES | 0.78 | 1.00 | 0.63 | 1.00 | 0.97 | 0.65 | 0.71 | 0.56 | 0.93 |
| PROMOTION OF DIMBA PRODUCTION OF MAIZE AND VEGETABLES | 0.62 | 0.86 | 0.66 | 0.80 | 0.70 | 0.88 | 0.56 | 0.74 | 1.00 |
| AFFORESTATION PROJECT FOR CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 1.00 | 0.35 | 0.95 | 0.87 | 0.85 | 1.00 | 0.50 | 0.44 | 0.75 |
| EXTENSION OF MALAWI RURAL ELECTRIFICATION PROGRAMME | 0.84 | 0.81 | 1.00 | 0.80 | 0.95 | 0.44 | 0.25 | 0.39 | 0.92 |
| DISSEMINATION OF BEDNETS TO HIGH MALARIA AREAS | 1.00 | 0.03 | 0.57 | 0.94 | 0.97 | 0.44 | 0.88 | 0.08 | 0.83 |
| PROMOTION OF REARING OF SMALL RUMINANTS TO IMPROVE NUTRITION AMONG RURAL COMMUNITIES | 0.73 | 0.72 | 0.47 | 0.67 | 0.89 | 0.50 | 0.06 | 0.54 | 1.00 |
| DROUGHT MITIGATION WORKS | 0.45 | 0.58 | 0.52 | 0.87 | 0.30 | 0.50 | 1.00 | 0.64 | 0.67 |
| COMMUNITY BASED FOREST FIRES MANAGEMENT | 0.67 | 0.13 | 0.47 | 0.34 | 0.85 | 0.56 | 0.81 | 0.49 | 0.75 |
| DEVELOPMENT OF LOW COST FOOD SUPPLEMENTS | 0.56 | 0.31 | 0.61 | 0.67 | 1.00 | 0.50 | 0.31 | 0.33 | 0.75 |
| COMMUNITY BASED WILDLIFE RANCH AND NYALA BREEDING | 0.67 | 0.40 | 0.52 | 0.47 | 0.93 | 0.56 | 0.31 | 0.54 | 0.58 |
| TECHNOLOGIES TO MITIGATE CLIMATE CHANGE | 0.34 | 0.63 | 0.42 | 0.54 | 0.93 | 0.31 | 0.44 | 0.54 | 0.67 |
| STANDBY POWER GENERATION | 0.34 | 0.86 | 0.42 | 0.67 | 0.85 | 0.38 | 0.63 | 0.33 | 0.25 |
| SEASONAL DIFFERENCE OF MALARIA IN DIFFERENT AGROECOLOGICAL ZONES | 0.51 | 0.26 | 0.52 | 0.47 | 0.99 | 0.56 | 0.56 | 0.18 | 0.58 |
| DISSEMINATION OF LOW COST IMPROVED INSTITUTIONAL COOKSTOVES | 0.62 | 0.22 | 0.47 | 0.34 | 1.00 | 0.50 | 0.25 | 0.39 | 0.75 |
| WOMEN IN FISHERIES | 0.36 | 0.65 | 0.53 | 0.20 | 0.98 | 0.44 | 0.23 | 0.33 | 0.75 |
| DEVELOPMENT AND IMPLEMENTATION OF DAMS | 0.48 | 0.55 | 0.37 | 0.85 | 0.54 | 0.38 | 0.23 | 0.45 | 0.48 |
| FLOOD DELINEATIONS AND ZONING | 0.45 | 0.26 | 0.47 | 0.40 | 0.98 | 0.31 | 0.91 | 0.17 | 0.30 |
| IMPACT OF DEFORESTATION AND DEGRADATION ON RIVER SYSTEMS AND FOREST ECOSYSTEMS | 0.51 | 0.17 | 0.71 | 0.40 | 0.77 | 0.31 | 0.50 | 0.23 | 0.58 |
| SEASONAL VARIATION IN INCIDENCE AND PREVALENCE OF MALNUTRITION | 0.51 | 0.45 | 0.52 | 0.54 | 0.95 | 0.44 | 0.38 | 0.13 | 0.08 |
| LAKESHORE AQUACULTURE | 0.51 | 0.49 | 0.32 | 0.40 | 0.97 | 0.44 | 0.00 | 0.39 | 0.42 |
| ENHANCEMENT OF RELIANCE OF CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.73 | 0.31 | 0.47 | 0.40 | 0.81 | 0.63 | 0.25 | 0.03 | 0.25 |
| IMPROVE ROAD INFRASTRUCTURE/ CONSTRUCTION OF SCHOOLS WITHIN VILLAGES | 0.60 | 0.30 | 0.53 | 0.49 | 0.77 | 0.51 | 0.10 | 0.06 | 0.48 |
| DISSEMINATION OF BIOGAS TECHNOLOGY TO RURAL HOUSEHOLDS | 0.40 | 0.35 | 0.61 | 0.07 | 0.98 | 0.44 | 0.00 | 0.33 | 0.58 |
| INTEGRATING CLIMATE INTO FISHERIES | 0.34 | 0.54 | 0.47 | 0.20 | 0.95 | 0.31 | 0.25 | 0.28 | 0.42 |
| FENCE INSTALLATION AROUND LENGWE NATIONAL PARK | 0.51 | 0.13 | 0.57 | 0.34 | 0.81 | 0.31 | 0.56 | 0.08 | 0.00 |
| FLOODS MITIGATION WORKS | 0.23 | 0.40 | 0.42 | 0.54 | 0.00 | 0.31 | 0.88 | 0.28 | 0.08 |
| IEC/BEHAVIOURAL CHANGE STRATEGY: INCREASED RATE OF MEN CARING FOR THE SICK | 0.42 | 0.10 | 0.21 | 0.20 | 0.99 | 0.10 | 0.16 | 0.00 | 0.93 |
| ELEPHANT RESEARCH AND MONITORING PROJECT FOR LIWONDE AND KASUNGU | 0.45 | 0.08 | 0.42 | 0.00 | 0.93 | 0.00 | 0.75 | 0.18 | 0.08 |
| RECONSTRUCTION AND RESETTLEMENTS PROGRAMMES | 0.00 | 0.00 | 0.00 | 0.12 | 0.97 | 0.03 | 0.44 | 0.00 | 0.39 |

NOTE: Equal weighting of 1 was used at this stage.

TABLE 3: WEIGHTED STANDARDISED SCORES AND SECOND RANKING FOR THE REMAINING OPTIONS (MCA 2)

| Options | Tech. Feasibility | Econ. Growth | Synergies | Impact | Cost | Participation | Losses avoided | L/hood. Sustainability | Cross cutting |
|--|-------------------|--------------|-----------|--------|----------|---------------|----------------|------------------------|---------------|
| UNITS | (1-5) | (1-5) | (1-5) | (1-5) | (Ratios) | (1-5) | (1-5) | (1-5) | (1-5) |
| DEVELOPMENT OF SUSTAINABLE LIVELIHOODS STRATEGIES FOR VULNERABLE COMMUNITIES | 0.11 | 0.12 | 0.07 | 0.17 | 0.05 | 0.10 | 0.04 | 0.15 | 0.05 |
| DEVELOPMENT OF COMMUNITY BASED STORAGE SYSTEMS FOR SEED AND FOOD | 0.14 | 0.09 | 0.06 | 0.19 | 0.05 | 0.10 | 0.04 | 0.13 | 0.05 |
| APPROPRIATE CROP PRODUCTION TECHNOLOGIES | 0.12 | 0.15 | 0.06 | 0.20 | 0.05 | 0.06 | 0.04 | 0.08 | 0.05 |
| PROMOTION OF DIMBA PRODUCTION OF MAIZE AND VEGETABLES | 0.09 | 0.13 | 0.07 | 0.16 | 0.03 | 0.09 | 0.03 | 0.11 | 0.05 |
| AFFORESTATION PROJECT FOR CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.15 | 0.05 | 0.10 | 0.17 | 0.04 | 0.10 | 0.03 | 0.07 | 0.04 |
| EXTENSION OF MALAWI RURAL ELECTRIFICATION PROGRAMME | 0.13 | 0.12 | 0.10 | 0.16 | 0.05 | 0.04 | 0.01 | 0.06 | 0.05 |
| PROMOTION OF REARING OF SMALL RUMINANTS TO IMPROVE NUTRITION AMONG RURAL COMMUNITIES | 0.11 | 0.11 | 0.05 | 0.13 | 0.04 | 0.05 | 0.00 | 0.08 | 0.05 |
| DROUGHT MITIGATION WORKS | 0.07 | 0.09 | 0.05 | 0.17 | 0.02 | 0.05 | 0.05 | 0.10 | 0.03 |
| DISSEMINATION OF BEDNETS TO HIGH MALARIA AREAS | 0.15 | 0.01 | 0.06 | 0.19 | 0.05 | 0.04 | 0.04 | 0.01 | 0.04 |
| COMMUNITY BASED WILDLIFE RANCH AND NYALA BREEDING | 0.10 | 0.06 | 0.05 | 0.09 | 0.05 | 0.06 | 0.02 | 0.08 | 0.03 |
| STANDBY POWER GENERATION | 0.05 | 0.13 | 0.04 | 0.13 | 0.04 | 0.04 | 0.03 | 0.05 | 0.01 |
| DEVELOPMENT AND IMPLEMENTATION OF DAMS | 0.07 | 0.08 | 0.04 | 0.17 | 0.03 | 0.04 | 0.01 | 0.07 | 0.02 |
| DEVELOPMENT OF LOW COST FOOD SUPPLEMENTS | 0.08 | 0.05 | 0.06 | 0.13 | 0.05 | 0.05 | 0.02 | 0.05 | 0.04 |
| TECHNOLOGIES TO MITIGATE CLIMATE CHANGE | 0.05 | 0.09 | 0.04 | 0.11 | 0.05 | 0.03 | 0.02 | 0.08 | 0.03 |
| COMMUNITY BASED FOREST FIRES MANAGEMENT | 0.10 | 0.02 | 0.05 | 0.07 | 0.04 | 0.06 | 0.04 | 0.07 | 0.04 |
| SEASONAL DIFFERENCE OF MALARIA IN DIFFERENT AGROECOLOGICAL ZONES | 0.08 | 0.04 | 0.05 | 0.09 | 0.05 | 0.06 | 0.03 | 0.03 | 0.03 |
| DISSEMINATION OF LOW COST IMPROVED INSTITUTIONAL COOKSTOVES | 0.09 | 0.03 | 0.05 | 0.07 | 0.05 | 0.05 | 0.01 | 0.06 | 0.04 |
| WOMEN IN FISHERIES | 0.05 | 0.10 | 0.05 | 0.04 | 0.05 | 0.04 | 0.01 | 0.05 | 0.04 |
| SEASONAL VARIATION IN INCIDENCE AND PREVALENCE OF MALNUTRITION | 0.08 | 0.07 | 0.05 | 0.11 | 0.05 | 0.04 | 0.02 | 0.02 | 0.00 |
| LAKESHORE AQUACULTURE | 0.08 | 0.07 | 0.03 | 0.08 | 0.05 | 0.04 | 0.00 | 0.06 | 0.02 |
| ENHANCEMENT OF RELIANCE OF CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.11 | 0.05 | 0.05 | 0.08 | 0.04 | 0.06 | 0.01 | 0.00 | 0.01 |
| IMPROVE ROAD INFRASTRUCTURE/ CONSTRUCTION OF SCHOOLS WITHIN VILLAGES | 0.09 | 0.05 | 0.05 | 0.10 | 0.04 | 0.05 | 0.00 | 0.01 | 0.02 |
| IMPACT OF DEFORESTATION AND DEGRADATION ON RIVER SYSTEMS AND FOREST ECOSYSTEMS | 0.08 | 0.03 | 0.07 | 0.08 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 |
| FLOOD DELINEATIONS AND ZONING | 0.07 | 0.04 | 0.05 | 0.08 | 0.05 | 0.03 | 0.05 | 0.03 | 0.01 |
| INTEGRATING CLIMATE INTO FISHERIES | 0.05 | 0.08 | 0.05 | 0.04 | 0.05 | 0.03 | 0.01 | 0.04 | 0.02 |
| FLOODS MITIGATION WORKS | 0.03 | 0.06 | 0.04 | 0.11 | 0.00 | 0.03 | 0.04 | 0.04 | 0.00 |
| DISSEMINATION OF BIOGAS TECHNOLOGY TO RURAL HOUSEHOLDS | 0.06 | 0.05 | 0.06 | 0.01 | 0.05 | 0.04 | 0.00 | 0.05 | 0.03 |
| FENCE INSTALLATION AROUND LENGWE NATIONAL PARK | 0.08 | 0.02 | 0.06 | 0.07 | 0.04 | 0.03 | 0.03 | 0.01 | 0.00 |
| IEC/BEHAVIOURAL CHANGE STRATEGY: INCREASED RATE OF MEN CARING FOR THE SICK | 0.06 | 0.02 | 0.02 | 0.04 | 0.05 | 0.01 | 0.01 | 0.00 | 0.05 |
| ELEPHANT RESEARCH AND MONITORING PROJECT FOR LIWONDE AND KASUNGU | 0.07 | 0.01 | 0.04 | 0.00 | 0.05 | 0.00 | 0.04 | 0.03 | 0.00 |
| RECONSTRUCTION AND RESETTLEMENTS PROGRAMMES | 0.00 | 0.00 | 0.00 | 0.02 | 0.05 | 0.00 | 0.02 | 0.00 | 0.02 |

TABLE 4: WEIGHTED STANDARDISED SCORES AND SECOND RANKING FOR THE REMAINING OPTIONS (MCA 3)

| OPTIONS | Tech. Feasib | Econ. Growth | Synergies | Impact | Cost | Participation | Losses avoided | L/hood. Sustainabil | Cross cutting |
|---|--------------|--------------|-----------|--------|----------|---------------|----------------|---------------------|---------------|
| UNITS | (1-5) | (1-5) | (1-5) | (1-5) | (Ratios) | (1-5) | (1-5) | (1-5) | (1-5) |
| DEVELOPMENT OF SUSTAINABLE LIVELIHOODS STRATEGIES FOR VULNERABLE COMMUNITIES | 0.10 | 0.11 | 0.06 | 0.17 | 0.05 | 0.10 | 0.04 | 0.15 | 0.05 |
| DEVELOPMENT OF COMMUNITY BASED STORAGE SYSTEMS FOR SEED AND FOOD | 0.14 | 0.09 | 0.04 | 0.19 | 0.05 | 0.10 | 0.04 | 0.13 | 0.05 |
| APPROPRIATE CROP PRODUCTION TECHNOLOGIES | 0.11 | 0.15 | 0.05 | 0.20 | 0.05 | 0.05 | 0.04 | 0.08 | 0.05 |
| AFFORESTATION PROJECT FOR CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.15 | 0.05 | 0.09 | 0.17 | 0.04 | 0.10 | 0.03 | 0.06 | 0.04 |
| PROMOTION OF DIMBA PRODUCTION OF MAIZE AND VEGETABLES | 0.08 | 0.13 | 0.05 | 0.16 | 0.03 | 0.08 | 0.03 | 0.11 | 0.05 |
| EXTENSION OF MALAWI RURAL ELECTRIFICATION PROGRAMME | 0.12 | 0.12 | 0.10 | 0.16 | 0.05 | 0.02 | 0.01 | 0.06 | 0.05 |
| PROMOTION OF REARING OF SMALL RUMINANTS TO IMPROVE NUTRITION AMONG RURAL COMMUNIT | 0.10 | 0.11 | 0.02 | 0.13 | 0.04 | 0.03 | 0.00 | 0.08 | 0.05 |
| DROUGHT MITIGATION WORKS | 0.04 | 0.09 | 0.03 | 0.17 | 0.02 | 0.03 | 0.05 | 0.09 | 0.03 |
| DISSEMINATION OF BEDNETS TO HIGH MALARIA AREAS | 0.15 | 0.00 | 0.04 | 0.19 | 0.05 | 0.02 | 0.04 | 0.01 | 0.04 |
| COMMUNITY BASED WILDLIFE RANCH AND NYALA BREEDING | 0.09 | 0.06 | 0.03 | 0.09 | 0.05 | 0.04 | 0.02 | 0.08 | 0.03 |
| DEVELOPMENT OF LOW COST FOOD SUPPLEMENTS | 0.06 | 0.04 | 0.04 | 0.13 | 0.05 | 0.03 | 0.02 | 0.05 | 0.04 |
| DEVELOPMENT AND IMPLEMENTATION OF DAMS | 0.05 | 0.08 | 0.01 | 0.17 | 0.03 | 0.01 | 0.01 | 0.06 | 0.02 |
| STANDBY POWER GENERATION | 0.02 | 0.13 | 0.01 | 0.13 | 0.04 | 0.01 | 0.03 | 0.05 | 0.01 |
| TECHNOLOGIES TO MITIGATE CLIMATE CHANGE | 0.02 | 0.09 | 0.01 | 0.10 | 0.05 | 0.00 | 0.02 | 0.08 | 0.03 |
| COMMUNITY BASED FOREST FIRES MANAGEMENT | 0.09 | 0.01 | 0.02 | 0.06 | 0.04 | 0.04 | 0.04 | 0.07 | 0.04 |
| SEASONAL DIFFERENCE OF MALARIA IN DIFFERENT AGROECOLOGICAL ZONES | 0.05 | 0.04 | 0.03 | 0.09 | 0.05 | 0.04 | 0.03 | 0.02 | 0.03 |
| DISSEMINATION OF LOW COST IMPROVED INSTITUTIONAL COOKSTOVES | 0.08 | 0.03 | 0.02 | 0.06 | 0.05 | 0.03 | 0.01 | 0.06 | 0.04 |
| SEASONAL VARIATION IN INCIDENCE AND PREVALENCE OF MALNUTRITION | 0.05 | 0.06 | 0.03 | 0.10 | 0.05 | 0.02 | 0.02 | 0.02 | 0.00 |
| ENHANCEMENT OF RELIANCE OF CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.10 | 0.04 | 0.02 | 0.07 | 0.04 | 0.05 | 0.01 | 0.00 | 0.01 |
| WOMEN IN FISHERIES | 0.03 | 0.10 | 0.03 | 0.03 | 0.05 | 0.02 | 0.01 | 0.05 | 0.04 |
| LAKESHORE AQUACULTURE | 0.05 | 0.07 | 0.00 | 0.07 | 0.05 | 0.02 | 0.00 | 0.06 | 0.02 |
| IMPROVE ROAD INFRASTRUCTURE/ CONSTRUCTION OF SCHOOLS WITHIN VILLAGES | 0.07 | 0.04 | 0.03 | 0.09 | 0.04 | 0.03 | 0.00 | 0.00 | 0.02 |
| IMPACT OF DEFORESTATION AND DEGRADATION ON RIVER SYSTEMS AND FOREST ECOSYSTEMS | 0.05 | 0.02 | 0.06 | 0.07 | 0.04 | 0.00 | 0.03 | 0.03 | 0.03 |
| FLOOD DELINEATIONS AND ZONING | 0.04 | 0.04 | 0.02 | 0.07 | 0.05 | 0.00 | 0.05 | 0.02 | 0.01 |
| INTEGRATING CLIMATE INTO FISHERIES | 0.02 | 0.08 | 0.02 | 0.03 | 0.05 | 0.00 | 0.01 | 0.04 | 0.02 |
| DISSEMINATION OF BIOGAS TECHNOLOGY TO RURAL HOUSEHOLDS | 0.03 | 0.05 | 0.04 | 0.00 | 0.05 | 0.02 | 0.00 | 0.05 | 0.03 |
| FLOODS MITIGATION WORKS | 0.00 | 0.06 | 0.01 | 0.10 | 0.00 | 0.00 | 0.04 | 0.04 | 0.00 |
| FENCE INSTALLATION AROUND LENGWE NATIONAL PARK | 0.05 | 0.01 | 0.04 | 0.06 | 0.04 | 0.00 | 0.03 | 0.01 | 0.00 |

TABLE 5: WEIGHTED STANDARDISED SCORES AND SECOND RANKING FOR THE REMAINING OPTIONS (MCA 4)

| OPTIONS | Tech. Feasibi | Econ. Growth | Synergies | Impact | Cost | Participation | Losses avoided | L/hood. Sustainabili | Cross cutting |
|---|---------------|--------------|-----------|--------|----------|---------------|----------------|----------------------|---------------|
| UNITS | (1-5) | (1-5) | (1-5) | (1-5) | (Ratios) | (1-5) | (1-5) | (1-5) | (1-5) |
| DEVELOPMENT OF SUSTAINABLE LIVELIHOODS STRATEGIES FOR VULNERABLE COMMUNITIES | 0.09 | 0.11 | 0.06 | 0.17 | 0.04 | 0.10 | 0.04 | 0.15 | 0.05 |
| DEVELOPMENT OF COMMUNITY BASED STORAGE SYSTEMS FOR SEED AND FOOD | 0.14 | 0.09 | 0.04 | 0.18 | 0.05 | 0.10 | 0.04 | 0.13 | 0.05 |
| APPROPRIATE CROP PRODUCTION TECHNOLOGIES | 0.10 | 0.15 | 0.05 | 0.20 | 0.05 | 0.05 | 0.04 | 0.08 | 0.05 |
| AFFORESTATION PROJECT FOR CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.15 | 0.05 | 0.09 | 0.17 | 0.04 | 0.10 | 0.03 | 0.06 | 0.04 |
| PROMOTION OF DIMBA PRODUCTION OF MAIZE AND VEGETABLES | 0.06 | 0.13 | 0.05 | 0.15 | 0.03 | 0.08 | 0.03 | 0.11 | 0.05 |
| EXTENSION OF MALAWI RURAL ELECTRIFICATION PROGRAMME | 0.11 | 0.12 | 0.10 | 0.15 | 0.05 | 0.02 | 0.01 | 0.06 | 0.05 |
| PROMOTION OF REARING OF SMALL RUMINANTS TO IMPROVE NUTRITION AMONG RURAL COMMUNIT | 0.09 | 0.11 | 0.02 | 0.12 | 0.04 | 0.03 | 0.00 | 0.08 | 0.05 |
| DISSEMINATION OF BEDNETS TO HIGH MALARIA AREAS | 0.15 | 0.00 | 0.04 | 0.18 | 0.05 | 0.02 | 0.04 | 0.01 | 0.04 |
| DROUGHT MITIGATION WORKS | 0.03 | 0.09 | 0.03 | 0.17 | 0.00 | 0.03 | 0.05 | 0.09 | 0.03 |
| COMMUNITY BASED WILDLIFE RANCH AND NYALA BREEDING | 0.08 | 0.06 | 0.03 | 0.07 | 0.04 | 0.04 | 0.02 | 0.08 | 0.03 |
| DEVELOPMENT OF LOW COST FOOD SUPPLEMENTS | 0.05 | 0.04 | 0.04 | 0.12 | 0.05 | 0.03 | 0.02 | 0.05 | 0.04 |
| DEVELOPMENT AND IMPLEMENTATION OF DAMS | 0.03 | 0.08 | 0.01 | 0.16 | 0.02 | 0.01 | 0.01 | 0.06 | 0.02 |
| STANDBY POWER GENERATION | 0.00 | 0.13 | 0.01 | 0.12 | 0.04 | 0.01 | 0.03 | 0.05 | 0.01 |
| TECHNOLOGIES TO MITIGATE CLIMATE CHANGE | 0.00 | 0.09 | 0.01 | 0.08 | 0.04 | 0.00 | 0.02 | 0.08 | 0.03 |
| COMMUNITY BASED FOREST FIRES MANAGEMENT | 0.08 | 0.01 | 0.02 | 0.03 | 0.04 | 0.04 | 0.04 | 0.07 | 0.04 |
| SEASONAL DIFFERENCE OF MALARIA IN DIFFERENT AGROECOLOGICAL ZONES | 0.04 | 0.04 | 0.03 | 0.07 | 0.05 | 0.04 | 0.03 | 0.02 | 0.03 |
| DISSEMINATION OF LOW COST IMPROVED INSTITUTIONAL COOKSTOVES | 0.06 | 0.03 | 0.02 | 0.03 | 0.05 | 0.03 | 0.01 | 0.06 | 0.04 |
| SEASONAL VARIATION IN INCIDENCE AND PREVALENCE OF MALNUTRITION | 0.04 | 0.06 | 0.03 | 0.08 | 0.05 | 0.02 | 0.02 | 0.02 | 0.00 |
| ENHANCEMENT OF RELIANCE OF CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.09 | 0.04 | 0.02 | 0.05 | 0.04 | 0.05 | 0.01 | 0.00 | 0.01 |
| LAKESHORE AQUACULTURE | 0.04 | 0.07 | 0.00 | 0.05 | 0.05 | 0.02 | 0.00 | 0.06 | 0.02 |
| IMPROVE ROAD INFRASTRUCTURE/ CONSTRUCTION OF SCHOOLS WITHIN VILLAGES | 0.06 | 0.04 | 0.03 | 0.07 | 0.03 | 0.03 | 0.00 | 0.00 | 0.02 |
| WOMEN IN FISHERIES | 0.00 | 0.10 | 0.03 | 0.00 | 0.05 | 0.02 | 0.01 | 0.05 | 0.04 |
| IMPACT OF DEFORESTATION AND DEGRADATION ON RIVER SYSTEMS AND FOREST ECOSYSTEMS | 0.04 | 0.02 | 0.06 | 0.05 | 0.03 | 0.00 | 0.03 | 0.03 | 0.03 |
| FLOOD DELINEATIONS AND ZONING | 0.03 | 0.04 | 0.02 | 0.05 | 0.05 | 0.00 | 0.05 | 0.02 | 0.01 |

TABLE 6: SENSITIVITY ANALYSIS 1 (MCA5)

| Absolute weights | 15 | 15 | 10 | 20 | 5 | 10 | 5 | 15 | 5 |
|---|--------------|--------------|-----------|--------|----------|---------------|----------------|---------------------|---------------|
| Relative weights | 0.15 | 0.15 | 0.1 | 0.2 | 0.05 | 0.1 | 0.05 | 0.15 | 0.05 |
| OPTIONS | Tech. Feasib | Econ. Growth | Synergies | Impact | Cost | Participation | Losses avoided | L/hood. Sustainabil | Cross cutting |
| UNITS | (1-5) | (1-5) | (1-5) | (1-5) | (Ratios) | (1-5) | (1-5) | (1-5) | (1-5) |
| DEVELOPMENT OF SUSTAINABLE LIVELIHOODS STRATEGIES FOR VULNERABLE COMMUNITIES | 0.09 | 0.11 | 0.05 | 0.16 | 0.05 | 0.10 | 0.04 | 0.15 | 0.05 |
| DEVELOPMENT OF COMMUNITY BASED STORAGE SYSTEMS FOR SEED AND FOOD | 0.14 | 0.09 | 0.03 | 0.18 | 0.05 | 0.10 | 0.04 | 0.13 | 0.04 |
| APPROPRIATE CROP PRODUCTION TECHNOLOGIES | 0.10 | 0.15 | 0.04 | 0.20 | 0.05 | 0.05 | 0.03 | 0.08 | 0.05 |
| AFFORESTATION PROJECT FOR CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.15 | 0.05 | 0.09 | 0.16 | 0.04 | 0.10 | 0.02 | 0.06 | 0.03 |
| PROMOTION OF DIMBA PRODUCTION OF MAIZE AND VEGETABLES | 0.06 | 0.13 | 0.05 | 0.14 | 0.03 | 0.08 | 0.03 | 0.11 | 0.05 |
| EXTENSION OF MALAWI RURAL ELECTRIFICATION PROGRAMME | 0.11 | 0.12 | 0.10 | 0.14 | 0.05 | 0.02 | 0.01 | 0.05 | 0.04 |
| DISSEMINATION OF BEDNETS TO HIGH MALARIA AREAS | 0.15 | 0.00 | 0.03 | 0.18 | 0.05 | 0.02 | 0.04 | 0.00 | 0.04 |
| PROMOTION OF REARING OF SMALL RUMINANTS TO IMPROVE NUTRITION AMONG RURAL COMMUNIT | 0.09 | 0.11 | 0.02 | 0.10 | 0.04 | 0.03 | 0.00 | 0.08 | 0.05 |
| DROUGHT MITIGATION WORKS | 0.03 | 0.09 | 0.02 | 0.16 | 0.00 | 0.03 | 0.05 | 0.09 | 0.03 |
| DEVELOPMENT OF LOW COST FOOD SUPPLEMENTS | 0.05 | 0.04 | 0.04 | 0.10 | 0.05 | 0.03 | 0.01 | 0.04 | 0.03 |
| COMMUNITY BASED WILDLIFE RANCH AND NYALA BREEDING | 0.08 | 0.06 | 0.02 | 0.04 | 0.05 | 0.04 | 0.01 | 0.08 | 0.02 |
| DEVELOPMENT AND IMPLEMENTATION OF DAMS | 0.03 | 0.08 | 0.00 | 0.16 | 0.02 | 0.01 | 0.01 | 0.06 | 0.02 |
| STANDBY POWER GENERATION | 0.00 | 0.13 | 0.01 | 0.10 | 0.04 | 0.01 | 0.03 | 0.04 | 0.00 |
| TECHNOLOGIES TO MITIGATE CLIMATE CHANGE | 0.00 | 0.09 | 0.01 | 0.06 | 0.05 | 0.00 | 0.02 | 0.08 | 0.03 |
| COMMUNITY BASED FOREST FIRES MANAGEMENT | 0.08 | 0.01 | 0.02 | 0.00 | 0.04 | 0.04 | 0.04 | 0.07 | 0.03 |

TABLE 7: SENSITIVITY ANALYSIS 2 (MCA6)

| Absolute weights | 15 | 10 | 5 | 15 | 10 | 10 | 15 | 15 | 5 |
|---|----------------|--------------|-----------|--------|----------|---------------|----------------|-----------------------|---------------|
| Relative weights | 0.15 | 0.1 | 0.05 | 0.15 | 0.1 | 0.1 | 0.15 | 0.15 | 0.05 |
| 0.00 | Tech. Feasibil | Econ. Growth | Synergies | Impact | Cost | Participation | Losses avoided | L/hood. Sustainabilit | Cross cutting |
| 0.00 | (1-5) | (1-5) | (1-5) | (1-5) | (Ratios) | (1-5) | (1-5) | (1-5) | (1-5) |
| DEVELOPMENT OF COMMUNITY BASED STORAGE SYSTEMS FOR SEED AND FOOD | 0.14 | 0.06 | 0.02 | 0.14 | 0.10 | 0.10 | 0.13 | 0.13 | 0.04 |
| DEVELOPMENT OF SUSTAINABLE LIVELIHOODS STRATEGIES FOR VULNERABLE COMMUNITIES | 0.09 | 0.08 | 0.03 | 0.12 | 0.09 | 0.10 | 0.13 | 0.15 | 0.05 |
| APPROPRIATE CROP PRODUCTION TECHNOLOGIES | 0.10 | 0.10 | 0.02 | 0.15 | 0.10 | 0.05 | 0.10 | 0.08 | 0.05 |
| AFFORESTATION PROJECT FOR CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.15 | 0.03 | 0.05 | 0.12 | 0.08 | 0.10 | 0.07 | 0.06 | 0.03 |
| PROMOTION OF DIMBA PRODUCTION OF MAIZE AND VEGETABLES | 0.06 | 0.09 | 0.02 | 0.11 | 0.06 | 0.08 | 0.08 | 0.11 | 0.05 |
| DISSEMINATION OF BEDNETS TO HIGH MALARIA AREAS | 0.15 | 0.00 | 0.02 | 0.14 | 0.10 | 0.02 | 0.13 | 0.00 | 0.04 |
| EXTENSION OF MALAWI RURAL ELECTRIFICATION PROGRAMME | 0.11 | 0.08 | 0.05 | 0.11 | 0.09 | 0.02 | 0.03 | 0.05 | 0.04 |
| DROUGHT MITIGATION WORKS | 0.03 | 0.06 | 0.01 | 0.12 | 0.00 | 0.03 | 0.15 | 0.09 | 0.03 |
| PROMOTION OF REARING OF SMALL RUMINANTS TO IMPROVE NUTRITION AMONG RURAL COMMUNIT | 0.09 | 0.07 | 0.01 | 0.08 | 0.08 | 0.03 | 0.00 | 0.08 | 0.05 |
| COMMUNITY BASED FOREST FIRES MANAGEMENT | 0.08 | 0.01 | 0.01 | 0.00 | 0.08 | 0.04 | 0.12 | 0.07 | 0.03 |
| COMMUNITY BASED WILDLIFE RANCH AND NYALA BREEDING | 0.08 | 0.04 | 0.01 | 0.03 | 0.09 | 0.04 | 0.04 | 0.08 | 0.02 |
| DEVELOPMENT OF LOW COST FOOD SUPPLEMENTS | 0.05 | 0.03 | 0.02 | 0.08 | 0.10 | 0.03 | 0.04 | 0.04 | 0.03 |
| STANDBY POWER GENERATION | 0.00 | 0.09 | 0.00 | 0.08 | 0.08 | 0.01 | 0.09 | 0.04 | 0.00 |
| TECHNOLOGIES TO MITIGATE CLIMATE CHANGE | 0.00 | 0.06 | 0.00 | 0.05 | 0.09 | 0.00 | 0.06 | 0.08 | 0.03 |
| DEVELOPMENT AND IMPLEMENTATION OF DAMS | 0.03 | 0.05 | 0.00 | 0.12 | 0.03 | 0.01 | 0.03 | 0.06 | 0.02 |

TABLE 7: SENSITIVITY ANALYSIS 2 (MCA6)

| Absolute weights | 15 | 10 | 5 | 15 | 10 | 10 | 15 | 15 | 5 |
|---|---------------|--------------|-----------|--------|----------|---------------|----------------|----------------------|---------------|
| Relative weights | 0.15 | 0.1 | 0.05 | 0.15 | 0.1 | 0.1 | 0.15 | 0.15 | 0.05 |
| 0.00 | Tech. Feasibi | Econ. Growth | Synergies | Impact | Cost | Participation | Losses avoided | L/hood. Sustainabili | Cross cutting |
| 0.00 | (1-5) | (1-5) | (1-5) | (1-5) | (Ratios) | (1-5) | (1-5) | (1-5) | (1-5) |
| DEVELOPMENT OF COMMUNITY BASED STORAGE SYSTEMS FOR SEED AND FOOD | 0.14 | 0.06 | 0.02 | 0.14 | 0.10 | 0.10 | 0.13 | 0.13 | 0.04 |
| DEVELOPMENT OF SUSTAINABLE LIVELIHOODS STRATEGIES FOR VULNERABLE COMMUNITIES | 0.09 | 0.08 | 0.03 | 0.12 | 0.09 | 0.10 | 0.13 | 0.15 | 0.05 |
| APPROPRIATE CROP PRODUCTION TECHNOLOGIES | 0.10 | 0.10 | 0.02 | 0.15 | 0.10 | 0.05 | 0.10 | 0.08 | 0.05 |
| AFFORESTATION PROJECT FOR CHONGONI PLANTATION AND NEIGHBOURING VILLAGES | 0.15 | 0.03 | 0.05 | 0.12 | 0.08 | 0.10 | 0.07 | 0.06 | 0.03 |
| PROMOTION OF DIMBA PRODUCTION OF MAIZE AND VEGETABLES | 0.06 | 0.09 | 0.02 | 0.11 | 0.06 | 0.08 | 0.08 | 0.11 | 0.05 |
| DISSEMINATION OF BEDNETS TO HIGH MALARIA AREAS | 0.15 | 0.00 | 0.02 | 0.14 | 0.10 | 0.02 | 0.13 | 0.00 | 0.04 |
| EXTENSION OF MALAWI RURAL ELECTRIFICATION PROGRAMME | 0.11 | 0.08 | 0.05 | 0.11 | 0.09 | 0.02 | 0.03 | 0.05 | 0.04 |
| DROUGHT MITIGATION WORKS | 0.03 | 0.06 | 0.01 | 0.12 | 0.00 | 0.03 | 0.15 | 0.09 | 0.03 |
| PROMOTION OF REARING OF SMALL RUMINANTS TO IMPROVE NUTRITION AMONG RURAL COMMUNIT | 0.09 | 0.07 | 0.01 | 0.08 | 0.08 | 0.03 | 0.00 | 0.08 | 0.05 |
| COMMUNITY BASED FOREST FIRES MANAGEMENT | 0.08 | 0.01 | 0.01 | 0.00 | 0.08 | 0.04 | 0.12 | 0.07 | 0.03 |
| COMMUNITY BASED WILDLIFE RANCH AND NYALA BREEDING | 0.08 | 0.04 | 0.01 | 0.03 | 0.09 | 0.04 | 0.04 | 0.08 | 0.02 |
| DEVELOPMENT OF LOW COST FOOD SUPPLEMENTS | 0.05 | 0.03 | 0.02 | 0.08 | 0.10 | 0.03 | 0.04 | 0.04 | 0.03 |
| STANDBY POWER GENERATION | 0.00 | 0.09 | 0.00 | 0.08 | 0.08 | 0.01 | 0.09 | 0.04 | 0.00 |
| TECHNOLOGIES TO MITIGATE CLIMATE CHANGE | 0.00 | 0.06 | 0.00 | 0.05 | 0.09 | 0.00 | 0.06 | 0.08 | 0.03 |
| DEVELOPMENT AND IMPLEMENTATION OF DAMS | 0.03 | 0.05 | 0.00 | 0.12 | 0.03 | 0.01 | 0.03 | 0.06 | 0.02 |