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Facility

MINISTRY OF TOURISM, ENVIRONMENT AND NATURAL RESOURCES



FORMULATION OF THE NATIONAL ADAPTATION PROGRAMME OF ACTION ON CLIMATE CHANGE

(Final Report)

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THE NAPA COORDINATION TEAM

Project Management Unit:

Dr. Cassim Masi NAPA Project Coordinator (July 2005 – December 2006)
Mr. Charles Rwandekeye NAPA Project Coordinator (January – April 2007)
Dr. Nicholas J Kwendakwema NAPA Project Coordinator (May – July 2007)

NAPA Technical Team and Contributors:

Prof. F. D. Yamba Energy Expert, CEEEZ, Lusaka, Zambia
Mr. Hartley Walimwipi Water Balance Model/Baseline Climate Expert, CEEEZ
Mr. G. Phiri Global Circulation Model/RCM Expert, CEEEZ
Mr. G. Chipeta Climatologist, University of Zambia
Dr. K. Muyinda, Agronomist, University of Zambia, Lusaka, Zambia.
Dr. K. Yambayamba, Livestock Expert, Livestock Development Trust, Lusaka, Zambia.
Mr. H. Mudenda, Fisheries Expert, University of Zambia
Dr. G. Kasali, Health, Copperbelt University, Ndola, Zambia.
Dr. M. Silengo, Natural Resources and Wildlife Expert, Associate, RuralNet, Lusaka, Zambia
Ms. T. T. Kambikambi, Agronomist, University of Zambia
Mr. E. Matsika, Climate Change Expert
Dr. C. Masi NAPA Project Coordinator, MTENR
Mr. Charles Rwandekeye NAPA Project Coordinator (January – April 2007)
Dr. Nicholas J Kwendakwema NAPA Project Coordinator (May – July 2007)

NAPA Document Preparation Team:

Dr. Cassim Masi, MTENR
Prof. Francis D. Yamba, CEEEZ, Lusaka
Mr. Hartley Walimpi CEEEZ, Lusaka
Mr. Emmanuel Matsika, CEEEZ, Lusaka
Mr. Charles Rwandekeye NAPA Project Coordinator (January – April 2007)
Dr. Nicholas J Kwendakwema NAPA Project Coordinator (May – July 2007)

NAPA Internal Departmental Document Reviewers:

Mr. M. E. Shitima Acting Principal Environmental Management Officer
Mr. G. F. Gondwe Acting Chief Environmental Management Officer
Mr. I. N. Makumba Principal Natural Resources Management Officer

NAPA Focal Points:

Dr. K. Nkowani Director, ENRMD/Climate Change Focal Point
Ms. Annalisa Lodato GEF Analyst, UNDP, Lusaka, Zambia

NAPA Working Group:

Mr. Lovemore Simwanda	ECAZ/ZNFU
Ms. Mutete Khonde	EECZ
Ms. Celine G.Z. Macfoy	ZAW
Ms. Bernadette Mwakacheya	MMMD
Dr. Kenneth Nkowani	MTENR
Dr. Muyoba Macwani	NCL
Mr. Mellon H. Chinjila	ZESCO
Mr. Christopher kaniki	ZESCO
Mr. Patrick Shawa	WECSZ
Dr. Cassim Masi	NAPA Secretariat
Mr. Francis S. Malala	TPAZ
Mr. Hartley Walimpi	CEEEZ
Ms. Monde M. Gwaba	GIDD-Cabinet Office
Dr. Richard Mugara	ZMD
Mr. Mindenda K. Pande	MTENR – Forestry Department
Mr. M. Seshikanu	MACO
Ms. Yande Mwape	DMMU
Mr. Gershom Chilukusha	ZAWA

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FOREWORD

The Zambian economy is predominantly based on the exploitation of the country's natural resources. The adverse effects of climate conditions to which the country is exposed overtly affect these resources. Climate-induced changes to physical and biological systems are already being felt and exerting considerable stress on the country vulnerable sectors. Already, the country's sensitive sectors - agriculture and food security, wildlife, forestry, water and energy, and human health have been adversely affected by climate change, thereby significantly affecting the economic, social, and environmental dimensions of our national sustainable development.

The primary concern of the Government is to protect its people, infrastructure, and other national assets against disasters and climatic hazards such as droughts and floods. It is in this regard that Government has put in place the National Disaster Management Policy and the Disaster Management and Mitigation Unit under the Office of the Vice President in order to respond to the disasters at the national level. Government is also committed in ensuring that the vulnerable communities who suffer the most are supported with safety-net initiatives which would enhance their adaptive capacity in reducing their vulnerabilities.

As a party to the Least Developed Countries (LDCs), Zambia recognizes that it has limited resources to effectively respond to the threats posed by climate change. It has therefore taken appropriate steps by responding to the United Nations Framework Convention on Climate Change (UNFCCC) initiatives, to which it's a party, and devised strategies against climate change through this National Adaptation Programme of Action (NAPA) and other programmes.

There is significant recognition country wide of the importance of a national plan such as the NAPA that will steer the country forward in adapting and ameliorating problems related to climate change. This noble cause has received considerable attention in the Fifth National Development Plan (FNDP) in which the Government has pledged to complement and support the NAPA. The NAPA will complement the efforts of the government through the following: (1) contributing to the security of the vulnerable Zambians; (2) ensuring that the livelihoods of the most vulnerable households are secured against the adverse effects of climate change and their basic needs assured; (3), vulnerable groups are protected from the worst impacts of risks and shocks as a result of climate change; and (4) creating public awareness of the adverse effects of climate change. It is hoped that the formulation of NAPA will not be seen as an academic exercise but a serious step towards addressing the urgent and immediate needs of our country against the backdrop of climate change. On behalf of Government I would like to appeal to the international community, our cooperating partners, and other stakeholders to support the NAPA through the implementation of intervention projects identified in the document so that adaptation to climate change is enhanced.

Zambia therefore takes pride in submitting this action plan to UNFCCC Secretariat and remains indebted to the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) for their support in finalizing this NAPA document.

Hon. Michael L. Kaingu, MP.
MINISTER OF TOURISM, ENVIRONMENT AND NATURAL RESOURCES

ACRONYMS AND ABBREVIATIONS

AIACC	Assessment of Impacts and Adaptation to Climate Change
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CEEEZ	Centre for Energy, Environment and Engineering Zambia
COP	Conference of Parties
DACO	District Agricultural Coordinator
EIA	Environmental Impact Assessment
FNDP	Fifth National Development Plan
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographic Information System
HDI	Human Development Index
HIPC	Highly Indented Poor Countries
HIV	Human Immune Deficiency Virus
HSI	Habitat Suitability Index
HWC	Human Wildlife Conflict
ITK	Indigenous Technical Knowledge
ITN	Insect Treated Nets
LDCs	Least Developed Countries
LEG	Least Developed Countries Expert Group
MACO	Ministry of Agriculture and Cooperatives
MCA	Multi-Criteria Analysis
MEAs	Multilateral Environmental Agreements
MEWD	Ministry of Energy and Water Development
NAPA	National Adaptation Programme of Action
NCSA	National Capacity Self Assessment
NEAP	National Environment Action Plan
NGO	Non-Governmental Organization
NPE	National Policy on Environment
PMU	Project Management Unit
PRA	Participatory Rural Appraisal
PRSP	Poverty Reduction Strategy Paper
SADC	Southern African Development Community
SAP	Structural Adjustment Programme
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
ZMD	Zambia Meteorological Department

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EXECUTIVE SUMMARY

Zambia has experienced a number of climatic hazards over several decades. The most serious have been drought, seasonal floods and flush floods, extreme temperatures and dry spells. 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.

Zambia has developed its NAPA by evaluating the impacts of climate change on the relevant sectors and using Multi-Criteria Analysis (MCA), has ranked the identified most urgent needs to prioritize ten immediate adaptation interventions. The sectors that were analyzed are agriculture and food security (livestock, fisheries and crops), energy and water, human health, natural resources and wildlife.

FRAMEWORK FOR ADAPTATION PROGRAMME

This section of the report considers assessment of climate change/variability, vulnerability assessments based on previous studies, correlations and community participatory consultations, and rationale for developing the NAPA

Assessment of climate change/variability for Zambia's three ecological regions, in particular, precipitation for both baseline (1970-2000) and projected (2010-2070) scenarios covering agriculture and food security, human health and natural resources and wildlife was conducted.

Baseline data shows that Region I has the lowest rainfall, over 30 years followed by Regions II and III, respectively. Projected data shows that Regions I and II will experience lower average rainfall figures contrary to Region III which is expected to have an increase in average rainfall. During both periods, below and above normal years were noted and recorded.

The analysis of the results of vulnerability assessments in specific sectors are summarized briefly below:

Agriculture and Food Security

Region I is extremely vulnerable followed by Region II in terms of arable cropping. Hence planning for climate change in these two regions is definitely a necessity.

Results from crop production, suggest that key varieties, particularly maize, would not mature due to shortening of the growing season in agro-ecological Regions¹ I and II, respectively, undermining food security in the two regions.

For livestock, as temperatures rose, the cattle population reduced, and as they fell, the population increased. This scenario was related to the amount of rainfall; extreme temperatures are associated with droughts (less rainfall) and vice versa. Thus, as the amount of rainfall increased, the number of animals also increased. This situation may be explained in relation to increased plant growth and the subsequent increased availability of pastures leading to good nutrition, enhanced immunity and productive capacity. The AIACC study of

2002 showed that the communities in Southern Province depend mostly on cattle as a source of livelihood and nutrition and also for draught power. This implies that the households that depend on cattle for livelihood are most vulnerable once the area experiences climatic hazards.

The USCSP study on fisheries on the effect of variations in climatic indicators on fresh water fishery and fish farming revealed that lower rainfall would reduce nutrient levels in rivers and lakes and impacting negatively on fish breeding activity and as well as depletion of fish species in the long-term. The most vulnerable fish species being the breams and sardines in the drought-prone agro-ecological region I and II.

The AIACC study recorded community knowledge about floods, vulnerability stresses (which in turn affected the socio-economic status of the people of Gwembe district during the 2002/03 rainy season), and their coping strategies. Most of the respondents had witnessed floods more than 2 times in their lives, with such floods occurring between January and March. Most respondents remember the worst flood years as 1973/74 (889 mm), 1984/85 (895 mm), and 2002/03 (932 mm).

The following is the recorded effect of floods as submitted by respondents from their experiences in the area: destroys crops, infrastructure and brings hunger; makes communication rather difficult especially by road; causes siltation and sedimentation of rivers and streams; causes soil erosion and leaves gullies across roads and agriculture fields; reduces cultivatable land; brings epidemics such as malaria; destroys livestock; causes displacement of people and destroys grasses, reeds and some plants.

The five most prominent mitigation and adaptation measures against flood impacts that the farmers would like to take on their holdings in case of future floods are avoid cultivating, cutting of trees and building houses along river banks; practice sustainable agriculture on the upper land and grow and store sufficient food stocks.

Natural Resources (wildlife and forestry)

Wildlife impacts under the same USCSP study were assessed by the climatic correlation and Habitat Suitability Index (HSI) methodology. From the empirical study, it was observed that a decrease in rainfall would be very harsh on wildlife and would affect its diversity and abundance.

As regards wildlife, under drought conditions, reduced soil moisture would give rise to poor quality fodder, stress and uncontrolled migration. Under excessive rainfall, wetland animals like the Lechwe and Puku would be adversely affected. Adaptation measures call for sinking of boreholes and culling animals in order to reduce competition for food.

The main 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. To be impacted greatly would be low-income families dependent on biomass fuel for their lighting and cooking.

The distribution of vegetation types is related to the amount of rainfall, moisture content and temperature prevailing at a given area. Based on this study, climatic changes (drought and high temperatures) seem to be jeopardizing regeneration of Miombo forest, which normally regenerates easily and fast. The suggested intervention is to reduce the pace of deforestation (land clearing for agriculture and charcoal production) to allow adjustments to the lower

precipitation. Viable alternatives should be given to those that live off forest resources: conservation farming and sustainable fuel among other options.

Human Health

Human health is particularly sensitive to climate and synoptic weather patterns because many maladies in the tropics are associated with temperature and precipitation regimes. Malaria was chosen for further study because it is the leading killer disease in the country, responsible for 4.0 millions cases and 50,000 deaths annually.

The vulnerability assessment showed that the entire Zambia is vulnerable to a multitude of other climate-sensitive diseases such as dysentery, cholera, respiratory infections and malnutrition. These diseases are more pronounced in the provinces that are most vulnerable to climate change/variability in agro-ecological regions I and II. The target provinces are, therefore, Central, Southern, Eastern, Lusaka and Western.

The US Country Study Programme showed that there are low disease transmission rates during the cold season implying that temperature is a major limiting abiotic factor. Years of high rainfall also showed high malaria incidence thereby implying that rainfall is another regulating abiotic factor.

Energy and Water

Despite Zambia having abundant surface water resources, communities living in arid parts of the country's agro-ecological Region I experience severe water shortages during summer. Moreover, population increases in urban centres have also put pressure on groundwater through mismanagement of this scarce resource. The water balances between demands and resources for the drought year with a ten-year return period showed that Southern province is extremely vulnerable and does in fact experience critical shortages during drought conditions.

The hydro-electric power generation has been negatively affected by the droughts and floods. Drought has had devastating effect on the hydropower generation in Zambia with significant economic reduction in the power potential.

A study into the baseline period (1970-2000) established the influence of rainfall fluctuations on run-off, reservoir storage capacity and hydropower potential on the Zambezi River basin. The analysis shows that climate change/variability, indeed has effects on hydropower generation. Significant wet and dry episodes were identified in the sub basins for the baseline period of 30 years. And the response of run-off, reservoir storage capacity and hydroelectric power potential to extreme wet and dry years was ascertained. In the 1991/92 rainy season, a devastating drought crippled many sectors of the economies in the riparian states of the Zambezi basin. Amongst the sectors worst affected were agriculture and hydroelectricity power generation.

Community Participatory Consultation

Vulnerability assessments with respect to community responses on effects of climate change/variability on livelihoods / health, and socio-economic situation were undertaken in Eastern and Southern Provinces using a wide range of participatory methods. Farmers in both Eastern and Southern provinces recognized that there was a general shortening of the growing season. Further, it was observed that the frequency of droughts had increased, consequently resulting in reduced amount of rainfall and reduced crop production.

Coping strategies by farmers in both provinces, involved growing crops which were diverse and from different categories to include groundnuts, sunflower, cowpeas, maize, sweet potatoes and cassava.

Two field surveys were taken to South Luangwa National Park and Chongwe and given below are the responses obtained. Discussions identified two sources of risks associated with land management and invariably to wildlife management, namely: poverty and hunger – especially reflected in food insecurity of communities living in and around the Game Management Areas (GMAs) and lack of wage income – or alternative sources of livelihoods to subsistence farming.

The field study showed that Mazabuka district underwent drought conditions during the 2004/05 agricultural season and over 82,000 persons were at risk of starvation and protein-energy malnutrition within the area. There were also increased cases of dysentery and respiratory infections (non-pneumonia). In the 2005/06 rainy season, the heavy rains caused cholera outbreaks and increased cases of malaria in various parts of Mazabuka district. Mazabuka thus provided opportunities to understand the impacts of both floods and droughts on the health of people. People in the district associated droughts with malnutrition, coughs, diarrhoea, eye problems, food poisoning, dysentery and water-borne diseases, while floods were associated with malaria, cholera and bilharzia. Some of the respondents claimed that some old people in the area are able to predict the occurrence of droughts by observing the direction of winds in the season proceeding the rainy season. This indigenous knowledge could be further studied and integrated into a climate-based early warning system for disease outbreaks.

Groups

In general, all groups of people (men, women, and children) in both Lusitu and Monze are affected by the situation to a large extent. For example, lack of drought animals and farming implements means that smaller areas of land will be cultivated since the families must resort to simple hand hoes. Expensive inputs mean low production levels and less income for the families. These hardships have a drastic effect particularly on women who, in the Tonga culture, must grow their own food, women headed households, subsistence farmers who are dependant on rain-fed agriculture. In the case of Mazabuka, when diseases strike, under-five children, women, old people, fishermen, farmers, orphans and people living with HIV/AIDS (PLWHA) are the most affected. The localities that are most affected by disease outbreaks include Kafue flats (flood plains), fish camps, shanty compounds and villages.

Rationale for developing the NAPA

The primary goal of the NAPA process is to broadly communicate to the international community priority activities that address Zambia's urgent and immediate needs for adapting to the adverse impacts of climate change.

ACKNOWLEDGEMENT

The formulation of the National Adaptation Programmes of Action (NAPA) for Zambia is as a result of the consultation and participation of key stakeholders drawn from different sectors – senior government officers in key ministries and departments, representative of NGOs, civil societies, academicians, the private sector, and vulnerable rural communities in targeted vulnerable areas of Eastern and Southern provinces. This process ensured transparency, consensus building, and integration of strategies and plans in the document. A team of consultants drawn from the Center of Environment Engineering and Energy Zambia (CEEEZ), Ruralnet, and the Universities of Zambia and the Copperbelt with specialization in agriculture and food security, water and energy, human health, forestry and wildlife, and climate assembled and produced consolidated background synthesis sectoral reports on the adverse effects of climate change which helped shape the outcome of the NAPA. The synthesis reports were further augmented with vulnerability assessments conducted in Eastern and Southern provinces.

The Environment and Natural Resources Management Department (ENRMD) under the Ministry of Tourism, Environment and Natural Resources greatly wishes to acknowledge the valuable contributions and comments of the consultants and the workshop participants in the preparation of the NAPA document. The communities living in the remote rural areas where the vulnerability assessments were conducted, are thanked for their participation and sharing critical information on their current coping mechanisms against climate change.

Special thanks go to the various committees formed which contributed to the work plan and endorsed the selection criteria for the NAPA projects. The ENRMD acknowledges the valuable comments of the Department of Agriculture of the Ministry of Agriculture and Cooperatives and the Disaster Management and Mitigation Unit (DMMU) in the Office the Vice President on the NAPA selection criteria.

Many thanks to all the individuals and institutions that contributed to the NAPA process including drafting of the NAPA document.

Last, but not least, the Zambian government wishes to sincerely thank the Global Environment Facility (GEF) and the United Nations Development Programme (UNDP) for providing financial and technical support for the formulation of the action plan. The government is greatly indebted to this support.

Kenneth Nkowani (Dr.)

**DIRECTOR, ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT
DEPARTMENT**

1.0 INTRODUCTION AND SETTING

1.1 Background

Zambia is a landlocked Sub-Saharan African country sharing boundaries with Angola, Botswana, the Democratic Republic of Congo, Malawi, Mozambique, Namibia, Tanzania and Zimbabwe (MTENR, 2002). It belongs to the Least Developing Countries (LDC) and has a total surface area of about 752,614 km² and lies between 8 ° and 18 °south latitudes and longitudes 22 °and 34 ° east.

Zambia's population in 2000 was 9.8 million with a growth rate of 2.4% between 1990 and 2000 according to the Central Statistics Office. About 39.2% of the population lives in the urban areas making Zambia one of the highly urbanized countries within the Southern African Development Community (SADC) region. Compared to its neighbors, Zambia's life expectancy of 36 years was the lowest in 2003 perhaps due to impacts of the structural adjustment programme (SAP) adopted by Government in 1991 and the HIV/AIDS pandemic.

Furthermore, the 2002-2005 Poverty Reduction Strategy Paper (PRSP) indicates that about 73 percent of Zambians are classified as poor. The level of poverty in the rural areas where 64% of the population resides is about 83%. Poverty is attributed to lack of economic growth. Zambia's economic growth is constrained by many factors, but of key concern are macroeconomic instability, low savings, low investment, food insecurity, and unemployment. In addition, human resource productivity is constrained by HIV/AIDS and its social consequences.

Zambia enjoys a sub-tropical climate with three distinct seasons. The hot and dry season starts in mid-August and ends in November with temperatures that range between 26°C and 38°C; the cool dry season (May to mid-August) with temperatures that range between 13°C and 26°C and the rainy season from November to April. During the rainy season the temperature ranges from 27°C to 34°C. The rainfall is unimodal and is influenced by the movement of the Inter-Tropical Convergence Zone (ITCZ). The rainfall increases from an annual average of 600 mm in the lower south to 1300 mm in the upper north of the country. Drought conditions have been on the increase during the last 30 years with the 1991/2-drought being the worst experienced so far while the 1978/79 period saw the wettest conditions in Zambia. From 2000 to 2007, there have been two drought years, two flood years and two normal condition years. The intensity and frequency of droughts and floods has been increasing. The geographical distribution of these events has also been changing. These climatic variations have caused immense food security problems including destruction to humans, wildlife and economic infrastructure. The impact of the 2006/07 floods in all the affected areas was cross cutting affecting 1,443,583 people in 41 districts of the nine provinces of Zambia. These floods affected all sectors of the economy (DMMU, 2007).

Zambia

- Area: 752,6124 km²
- Population: 10 million
- 9 provinces, 72 districts
- Literacy: 74%
- HIV prevalence (adult population): 16%
- Climate: tropical
- Rainfall: 1100– 600mm
- Arable land: 42 million hectares (58%)
- Cultivated area: 14%
- Irrigated area / potential: 12%
- Rural Population: 64%
- Woodland: 47%
- Total labor force : 4.39 million
- Female labor force / total: 45%

The agriculture sector growth has been in the doldrums for several years now. This is so because it is overwhelmingly depended on rain-fed farming which is dominated by a mono-maize based production system. Despite holding about 40% of the water in the SADC region, the country has not taken advantage to promote irrigation. The southern part of Zambia is drought-prone especially Region 1 of the Agro-ecological Region of Zambia (Fig. 1.1) and thus the country has suffered severe droughts, becoming more pronounced and acute since the

1980s. The impact of drought on agriculture and other sectors has seriously eroded the opportunities for further economic advancement. Poverty is singled out as the number one social evil which is now widespread and affecting a greater number of the population. A non-vibrant and operative agriculture system which is seriously crippled by climate change related phenomenon would worsen the situation.

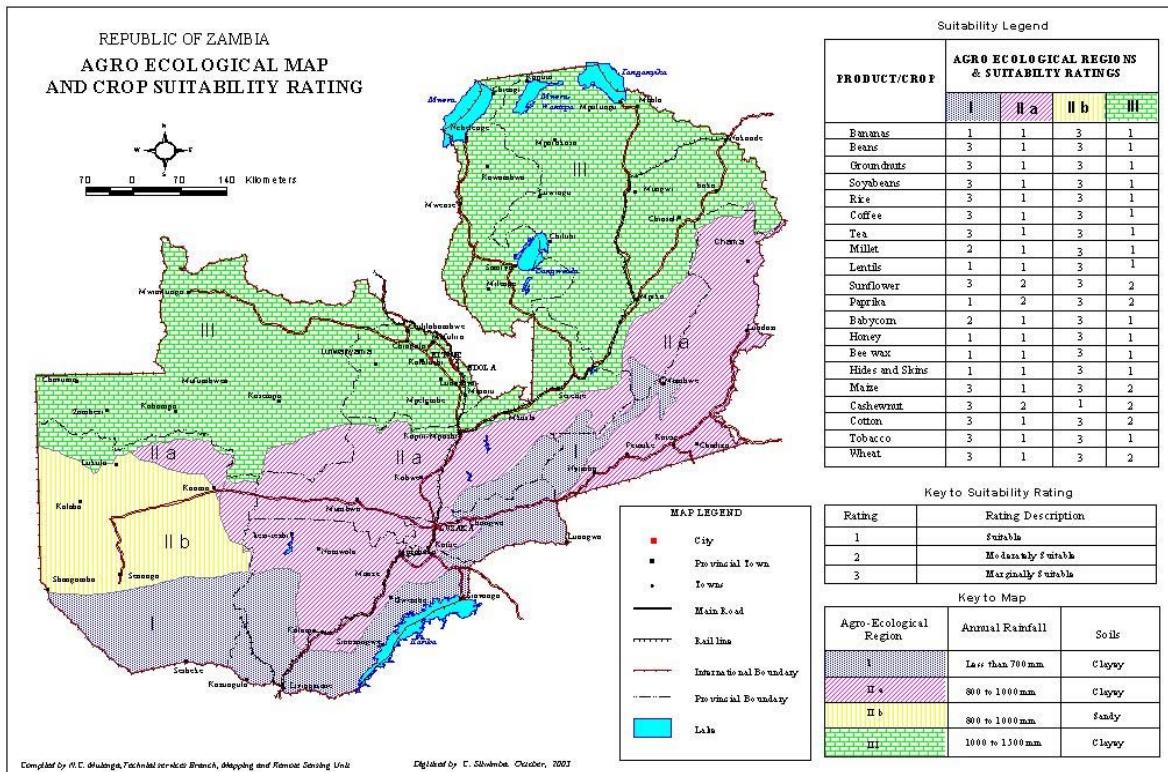


Fig. 1.1: Agro-Ecological Map and Crop Suitability Rating for Zambia

Zambia, having reached the Highly Indebted Poor Countries (HIPC) initiative completion point, is eligible for multilateral debt relief. It is thus poised to tackle poverty and its offshoots and thus ensure wealth creation and equity. The Government has thus acknowledged the role of planning in the development process as elaborated the Fifth National Development Plan (FNDP) whose goal is to contribute to wealth creation through sustained economic growth and poverty reduction. The FNDP presents the country's macro economic and social policies and sector plans that will be implemented during the next five years. These policies are expected to contribute to the advancement of the Millennium Development Goals (MDGs) by 2015 and the National Long Term Vision 2030.

Millennium Development Goals

- Eradicate extreme poverty & hunger
- Achieve universal primary education
- Promote gender equality & women empowerment
- Reduce child mortality
- Improve maternal health
- Combat HIV/AIDS, malaria & other diseases
- Ensure environment sustainability
- Develop a global partnership

1.2 Key Environmental Stresses

There are a number of environmental stresses that affect Zambia. These have been articulated in the National Policy on Environment (NPE) and other Multilateral Environment Agreements (MEAs) such as the Convention on Biological Diversity (CBD), the Convention to Combat

Desertification, the Ramsar Convention, to name just a few. According to the Zambia National Action Programme for Combating Desertification and Mitigating Serious Effects of Drought in the Context of the UNCCD (2002) indicates environmental problems to be air pollution in mining towns, deforestation, water pollution and inadequate sanitation, wildlife depletion and land degradation which, when combined with human unsustainable activities and climate change, lead to biodiversity losses of serious magnitude. Thus, there is a need to formulate strategies that will promote economic growth and the well-being of the people through climate proofing.

The effect of climate change and variability in terms of droughts and floods on key sectors of the economy is shown in Table 1.1.

Table 1.1: A Summary List of Vulnerabilities of Five Key Socio-economic Sectors

Key Sector	Vulnerability
Agriculture and Food Security	The major climatic threats affecting this sector are excessive precipitation leading to water logging, erosion and hindrance to field operation, increased frequency of droughts in terms of seasonal, shortening of the growing season, and flash floods – all have negative impacts on food security, livelihoods and adaptive capacity of the vulnerable communities. Drought-induced crop failures may in turn cause serious malnutrition in children. Extreme cases may result in famine and loss of productive assets and lives.
Human Health	Increased frequency of drought results in crop failures and water scarcity leading to increased malnutrition and diarrhoeal diseases. Increased cases of malaria and major epidemics of cholera and other water-borne diseases are associated with floods and increased temperature regimes.
Natural Resources/Wildlife/Forestry	Drought significantly affect wildlife habitat through changes in rangelands causing desert-type conditions to occur. In addition scarcity of water undermines wildlife health. Further, the regeneration of forest resources are negatively impacted by drought and climatic changes that affect the resilience of forest vegetation types could grossly affect income and welfare of the communities.
Water and Energy	Ground water resources are negatively affected by drought resulting in inadequate recharging, lowering of water tables and drying of boreholes and rivers. Region I especially Southern Province is extremely vulnerable and does in fact experience critical water shortages during drought conditions.

Source: Adapted from the Initial Communication Report, 2001

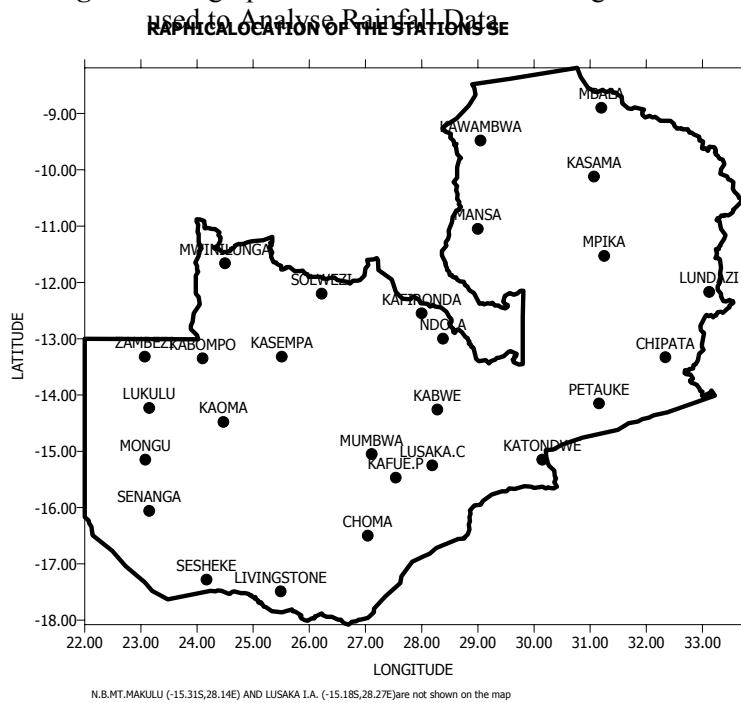
2.0 FRAMEWORK FOR THE ADAPTATION PROGRAMME

This chapter summarizes hazards posed by climate and climate change/ variability for Zambia's three ecological regions, in particular, precipitation for baseline (1970 – 2000) and projected (2010 – 2070) scenarios and some summary of vulnerability, based on past studies and or from stakeholder knowledge of their situation. The temperature was, however, analyzed over a period of 35 years (1970 – 2005).

2.1 Climatic Baseline Assessments

This assessment focuses on precipitation data collected from 29 stations (Fig. 2.1) and analyzed on the basis of the three main agro-ecological regions during the 30-year-baseline period from 1970 to 2000 (CEEEZ, 2001)

Fig. 2.1: Geographical Location of Meteorological Stations used to Analyse Rainfall Data



2.1.1 Climate and Agro-Ecological Regions

Region I is a low rainfall area which covers the country's major valleys, which are Gwembe, Lunsemfwa and Luangwa. It also includes the southern parts of western and southern provinces. The harshest climatic conditions (climatic hazards) are observed in this region and thus Region I is considered a drought-prone/risk area. Region II, the medium rainfall area, covers Sandveld plateau of Central, Eastern, Lusaka and Southern provinces. Kalahari sand plateau and Zambezi Flood plains of Western

province are also part of this region. The region has a total area of 27.4 million hectares of which 87% (23.8 million hectares) could be used for agricultural purposes, but only 50% is actually accessible. The rest has been set aside for national parks, game management areas and forests. Region III has the highest rainfall. It is part of the Central African Plateau covering Northern, Luapula, Copperbelt and North-Western provinces, as well as parts of Serenje and Mkushi districts. It is the largest with an area of 40.6 million hectares with very little set aside for national parks, game management areas and forests. Only 52.7% of the land is suitable for cultivation due to the soils being highly leached.

Due to relatively high temperatures, the average annual potential evapo-transpiration in Zambia ranges from 1394mm to 1892mm while the country average is 1574mm. Potential evapo-transpiration is larger than precipitation in Zambia. This means that Zambia is in a hydrological condition of precipitation deficit that amounts from 100 mm to 1100mm per year. This situation has implications on water availability and management in Zambia, particularly in agro-ecological Regions I and II.

2.1.2 Precipitation Trends and Rainfall Indices between 1970 and 2000

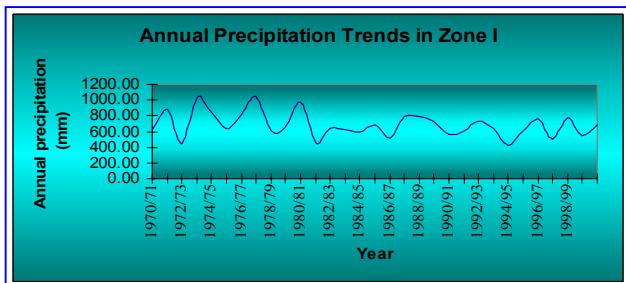


Fig 2.2: Annual Precipitation Trends in Region 1

mm occurred in 1994/95 rainy season. Region I is considered a drought-prone/risk area.

Key features of the region

Two distinct rainfall patterns are distinguishable in Region I – stage 1 comprising the period from 1970-1980 and stage II from 1980-2000 respectively (Fig. 2.3).

Period I (1970-1980)

- This stage is characterized by several wet episodes with rainfall scaling high to levels above 1000mm and dropping significantly to levels just above 400mm.
- Higher degree of annual rainfall variability
- There were five episodes having rainfall above average and five episodes having rainfall below average during the ten-year period.

Period II (1980-2000)

- This stage is depicted by low annual rainfall with the highest being just about 800 mm and lowest being slightly above 400mm.
- Less degree of annual rainfall variability
- In this stage, only seven episodes had rainfall above average. Conversely, twelve episodes had rainfall below average.
- 12 rainy seasons had rainfall above the 30 year average while 17 episodes had rainfall below average.

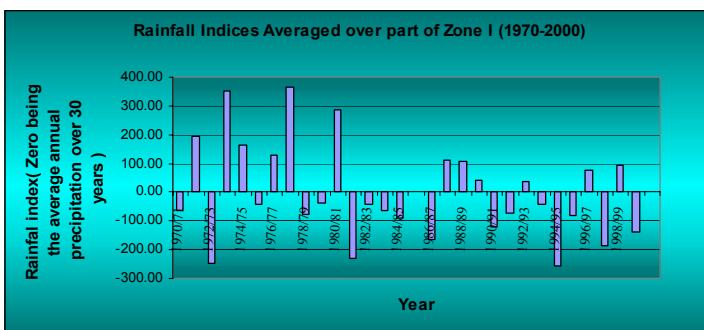


Fig.2.3: Rainfall Indices averaged over Region I (1970-2000)

Region II is a medium rainfall one. The rainfall averaged over the 30-year baseline period is 830 mm. The highest rainfall recorded of 1204mm occurred in the season 1977/78 – this coincided with the Kanyama disaster on the outskirts of Lusaka - a vivid example of

An assessment of historical rainfall patterns in this region revealed a decreasing trend of annual rainfall in the baseline period, implying that Region I is becoming drier as observed in Fig. 2.2. A mean annual rainfall of 684 mm occurred over the baseline period of 30 years in this region. The highest rainfall of 1048mm was recorded in 1977/78 rainy season while the lowest rainfall of 428

A comparison between period I and period II in the baseline period revealed stage I was wet as opposed to stage II. In general, observed rainfall patterns in Region I revealed a significant tendency of rainfall deficits and dryness.

excessive precipitation which culminated into climate induced floods with disastrous consequences. On the other hand the lowest amount of rainfall of about 544 mm was experienced in 1991/92 rainy season which was an El Nino year (Fig. 6).

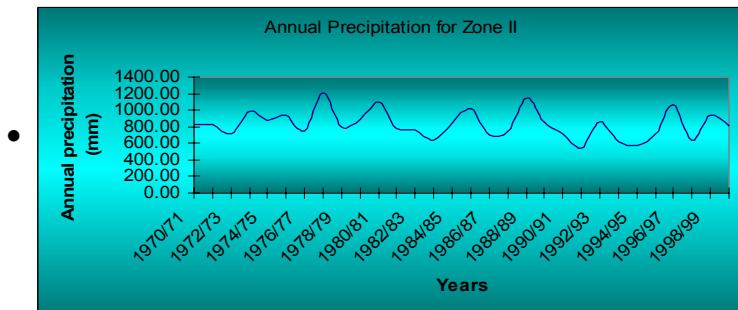
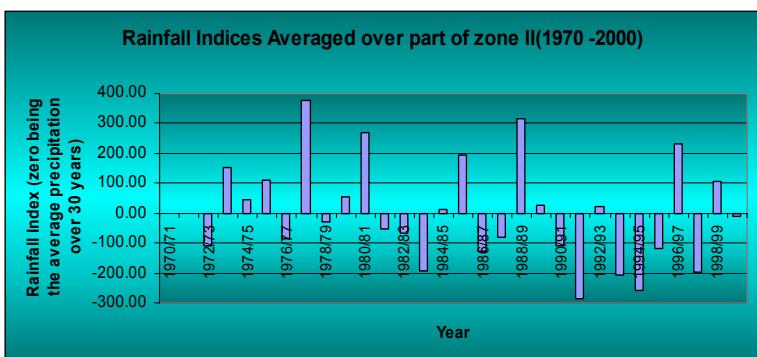


Fig. 2.4. Annual Precipitation Trends in Agro-ecological Region II

- Between 1970/71 and 1980/81 the frequency of above average rainfall was more than that of below average. The frequency and intensity of below average rainfall in this period was low.



In terms of climatic episodes the following features are portrayed:

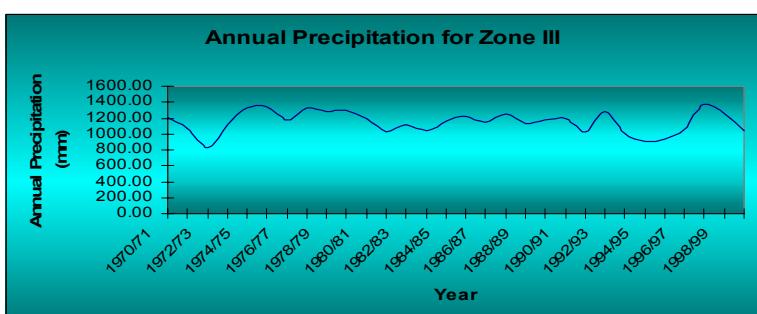
Over the baseline period, 13 episodes had rainfall above the 30 year average while 15 rainy seasons had rainfall below average.

The frequency and degree of dry episodes increased even further after the year 1990. The worst dry episode in 30 years was experienced in the season 1991/92 (Fig. 2.5). In this particular year, drought caused major crop failures in many parts of Zambia forcing the government to import huge volumes of food to feed the population.

The region has the highest rainfall with maximum over the baseline period being 1372 mm and a minimum of 836 mm. The average rainfall over the baseline period was 1151 mm

Key features of the region

- Characterized by a less variable annual rainfall compared to region I and region II



- Higher frequency of wet episodes between 1970-1980 with 8 episodes having rainfall above the 30 year average in the region III and only 3 episodes with rainfall below average.
- In the period 1981-1990, the annual rainfall was

varying slightly below and above the average value.

There was neither significant overshoots of wet episodes nor severe dry episodes in this period. The period between 1990 and 2000 had an increase in dry episodes with six occurrences of annual rainfall below average.

- Overall, there were sixteen occurrences of rainfall above average and 13 occurrences below 30 year average (Fig.2.7).

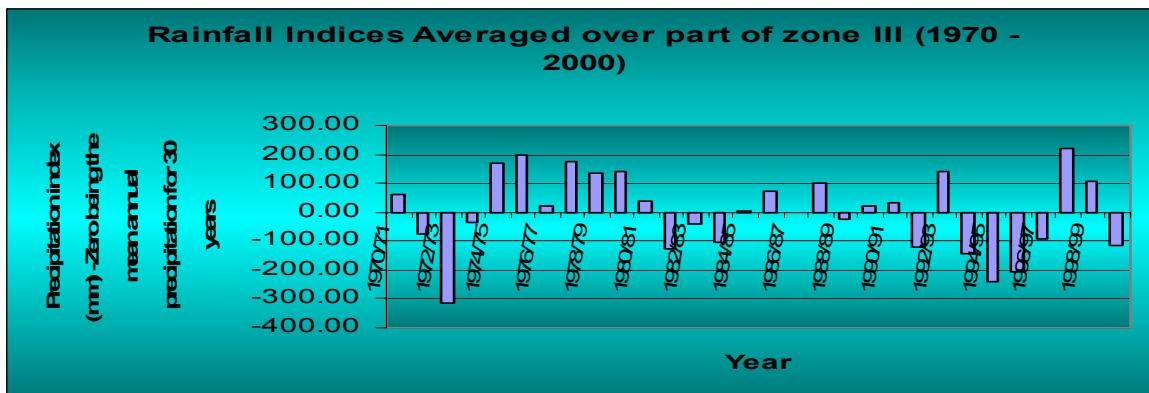


Fig. 2.7: Rainfall Indices Averaged over Region III (1970 – 2000)

Given in Table 2 is a comparison of mean, minimum and maximum rainfall among the regions. This Table shows that Region I continues to exhibit the lowest values in mean annual precipitation, 30-year average highest precipitation, and 30-year average lowest precipitation.

Table 2.1: Comparison of Mean, Minimum and Maximum Rainfall among the Three Agro-ecological Regions in Zambia over a 30-year Period

Agro-ecological region	Mean Annual Precipitation (mm)	Highest precipitation in 30 years	Lowest precipitation in 30 years
Region I	684	1048	428
Region II	830	1205	544
Region III	1151	1373	836

Given in Fig. 2.8 are the country's overall general historical rainfall trends. The minimum rainfall episodes as depicted in Fig. 2.8 appear to be correlated with the El Nino years. On the other hand the higher rainfall years correlated well with the La Nina episodes.

It is clearly demonstrated that Region III is a higher rainfall area followed by Region II and lastly Region I with consistently lower rainfall compared to the rest (Fig 2.8). Region I is therefore singled out as one region that is consistently experiencing climatic hazards in terms of droughts and water scarcity. Although the rainfall trends may not be that vivid, there is a general tendency of rainfall declining and shifting towards dryness.

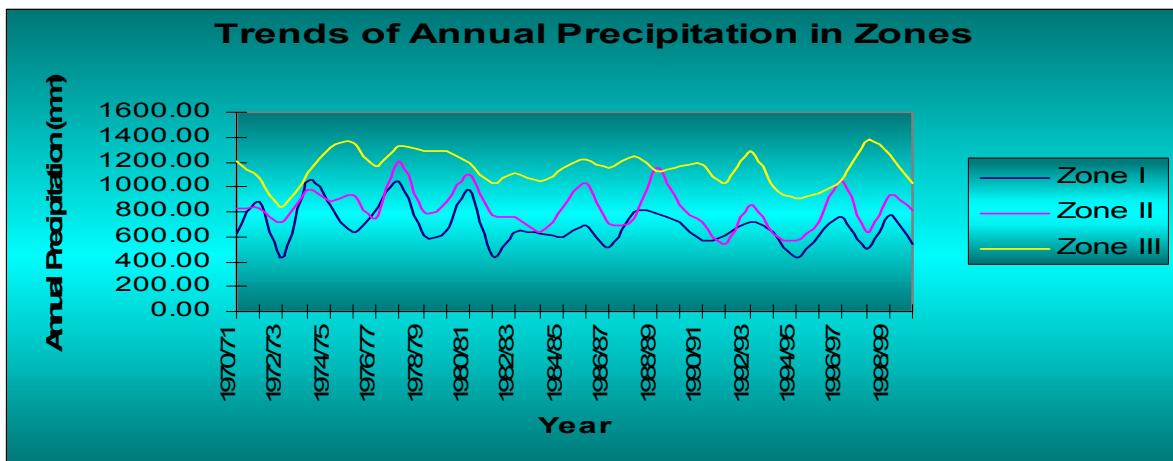


Fig. 2.8: Comparison of Annual Rainfall Trends in the Three Regions

2.2 Projected Climatic Fluctuations

To ascertain projected climatic fluctuations, the HADCM3 global Climate Model (GCM) was used. Projected rainfall and temperatures are plausible scenarios generated using the HADCM3 GCM. Projections were done for each zone for a sixty year period from 2010 to 2070.

Region I monthly totals give a maximum value of 560 mm in 2059, and a minimum value of 105mm the year 2043. Compared to the baseline, it shows a marginal increase in precipitation for almost all the sixty years with 2059 being very wet. The analysis shows that rainfall in this region is mostly below average, with the driest years being 2014, 2044 and 2065 in that order of increasing magnitude.

Region II: shows most of the monthly totals being below 500 mm, the wettest being the year 2024 with 1200 mm. The comparisons between baseline and projected rainfall again show increase in projected rainfall over the baseline situation. The wettest years are 2024 and 2059, while the driest years are 2065 and 2035.

Region III: shows a slightly different pattern from the other two. It has years 2024, and 2055 for wettest years with 1100 mm and 900 mm of total monthly rainfall, respectively. The driest years are 2044, and 2063. In comparison to the baseline, the projected rainfall shows a complete increase in almost all the years in some with significant amounts. The indices show a pattern of projected precipitation above average in the sixty years period.

The mean temperature scenarios for all the Regions show a similar trend of increasing mean temperatures for the period 2010 to 2070. There is an average increase of about 2°C (24.5 to 26°C) for this sixty years period. The years 2013, 2040 and 2062 show the lowest mean temperature in Regions I. Region II has lowest mean temperatures in the years 2013, 2041, and 2061, whilst Region III records a higher number of low temperatures especially after 2050.

2.3 Impacts of Climatic Hazards: Previous Studies and Assessments

Historically, Zambia has been ravaged by droughts and floods but recent decades the frequency and severity of these climatic hazards have increased. In the last seven years of this decade Zambia has had to endure droughts in the rainy seasons of 2000/01, 2001/02 and 2004/05 while floods have occurred in 2005/06 and 2006/07. The impacts of these droughts/floods have included widespread crop failure/loss, outbreaks of human and animal diseases, dislocation of human populations and destruction of property and infrastructure. In

2004/05 and 2006/07, the affected population sizes were 1,232,661 and 1,443,583 persons, respectively. Additionally shifts have been observed in the onset and withdrawal of a single season, resulting in decreased length of the agricultural growing season.

The critical economic sectors are extremely vulnerable to adverse effects of climate change as induced by global warming. Droughts, floods and to some extent extreme temperatures are the key climatic hazards in Zambia (DMMU, 2005, AIACC (2003, 2004) and IUCN, 2007). Shortening of the growing season and dry spells within the growing season have also been mentioned to be devastating especially for crops IUCN (2007). The contribution of the key sectors to the attainment of the national goals as prescribed in the PSRP, MDGs, and FNDP are thus in jeopardy.

The climatic impacts associated with vulnerability assessments are elaborated in the sections below.

2.3.1 Impacts of droughts

Droughts have impacts on virtually all sectors more especially on agriculture, energy, natural resources and wildlife and health.

Recently, the country experienced drought during the 2004/05 agriculture season in which two thirds of the country received little and/or no rainfall which coincided with critical flowering periods for major cereal crops. Even drought tolerant crops such as cotton and tobacco were also affected by the erratic nature of the rainfall. According to the Vulnerability Assessment Committee (VAC) report of June 2005, 120,000 tons of food was required to feed some 1.2 million starving vulnerable people in drought-prone rural areas of Zambia before the next harvest in March 2006. On average Zambia experiences two to three drought years in a decade. Severe droughts often cause total crop failures in the southern and western parts of the country (USAID, Country Strategic Plan FY2004 – 2010).

The cattle population was directly related to the amount of rainfall. As the amount increases the number of animals also increased. This could be due to increased plant growth and the consequent availability of pastures, leading to good nutrition and enhanced reproductive capacity, but also due to the fact that traditionally most farmer traditional cattle owners are under pressure to sell their animals. Under drought conditions most of these farmers are afraid that their animal will die of hunger and therefore tend to sell them in exchange for other food commodities.

The greatest correlation between climatic indicators and livestock population was observed in cattle. As temperatures rose, the cattle population reduced, and as they fell the population increased. This may also be attributed to the fact that extreme temperatures will always have some extent of adverse effect on the population. The AIACC study (2002), showed that communities in Southern Province depend the most on cattle as a source of livelihood and nutrition. This implies that households that depend on cattle for livelihood are the most vulnerable once the area experiences climatic hazards. In other parts of the country, it goes without saying that the groups that depend of rain-fed agriculture are most vulnerable.

A climate-sensitive disease is an illness that is sensitive to weather or climatic factors, with the current spatial distribution and seasonal transmission being affected. Implicitly, climate variability and change are expected to have a significant impact on the morbidity and mortality levels associated with these diseases. Broadly, a change in climatic conditions can affect human health directly either by impacts of thermal stress/drought or death/injury

occasioned by floods or storms. The indirect effects include changes in the prevalence and ranges of disease vectors (e.g., mosquitoes), water/food/rodent-borne pathogens, water/air quality, and food availability and quality. The multiplicity of factors that are able to influence human health is what complicates the elucidation of the impacts of climate on disease variables.

Human health is particularly sensitive to climate and synoptic weather patterns because many maladies in the tropics are associated with temperature and precipitation regimes. Malaria was chosen for further study because it's the leading killer disease in the country.

From the data collected during this study (Kasali, 2007), cases of malaria showed increased sensitivity to rainfall distribution than to just total rainfall. In fact, the correlation coefficient increased by 47% when rainfall distribution was used instead of total rainfall. Rainfall distribution incorporates the number of dry spells within the total monthly rainfall. This suggests the presence of some threshold with regard to the effect of rainfall on malaria, whereby excessive rainfall can wipe out breeding sites for mosquitoes and cause reduced transmission of malaria.

The water and energy sector generally derives the hydro-electric power from a number of sources which includes Kariba dam, and Kafue gorge. The hydro-electric power generation has been negatively affected by the droughts, which have had devastating effect on the hydropower generation in Zambia with significant economic reduction in the power potential (CEEEZ, 2007) Further, the water flow disruptions in rivers have been exacerbated by siltation caused by poor and unsustainable agricultural practices and deforestation.

It is a known fact that in rural communities, chores like fetching water and firewood are predominately for women and children. As such women and children who have to travel long distances in search of firewood and water are the most affected under these conditions.

Natural resources including wildlife and forests are threatened by major climatic hazards such as extended droughts, which lead to land degradation and loss of soil fertility, as well as forest fires caused by human activities (Silengo, 2007). The 1992 drought resulted in the deaths of many hippopotamuses in South Luangwa National Park and the migration of most animals from the Park. In 2005 the drier conditions induced changes in condition of elephants. Elephants were skinnier not robust as they normally are and foraged closer to the river reflection of quality of range.

Climate change (high temperatures and droughts) seems to be also jeopardizing regeneration of Miombo forest, which normally regenerates easily and fast. The suggested intervention is to reduce the pace of deforestation (land clearing for agriculture and charcoal production) to allow adjustments to the lower precipitation. Viable alternatives should be given to those that live off forest resources: conservation farming and sustainable fuel among the options.

2.3.2 Impacts of floods

From 2000 to-date there have been two major floods (2002/3 and 2006/7). According to a socio-economic case study carried out on the Gwembe floods of 2002/03 (AIACC, 2004), the effects recorded from communities cut across all key sectors. These include: hunger as a result of destruction of crops, reduction of cultivatable land and soil erosion; loss of shelter, displacement of people and disruption of communication due to destruction of infrastructure and natural resources (i.e. houses, roads, bridges, grasses, reeds, etc); increases epidemics

such as malaria and waterborne diseases; reduced nutrition and livelihoods from livestock. The most vulnerable groups were rural households.

During the recent floods the report by the DMMU (2007), indicates that floods affected 41 out of the 72 districts. This clearly indicates that floods have started to affect areas that traditionally had never known flooding before. While some of the affected populations have traditional coping mechanisms for floods, this year's floods came earlier than normal, thereby disrupting their livelihood patterns. The floods have also been more widespread than usual, affecting people that do not have traditional coping mechanisms (Zambia Flash Appeal, 2007). In the Western province which traditionally floods frequently, this year's floods came very early and of unusual magnitude which caught people unprepared. These could be indicators of the changing climate pattern. DMMU (2007) points out that although there was no immediate impact on health, it was expected that the effects would manifest as water receded and stagnate, though districts in Kafue flats have already recorded an increase in malarial and diarrhea cases. There were also an increase in cases of waterborne diseases in North Western Province, however chlorine was distributed widely and most outbreaks were prevented. Floods posed a high risk to water contamination due to an increase in the number of pit-latrines that had collapsed as well as flooded unprotected shallow wells.

2.3.3 Summary of impacts of climate change/variability

The impacts of climate hazards on communities are summarized in Table 2.1 below.

Table 2.2: Main Impacts of Climate Hazards

Drought	Floods	Extreme Heat	Shorter Rainy Season
<ul style="list-style-type: none"> • Crop damage/loss leading to food scarcity and hunger • Water shortages • Reduced fish stocks • Income loss • Increase in diseases (affecting humans and animals) • Decreased water quality • Increased soil erosion • Decreased soil fertility • Increased honey production (if drought is not too severe) 	<ul style="list-style-type: none"> • Crop damage/loss, leading to food scarcity and hunger • Loss of crop land and grazing ground • Decline in fish catches • Increase in diseases (malaria, dysentery, cholera, etc.) • Destruction of infrastructures (houses, roads) • Life loss (humans and livestock) Interference with energy production due to change in water flows. 	<ul style="list-style-type: none"> • Loss of life • Increase in diseases affecting animals, crops and humans (especially malaria) • Decreased human capacity to do work • Loss of life (animals and humans) • Crop damage/loss • Reduced fish stocks • Decreased livestock feed • Reduced water quality 	<ul style="list-style-type: none"> • Increase in risk of crop failure • Crop damage/loss • Decreased income from crop selling for those with reduced production • Crop seeds do not reach maturity (which negatively affects the next crop generation) • Reduced forest regeneration

Reference: (IUCN, 2007; DMMU, 2007; AIACC, 2002; AIACC 2007)

Variability is a feature of the Zambian climate, which has a history of droughts and floods. However, in the IUCN study, all communities mentioned an increase in droughts, rain intensity, and extreme heat events. They evaluated that the start of these changes 3 to 9 years ago. These changes are in accordance with the IPCC climate change observations and predictions (IPCC, 2007) for the 20th and 21st centuries, i.e. increased frequency of warm spells and heat waves over most land area; warmer and more frequent hot days and nights; increased frequency of heavy precipitations events and increased area affected by droughts.

2.4 Projections of Impacts of Climatic Hazards

In terms of food security, it is clear that the vulnerable groups are households which depend on rain-fed agriculture, particularly those that plant long maturing varieties. Using the Decision Support System for Agro-Technology Transfer (DSSAT3), the USCSP assessment focussed on the vulnerability of these crops and cultivars under a variety of climate change scenarios covering the three agro-ecological regions². Results suggest that most maize varieties would not mature due to shortening of the growing season, especially in agro-ecological Regions³ I and II, respectively.

Projections of future climate under health (Kasali, 2007) indicate that in Regions I and II the trend is towards increased temperatures and alternating episodes of drought and floods. In fact the 2005/06 floods of the Southern province resulted in the following: deaths caused by drowning, lightning and climate-sensitive diseases, outbreaks of infectious plant, zoonotic and human diseases, destruction of agricultural crops resulting in food shortages and potential malnutrition, displacement of populations-a condition that might bring about anxiety, depression, overcrowding and the likelihood of infectious disease outbreaks among the affected persons and damage of roads, housing, power and water supply infrastructure with the concomitant disruption of the accessibility and delivery of health services and relief assistance. In this respect, the most vulnerable population groups include riverine/floodplain under-five year olds, pregnant women and chronically-ill people. Zambia must, therefore, take measures to improve human health by reducing the widespread vulnerabilities to droughts and floods.

Since Zambia holds much of the water in SADC, many communities across the nation depend on fishing as source of food security and livelihood. The USCSP study revealed that lower rainfall would reduce nutrient levels in rivers and lakes and impacting negatively on fish breeding activity and as well as depletion of fish species in the long-term. The most vulnerable fish species being the breams and sardines in the drought-prone agro-ecological Region I and II.

A substantial number of rural communities rely on wildlife as a source of nutrition, and livelihood through, among others game viewing. The USCSP study showed that increased or decreased rainfall could significantly affect wildlife habitat through changes in rangelands and bushlands (under increased rainfall) or desert-type conditions (under decreased rainfall). In addition, increased or decreased rainfall would significantly affect the behaviour and habitat of migratory wetland species such as puku, lechwe and waterbucks. Such changes are likely to impact negatively on the livelihoods of surrounding communities who depend on these animals for income and food security.

Based on the USCSP study, climatic changes (drought and high temperatures) that affect the resilience of forest vegetation types could grossly affect income and welfare of the communities. The most important vegetation type in the country which was considered in the study mainly focussed on the miombo woodlands that are estimated to cover 60% of the country's total surface area. They are a source of fuelwood or charcoal for more than 80% households. The study showed that under a low rainfall scenario, the area under Miombo

² Data is based on the Vulnerability and Adaptation Assessments conducted under the United States Country Study Programme, 1992.

³ Summary of Agro-ecological Regions of Zambia:

I Annual rainfall about 800 mm, altitudes of 300 – 900 m a.s.l, growing season 80-120 days.

II Annual rainfall about 800 – 1000 mm, altitudes of 900 – 1300 m a.s.l, growing season 100 – 140 days.

III Annual rainfall over 1000 mm, altitudes of 1100 – 1770 m a.s.l, growing season 160 days.

vegetation type will adversely be affected and reduced, affecting about 50% of the area that is currently under Miombo woodland.

As indicated earlier climate change (droughts and high temperature) seems to be jeopardizing regeneration of Miombo forest that is normally easy and fast. Lack of baseline data to ascertain what the effect of climate change on regeneration of forests is seems to be a problem.

2.5 Community Participatory Consultations

Vulnerability assessments with respect to community responses on effects of climate change / variability on livelihoods / health, and socio-economic situation were undertaken in Eastern and Southern Provinces using a wide range of participatory methods. These methods included focused group discussion, one-on-one household interviews, expert opinion and judgments. The two provinces were selected since they were the most vulnerable regions arising from the analysis of the sector vulnerability assessment.

Farmers in both Eastern and Southern provinces recognized that there was a general reduction in length of growing season. Further, it was observed that the frequency of droughts had increased. The shift in length of growing season to where the rain started early and ended early suggests that there was a recognizable reduction in length of growing season by most of the respondents. This consequently resulted in reduced amount of rainfall and reduced crop production. This was probably the case in the 2004/05 growing season where there was a reduction of crop production from reduced amount of rainfall as observed by farmers in the study area. Farmers recollection as to when there was a shift of season was generally poor. This is the reason why a high proportion of respondents did not register when there was a change in length of growing season. During drought years, the communities in the study areas depended on food relief. The most common types of food relief found in the study area were relief food through “food for work programmes”, followed by food aid.

Farmers in both Eastern and Southern provinces were growing crops which were diverse and from different categories to include groundnuts, sunflower, cowpeas, maize, sweet potatoes and cassava as coping strategy. Farmers were aware of the early and late maturing attributes of crops as they relate to climate change in the study areas. Earliness of the variety was recognized as a required trait to adapt to direr conditions. In this regard, the communities were able to distinguish local early maturing varieties such as Kalahai and Muchichanjala (meaning hunger). Eastern province however, was not aware of improved early maize maturity varieties, but in Southern Provinces they were aware of both local and improved early maturing varieties.

Under Natural Resources and wildlife, two field surveys were undertaken in South Luangwa National Park and Chongwe and are given below are the responses obtained.

The discussions revealed that Luangwa Valley experienced extreme high water levels in February 2007, which affected all the tourism operators in the South Luangwa. The Park was inaccessible and camps and lodges were closed for a while. This was expected to be a short-term problem. Further discussions identified three sources of risk associated with land management and invariably to wildlife management, namely:

- Poverty and hunger – especially reflected in food insecurity of communities living in and around the Game Management Areas;

- Lack of wage income – or alternative sources of livelihoods to subsistence farming; and
- Heightened potential for Human-Wildlife Conflict (HWC) when droughts/floods affect these regions and their communities.

It was noted that there was need for integrated land management to ensure that watershed areas were not at risk to tree felling (for charcoal or firewood), that rivers and fisheries resources were protected and landscapes were preserved to support wildlife habitats.

In Chongwe District consultations were made with staff of the Department of Forestry. There was an indication that various projects were being implemented as part of the outreach programme of the Department. Some of the projects either needed scaling up or additional funding to supplement efforts already on the ground.

Consultations under energy revealed that there is need for sustainable management of water resources. Strengthening of the hydrological monitoring system could be the most realistic immediate intervention for adaptation in the energy sector. Closer collaboration between players in sector such as the Ministry of Energy and Water Development, Zesco Limited and farming community on the usage of water would help to reduce effects of droughts of the energy sector. It was also pointed out during drought years, Zesco Limited and the Zambia National Farmers Union come up with schedules of production figures in order to reduce the impact of water shortage on the hydroelectricity production.

In order to ensure that the adaptation options in the NAPA serve as adequate and effective responses to the adverse health impacts associated with climate hazards in Zambia, a field survey of Mazabuka District was undertaken during the period of 22 – 27 August 2006.

Mazabuka underwent drought conditions during the 2004/05 agricultural season and over 82,000 persons were at risk of starvation and protein-energy malnutrition within the area. In the 2005/06 rainy season, the heavy rains caused cholera outbreaks in various parts of Mazabuka district. Mazabuka thus provided opportunities to understand the impacts of both floods and droughts on the lives of people. Some of the respondents claimed that some old people in the area were able to predict the occurrence of droughts by observing the direction of winds in the season preceding the rainy season.

Under the AIACC project (2004), most of the respondents have witnessed floods more than 2 times in their lives. They remember that floods occur between January and March. 75% of the respondents remember 1973/74 rain season as their first ever serious flood period in the area which had an annual rainfall of 889 mm, followed by the floods of 1984/85 with 895 mm, and 2002/03 rain seasons with 932 mm. However, minor but frequent flood occurrences in selected parts of the area were experienced. These were recorded when the district received the following annual rainfall readings 801 mm for 2000/01, 695 mm for 2001/02, and 901.4 mm for 2003/04 rain seasons. The indications above seem to confirm that abnormal rainfall during a particular rain season is likely to be the major cause of floods as was experienced in the 2006/07 rainy season when flooding occurred in 43 out of 72 districts of Zambia.

According to the study by AIACC (2004), the 5 most prominent adaptation measures against flood impacts that the farmers would like to take on their holdings in case of future floods include avoiding cultivating along river banks, avoiding cutting of trees along river banks, avoiding building houses along river banks, practice sustainable agriculture on the upper land and growing and storing enough food.

2.6 Coping Strategies

Strategies to deal with increases in diseases (e.g. using traditional medicinal plants; boiling water; treating water with chlorine; going to the medical clinic) are very similar among villages. Medical clinics are often far away from the village and traditional medicines are considered to be effective by villagers.

Coping strategies to deal with crop loss and decreasing fish stocks are also very similar among the different villages. Communities cope mainly by diversifying their sources of income and relying more heavily on alternative natural resources from forests and wetlands. However, there are major differences in income diversification possibilities.

Consultations with both the Ministry of Agriculture and Cooperatives (MACO) and the Zambia Meteorological Department (ZMD) indicate that there is an early warning system in place, which provides information to MACO to guide crop planning. Enough information on climate patterns is processed at the ZMD that could contribute to adaptation, especially in the agricultural sector, but that is not adequately packaged and distributed to those farmers that would be the most affected by crop failure. Two bottle necks identified:

1. Outreach is weak: the information stays at higher levels, does not reach grass root where it is really needed
2. There is a communication gap between the ZMD and District authorities at different levels.

Some communities have access to more natural resources (wild foods, non-timber forest products, fish, etc.) or have a higher level of specialization, education, expertise, coordination, or institutional support (e.g. specialized charcoal makers in the Copperbelt Province) than other communities, which enhances their adaptive capacity. In addition, there are major differences in the extent of agricultural knowledge and coping strategies associated to crop management (use of crop rotations, intercropping, cover crops, etc.).

Table 2.3: Main Coping Strategies

Drought	Floods	Extreme Heat	Shorter Rainy Season
<ul style="list-style-type: none"> • Income diversification (charcoal making, fishing, honey and beer production, selling grass and livestock, casual labor) to buy food • Trading other commodities for food • Gathering and selling wild food • Food rationing • Selling less crops to keep more for household consumption • Shifting agricultural production from highlands to lower lands • Earlier crop planting • Growing more drought resistant 	<ul style="list-style-type: none"> • Income diversification (charcoal, crafts, mats and beer making, fishing , grass selling, casual labor) to buy food • Trading other commodities for food • Gathering and selling wild food • Shifting agricultural production, livestock and houses to higher lands • Using medicinal plants to treat diseases • Boiling water or treating it with chlorine to prevent diseases • Bury ditches to prevent waterborne diseases 	<ul style="list-style-type: none"> • Income diversification (charcoal, crafts, mats and beer making, fishing , grass selling, casual labor) to buy food • Trading other commodities for food • Gathering and selling wild food • Shifting agricultural production, livestock and houses to higher lands • Using medicinal plants to treat diseases • Boiling water or treating it with chlorine to prevent diseases • Bury ditches to prevent waterborne diseases 	<ul style="list-style-type: none"> • Using medicinal plants to treat diseases • Boiling water or treating it with chlorine to prevent diseases • Going to the medical clinic • Buying and using mosquito nets and repellents • Working earlier in the morning • Buying medicines for cattle • Income diversification (e.g. agricultural production to cope with decreased fish stocks; charcoal production to cope with crop loss)

crops (e.g. cassava) <ul style="list-style-type: none"> • Incorporation of crop residues instead of burning • Crop rotations, intercropping, and cover cropping • Irrigation (practiced by very few) • Sinking wells • Walking longer distances to get water • Using medicinal plants to treat diseases • Going to the medical clinic • Boiling water or treating it with chlorine • Getting support from NGOs and the government 	<ul style="list-style-type: none"> • Early evacuation when water levels increase • Improve drainage around houses • Putting plastic on top of houses • If houses are destroyed, build temporary shelters or live temporarily with neighbors 	<ul style="list-style-type: none"> • Early evacuation when water levels increase • Improve drainage • Putting plastic on top of houses • If houses are destroyed, build temporary shelters or live temporarily with neighbors 	<ul style="list-style-type: none"> • Trading other commodities for food • Earlier crop planting • Taking animals out early in the morning • Using zero-grazing for some animals • Income diversification (selling charcoal, livestock or grass; casual labor) • Selling less crops to keep more for household consumption • Gathering wild food • Buying seeds for the next growing season • Exchanging crop seeds between community members or between villages
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Reference: (IUCN, 2007; DMMU, 2007; AIACC, 2002; AIACC 2007)

Clearly some adaptation to current climate variability is taking place, as demonstrated by the coping strategies undertaken by various communities and summarized above in Table 2.2, but these strategies are not necessarily sufficient to deal effectively with present and future climate change and variability.

2.7 Rationale for Developing the NAPA

The United Nations Framework Convention on Climate Change (UNFCCC), to which Zambia is a party, recognizes that major changes of the weather are responsible for significant fluctuation in the climate. Climatic features such as surface air temperatures have either risen or fallen at unprecedented levels and similarly, excessive rainfall or the lack of it has changed the occurrence patterns of cyclones/floods and/or drought. Severe droughts and floods are now more frequent as shown earlier, and are threatening the livelihoods of the people and their local ecosystems. In 1978 and 1992 Zambia suffered greatly from both floods and drought respectively. The torrential rains of 1978 caused major floods with wide spread damage to crops and infrastructure. In 1992 serious drought caused major crop failures in many parts of Zambia. This forced the government to declare a national disaster and mobilize the needed resources to support the affected people and families. In the recent past, the frequency and severity of the hazards is increasing. The 2006/07 floods that affected 43 districts in all the nine provinces of Zambia were extremely severe and affected areas that had never been affected by floods before.

One of the UNFCCC's roles is to address the global impacts arising from climate change. The legal framework of this convention was established in 1991 to respond to the global climate change and specifically to mitigate and prepare for adaptation to its adverse effects. The Global Environment Facility (GEF) supports initiatives that are aimed at developing programs to address the unfavorable regimes caused by climate change and its impact on the people and environment. This key feature is clearly elaborated in Decision 28 CP. 7 which encourages Least Development Countries (LDCs) to formulate NAPAs. The objective of NAPA is to "serve as a simplified and direct channel of communication for information relating to urgent and immediate adaptation needs of LDCs".

To address the issue of climate change and its impact on the environment, the Government of the Republic of Zambia (GRZ) with support from the UNDP and the GEF formulated the NAPA project

2.8 Goal of the NAPA:

The primary goal of the NAPA process is to broadly communicate to the international community priority activities that address Zambia's urgent immediate needs for adapting to the adverse impacts of climate change.

2.9 NAPA Specific Objectives:

The NAPA process is a consultative, participatory and team building effort. Its objective is to develop a plan of action for addressing concerns of the impacts of climate change in Zambia. Basically, the NAPA contributes to the following:

- Serves as a roadmap for the country to develop adaptation strategies to identified adverse impacts of climate change;
- Contribute to the national objectives of poverty reduction through sustained economic growth, employment creation and enhancement of food security as stated in FNDP and other policy documents
- Contributes to the achievement of the Millennium Development Goals (MDGs);
- Raising public awareness of the urgency to adapt to adverse effects of extreme weather events; and
- Builds capacity to address vulnerabilities to climate change and climate variability.

2.10 Potential Barriers to Implementation

There are a number of barriers that can affect the running and smooth implementation of the initiatives in NAPA. These are outlined below:

- Lack of financial resources to implement adaptation measures for climate change. As a party to LDCs, Zambia is engulfed in extreme poverty coupled with HIV/AIDS pandemic. Its resources are over-stretched and have limited adaptive to implement adaptation programmes.
- Lack of a clear and specific legal and policy framework for climate change issues in the country. There is no legal framework that has been directed to ensure that climate change issues at various levels are properly institutionalized in the planning process. This is so, because most adaptation interventions that are identified to reduce the risks of increasing climate variability would require further “fine-tuning” of existing policies and programs to make them relevant and robust.
- Inadequate institutional, system and individual capacity in issues related to climate change. There is danger that with limited capacity, implementation of the NAPA initiative may be a challenge;
- Inadequate public awareness on climate change and their potential impact on the social-economics, livelihood, and the ecosystem. Inadequate awareness hinders public participation in helping to shape climate change policy and legislation (NCSA, Draft 2006).

- Inadequate human resources with skills to translate strategies into action at the community level where the impacts of climate change are the greatest. This also follows coping strategies by the communities although useful they lack adaptive planning tools which are needed to empower communities to deal with new threats and risks.
- Lack of private sector involvement in issues related to climate change.
- Limited understanding of concrete or best practices/ activities of what constitute to be adaptation to climate change;
- Monitoring and evaluation plans including environmental impact assessments are weak and lack best standards and practices that consider climate change implications and climate as a non-static element. Current deliberate efforts to address the problem of climate change are more reactive than futuristic.

3.0 IDENTIFICATION OF KEY ADAPTATION NEEDS

3.1 Need for Adaptation

Adaptation is in this context, defined as adjustments to natural or human systems in response to experienced or future variability and extreme events or their effects – which may be beneficial or adverse. It is therefore considered as a function of the present or future vulnerabilities.

Zambia has been experiencing adverse impacts of climate including climate variability, extreme events and other systematic changes in climate variables over the last several decades. Extreme weather events such as floods and droughts, as well as El Niño induced events have become more frequent and intense, with serious consequences for socio-economic and livelihood activities. For instance, between 1972 and 1996, agro-ecological region I suffered severe droughts with at least 8 droughts being observed barely in less than three decades.

With respect to climate change, the vulnerability of a given system or society is a function of its physical exposure to climate change effects and its ability to adapt to those conditions. This means that two aspects to vulnerability are identifiable - physical exposure and ability to cope with impacts. Thus, vulnerability recognizes the role of socio-economic systems in amplifying or moderating impacts of climate change and emphasizes the degree to which the risks of climate catastrophes can be cushioned or ameliorated by adaptive actions that can be brought within the reach of the populations at risk. Thus, adapting to climate change means making adjustments that:

- Reduce the adverse impacts of climate change;
- Allow for exploitation of opportunities created by climate change; and
- Preparedness to cope with the unavoidable consequences of climate change.

Several notable hazards/ or climatic risks peculiar to Zambia, which are directly or indirectly associated with climate change and climate variability can be cited. These are shown in Box 1. The seasonal droughts include occasional dry spells which are detrimental to crops when they occur at flowering stages. Mudslides can cause serious economic damage to installation and infrastructure e.g. mudslide partially burying Kafue Gorge Power Station causing outage of 600 MW of power and extensive blackout throughout Zambia.

Box 1 Notable Climatic Hazards in Zambia

- Seasonal droughts
- Occasional dry spells
- Intense rainfall
- Heat-wave 33-39°C Oct – November 2006
- High temperatures in valleys
- Floods
- Flash floods
- Changes in growing season
 - delayed onset of rainy season
 - shortened growing period

It is on the basis of the climatic hazards and the associated impacts that needs are defined.

3.2 Proposed Adaptation Measures

Based on the results and analysis of the assessment the following adaptation measures have been identified as given in Table 3.1.

Table 3.1: A List of Adaptation Measures for Various Sectors, and Targeted Vulnerable Communities and Areas

Agriculture and Food Security:		
Climatic Hazards	Adaptation Measure	Relevant Vulnerable Regions
Drought (seasonal and periodic), floods - water logging,, shortened growing season, and delayed on-set of the rains.	1a. Adaptation of crops (cereals, legumes, root and tuber crops, and horticultural crops) to climate change/variability including promotion of early maturing/drought resistance crops 1. b. Develop sustainable and appropriate programmes for both crops and livestock in the face of climate change	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought (seasonal and periodic), shortened growing season, and delayed on-set of the rains.	2. Promotion of irrigation and efficient use of water resources	Regions I & II, especially Eastern, Central, Western and Southern provinces
Droughts	3. Water harvesting	Regions I and II
Drought (seasonal and periodic), shortened growing season, and delayed on-set of the rains.	4. Use of technologies for fertility improvement and moisture storage (including soil conservation measures)	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought and floods	5. Improve post-harvest storage and marketing of produce	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought (seasonal and periodic), shortened growing season, and delayed on-set of the rains. and floods	6. Strengthening of early warning systems and preparedness	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought	7. Development of dams and dip tanks and sustainable supply of feed to mitigate the effects of droughts;	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought	8. Promotion of Improved crop and livestock management practices	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought	9. Introduction of well-adapted livestock	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought	10. Boosting the Zambezi River Water System to increase delivery	Regions I
Drought and Floods	11. Application of GIS/remote sensing in mapping of drought and flood prone areas	Agro-ecological region I & II

Agriculture and Food Security:		
Climatic Hazards	Adaptation Measure	Relevant Vulnerable Regions
Drought	12. Fish breeding to restock the lakes, rivers and dams	All regions with viable rivers and water bodies
Drought and high temperatures	13. Promotion of aquaculture	All regions with viable water bodies
Drought and floods	14. Using species suitable for aquaculture in vulnerable areas	All regions with viable rivers and water bodies

Human Health		
Climatic Hazards	Adaptation Measure	Relevant Vulnerable Regions
Drought (seasonal and periodic), shortened growing season, and delayed on-set of the rains.	15. Improved and diversified nutrition and fortified food supplementations for the under-fives and other vulnerable groups. Improved access to water for better environmental health.	Agro-ecological Regions I &II
Floods	16. Use of Insecticide Treated Nets (ITNs) and other vector-control measures to prevent malaria. Use of climate-based early warning systems and GIS-mapping of vulnerable localities.	Agro-ecological Regions I &II
Floods	17. Water treatment for quality control (to prevent waterborne diseases) and climate –proofing of sanitation.	Agro-ecological Regions I &II

Water and Energy Sector		
Climatic Hazards	Adaptation Measure	Relevant Vulnerable Regions
Drought	18. Use of renewable energies	Agro-ecological Regions I &II
Drought	19. Efficient use of charcoal and expanded use of ethanol stoves	Agro-ecological Regions I &II
Drought and high temperatures	20. Inter-Basin Water Transfers	Agro-ecological Regions I &II
Drought	21. Regional Integration of Electricity Infrastructure from Biomass Sources	Agro-ecological Regions I &II

Natural Resources - Wildlife and Forest Sector		
Climatic Hazards	Adaptation Measure	Relevant Vulnerable Regions
Drought (seasonal and periodic), floods - water logging, shortened growing season, and delayed on-set of the rains.	22. Improved fire management in game reserves	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought (seasonal and periodic), shortened growing season, and delayed on-set of	23. Construction of watering points e.g. boreholes for watering wildlife	Regions I & II, especially Eastern, Central, Western and Southern provinces

Natural Resources - Wildlife and Forest Sector		
Climatic Hazards	Adaptation Measure	Relevant Vulnerable Regions
the rains.		
Drought (seasonal and periodic), shortened growing season, and delayed on-set of the rains.	24. Breeding programme for selected species in National Park	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought and floods	25. Translocation of animals	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought (seasonal and periodic), shortened growing season, and delayed on-set of the rains. and floods	26. Community based ranching in order to protect vulnerable species	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought	27. Culling to maintain sustainable animal populations	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought	28. Identifying and protecting migratory routes of wildlife	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought	29. Undertaking protective management measures to protect displaced wildlife populations	Regions I & II, especially Eastern, Central, Western and Southern provinces
Drought	30. Developing small dams, and other storage facilities, to mitigate droughts/flooding, to harvest water and to initiate community-based fish farming and breeding	Regions I
Drought and high temperatures	31. Improved extension services to ensure sustainable land and forest management	All regions with viable water bodies
Drought and floods	32. Promotion of community forest management	All regions with viable rivers and water bodies
Drought and floods	33. Forest fire management at the community level	All regions with viable rivers and water bodies
Drought and floods	34. Targeting afforestation and re-afforestation programmes to control siltation of streams and rivers as well as to provide fuel wood to minimize encroachment of the forests	All regions with viable rivers and water bodies
Drought and floods	35. Promotion of community woodlots for the provision of fuel wood and as sources of alternative cash income	All regions with viable rivers and water bodies
Drought and high temperatures	36. Improving energy access and security, especially in rural areas (e.g., through the Rural Electrification Agency, promotion of	All regions with viable water bodies

Natural Resources - Wildlife and Forest Sector		
Climatic Hazards	Adaptation Measure	Relevant Vulnerable Regions
Drought and floods	37. Developing and implementing strategies for drought preparedness, flood zoning and mitigation works energy-efficient stoves)	All regions with viable rivers and water bodies
Droughts	38. Restocking of depleted game areas	Regions I & II, especially Eastern, Central and Western Provinces

Given in Appendix I is an elaboration of the projects in logical framework.

3.3 Linkages to National Priorities, Action Plans and Programs

The NAPA embraces and harnesses several on-going plans by the Government that offer the strating point to build adaptation concerns into national sustainable development. Many of these initiatives are underway and at various stages of implementation. Some of the key policies, strategies, programmes and projects that are relevant to the NAPA process and are related to the vulnerability to climate change and variability are summarized in Table 3.2.

Further review of these initiatives reveals that the strategies policies employed are relevant to climate change and therefore form the supportive legal framework for the implementation of the NAPA. For instance, several strategies as articulated in the National Policy on Environment (environment protection and sustainable utilization of natural resources) do, in fact, bring to the fold the environmental concerns in each of the sectors of the country's economy and linking it with poverty reduction strategies and the MDGs. The climate change hazards can derail the development process if an enabling environment is not put in place to synergize all the relevant policies (Table 3.2) for economic growth to flourish. The role of NAPA is therefore to augment the strategies already put in place in order to contribute to the national objectives of *poverty reduction through sustained economic growth, employment creation, and enhancement of food security*". This objective is well articulated in PSRP, other supportive policies, the Fifth National Development Plan (FNDP), and other the MEAs.

Table 3.2: Some of the Key Policies, Strategies, and Programmes that are Relevant to the NAPA Process

Policy/Strategies	Main focus of the Policy and programmes
National Environmental Action Plan (NEAP), 1994	Gives an overview of the county's environmental problems, existing legislation and institutions, and strategy options for improving environmental quality. Environmental problems identified included soil degradation, deforestation, water pollution and inadequate sanitation, air pollution, wildlife depletion.
National Policy on Environment 2007	Provides environment and natural resources management policies to address current and future threats to environment and to human livelihoods and provides a policy guidelines for sustainable development
Forestry Policy, 1998	To ensure rational & sustainable management & utilization of forest resources using a broad based & participating approach to ensure that all stakeholders are recognized and actively participate. Issues of concern include resource management and development, resources allocation, capacity building; and, gender equality
The Forest Act, Cap 199	The forest Act provides for the establishment and management of National Forests and Local Forests, makes provision for the conservation and protection of forests and trees and licensing and sale of forest produce. It permits joint forestry management for selected forests through the Local Forests (control and Management) Regulation, 2006. This means that local communities I these areas participate in the management of the forests areas through committees and registered Forest trusts to promote forest conservation and arrest forest destruction
The Zambia Wildlife Act, 1998	The main objectives of the Act are to provide for the establishment, control and management of National Parks and for the conservation and enhancement of wildlife, eco-systems, biodiversity, and of objects of aesthetic, pre-historic, historical, geological, archaeological and scientific interest in National Parks. It further provides for the promotion of opportunities for the equitable and sustainable

Policy/Strategies	Main focus of the Policy and programmes
	use of the special qualities of National Parks.
The Water Act, Cap 198	Provides for the ownership, control and use of water. It does not apply to any international waters and does not regulate private and ground water. The Act regulates the use of water for domestic use, irrigation, mechanical or industrial purposes or for the generation of power and for mining.
Zambia Forest Action Plan (ZFAP), 1995	ZFAP objectives is to establish a framework for strategic planning in forestry and raise awareness of issues related to the forest sector, prepare and update the forest policy, and prepare appropriation action plans and programmes.
National Agricultural Policy, 1995	To facilitate and support the development of a sustainable and competitive agricultural sector that assures food security at national and households levels and maximizes the sector's contribution to GNP. Sector policies and objectives include food security, contribution to industrial development, income and employment and sustaining the resource base.
Irrigation Policy and Strategy 2004	Aims to promote a well-regulated and profitable irrigation sector that is attractive to both private investors and the country's partners. The policy aims to remove constraints associated with agricultural produce through provision of various incentives so as to increase profitability of irrigated farming for different groups of farmers.
National Biodiversity Strategy and Action Plan, 1999	Aims to ensure the conservation of a full range of country's natural ecosystem through a network of protected areas and conservation of genetic diversity of crops and livestock. The plan also aims to improve the legal and institutional framework and human resources to implement the strategies for conservation of sustainable use and equitable sharing of the benefits from biodiversity;
Zambia National Action Plan for Combating Desertification, 2002	The action plan aims to contribute to sustainable environmental management through the reduction/control of land degradation thereby contributing to poverty reduction, food self sufficiency, & ultimately contributing to economic growth. The immediate objectives are to reduce the destruction of land resources in affected areas; promote sustainable use of land-resources; increase public awareness & information dissemination on matter of land degradation; provide a suitable policy & legislature framework for implementation of NAP; establish & support effective administration & coordination of NAP; introduce & improve assessment planning & monitoring systems for effective management of NAP; establish partnerships with multilateral & bilateral institutions in the management of arid areas.
National Energy Policy, 1994	The policy aims to promote optimum supply and utilization of energy, especially indigenous forms, to facilitate the socio-economic development of the country and maintenance of a safe and health environment. Specific policies include: reducing dependence on wood fuel; increasing accessibility and development of the most cost effective hydro-electricity power sites; improve efficiency in the importation and consumption of petroleum; promote the role of coal in meeting energy demands while minimizing the environmental impacts of coal mining and utilization; and, overcome the constraints preventing wider use of new and renewable sources of energy
Poverty Reduction Strategy Paper, 2002 -2005	This is the overall framework for national planning and interventions for development and poverty reduction. Identifies priority measures in each sector to be implemented in three years with the support of annual national budgets
National Water Policy, 1994	Aims to guide development in conservation, management, demand and supply of water resources and facilitate an equitable provision of adequate quantity and quality of water for all competing groups and users at acceptable costs and ensuring security of supply under varying conditions. The policy also recognizes the importance of water for public health, food production, and industrial development, production of energy, the natural environment and other aspects that enhance the quality of life such as transportation, recreation and tourism.
National Policy on Wetlands Conservation, 2002	Aims to promote the conservation and sustainable use of wetlands in order to sustain their ecological and socio-economic functions for the benefits of the present and future well being of the people.
National Health Strategic Plan, 2002-2005	Aims to implement an integrated approach to health care giving priority, among others, to eradication of malaria within the framework of Roll Back Malaria Initiative; control of TB; and, improved public health surveillance and control of epidemics
Disaster Management Operations Manual, 2005	This summarizes the roles, responsibilities and procedures relating to the management of disasters in general, and drought induced disasters, in particular. It sets minimum standards in the provision of disaster management services in order to embrace the most effective ways of saving lives, protecting property and the environment from damage and

Policy/Strategies	Main focus of the Policy and programmes
National Disaster Management Policy 2005	destruction. The policy aims to promote the safety net for protection of the public against disasters through a pro-active, community-based, developmental and multi-sectoral approach that combines disaster preparedness, prevention and mitigation, and integrates disaster management into national development.
Decentralization Policy, 2002	Aims to achieve a fully decentralized and democratically elected system of governance characterized by open, predictable and transparent policy making and implementation processes, effective community participation in decision-making, development and administration of their local affairs while maintaining sufficient linkages between the centre and the periphery.
Fifth National Development Plan (FNDP) 2006-10	FNDP whose theme is “Broad Based Wealth and job Creation through Citizenry Participation and Technological Advancement”. The strategic focus of the plan is on economic and human resource development. The plan recognized that in order to achieve economic and social development, social protection including issues such as environment protection, HIV/AIDS, gender and governance are critical for achievement of sustainable livelihood, job creation and poverty reduction and attainment of MDGs. This holistic approach that incorporates cross-cutting issues in national development and encompassing all sectors has been taken to accelerate development of pro-poor pillar. For instance, integrated water resource management programme, cross-sectoral issues such as land use, irrigation, wetland conservation and climate change will be addressed in order to optimize benefits for Zambians

3.4 Existing Programmes that can integrate Climate Change Adaptation

3.4.1 Agriculture

Collaborative projects on the formulation of the National Adaptation Programme of Action with the Ministry of Agriculture and Cooperatives include:

Table 3.3 Existing programmes and projects under agriculture

Sector: Agriculture			
Programme/Project	Objective	Strategies	Relevance to NAPA
Irrigation development and support	To promote a well regulated and profitable irrigation sub-sector that is attractive to both the public and private sectors	<ul style="list-style-type: none"> • Develop socially desirable and economically viable irrigation schemes; • Construct communal bulk water supply systems • Facilitate an irrigation development fund to enable farmers access funds for comprehensive irrigation development that goes beyond provision of irrigation equipment • Facilitate the establishment of water rights that are supportive of sustainable agriculture development • Promote sustainable utilization of wetlands and dambos 	The irrigation development fund will provide the irrigation sub-sector with loans and matching grants with regard to smallholder irrigation schemes which are Poverty Reduction Programmes. Small scale farmers can individually access loans to acquire irrigation technologies that will help farmers to address effects of drought.
Agriculture infrastructure and land development	To promote the improvement of agricultural infrastructure and land for sustainable production and productivity	<ul style="list-style-type: none"> • Ensure sustainable agricultural land use planning and management • Develop new farm blocks and facilitating basic infrastructure development • Develop a land information 	The 9 farm blocks that are being developed will provide new land and farming technologies to all levels of farmers. This will contribute to food security.

		system for the agricultural sector	
Livestock development programme	To improve the productive efficiency of the livestock sector in a sustainable manner and support the marketing of both livestock and livestock products and contribute to food security and increased income	<ul style="list-style-type: none"> • Regulate and control the quality of livestock, livestock products, and stock feeds • Promote private sector participation in the provision of livestock and extension services, and in marketing of livestock and livestock products • Create and promote awareness in the conservation of animal genetic resources • Facilitate implementation of disease and vector control programmes with private sector participation • Establish the emergency disease control fund to control transboundary animal diseases, such as foot and mouth disease, CBPP, etc. • Strengthen the early warning system; • Rehabilitate the vaccine unit • Establish two disease free zones by 2010 • Devise efficient and sustainable diagnostic techniques in investigations of diseases • Enforce all legislation in the livestock sub-sector 	One of the major components in this programme will be to develop a good early warning system in terms of disease outbreaks control. Relevance to NAPA is very high.
Agricultural services and technology development	To provide appropriate, efficient technology development and transfer services in order to assist farmers increase agricultural production and productivity	<ul style="list-style-type: none"> • Develop appropriate agronomic packages and technologies for sustained farming systems and overall agricultural production and utilization • Promote crop diversification • Design and promote appropriate on-farm transportation, processing and storage structures, especially for small scale farmers to minimize or prevent post-harvest losses • Promote research/ extension/ farmer linkages in order to have more farmers' input in research and technology transfer • Promote cost sharing with beneficiaries of agricultural research and extension • Regulate the introduction and use of agro-biotechnology products, in particular Genetically Modified Organisms (GMOs) • Promote and encourage the involvement of the private sector and NGOs in the provision of extension services • Ensure gender equity in access to 	This programme will promote crop diversification; development of appropriate farming technologies for sustainable farming systems. So the relevance to NAPA is very high.

		Animal Draught Power (ADP) among female and male small scale farmers	
Fertilizer Support Programme	To increase private sector participation in the supply of agricultural inputs to small-scale farmers and therefore contribute to increased household food security and income	<ul style="list-style-type: none"> i) The programme started in 2002 supporting 120,000 small scale farmers. ii) Each farmer is given fertilizer and seed input for one hectare only at 50% cost. iii) This programme will run up to the end of 2008 farming season. iv) From 2006 the subsidy was increased to 60%. 	The programme provides fertilizer and seed to small scale farmer at 50% subsidy. It also provides seed that is early maturing in drier parts of the country. This will improve food security among the poor communities. Relevance to NAPA is very high.
Conservation tillage for moisture conservation	To sustain yield and profit by saving soil, water and nutrients and to contain costs of production	<ul style="list-style-type: none"> To reduce labour demand at peak time; To reduce costs of production with relevance to land preparation; To save soil, nutrients and increase soil water storage through reduced run-off from organic matter build up; To have sustainable yields from improved plant growing conditions. 	This programme promotes use of appropriate technology in the face of reduced rainfall. It is therefore very good as an adaptation measure. Relevance to NAPA is very high

• **Livestock Production**

Introduction of well-adapted livestock could be incorporated into the on-going Government programme of “Cattle Restocking”. However, in Lusitu the local goats (rather than cattle) should be more seriously considered since they are hardier than cattle and can withstand more severe drought situations than cattle. For Monze, local breeds of cattle could be stocked as long as the supply of feed and water is guaranteed. To this effect, skills of feed conservation for dry season supplementation must be imparted into smallholder farmers.

• **Fisheries**

Currently the Department of fisheries is implementing the following programmes: Farmer-based Aquaculture Training; the National Aquaculture Research and Development Centre (NARDC); Rural Aquaculture Programme (RAP); Support to Agriculture in Eastern Province; Poverty Reduction Programme (PRP); CLIMAFISH; and Zambia Japan Cooperation Project on the Ecology and Behaviour of Fish in Lake Tanganyika; Some of the projects indicated above cover a wide range of activities and fisheries could be a small component of the project. Most of the current programmes implemented in the Department of Fisheries do not integrate climate change as a component. There is only one project the CLIMAFISH that aims at assessing impacts of climate change on the ecology of the area.

There is therefore need to re-orient programmes of the Fisheries Sector so that issues on climate change either from the capture or culture fisheries are taken into account as shown in Table 3.3.

Table 3.4: Existing Programmes under Fisheries

Programme/Project	Objectives	Activities	Relevance to NAPA
Farmer-based Aquaculture Training	To empower small scale and rural fish farmers	- started in 2006 and the current phase of the project should come	This programme will improve the

Project	with relevant agricultural knowledge and skills in order to increase aquaculture production.	to an end in 2007. - baseline data collection on fish Farmers in selected provinces, Copper-belt, Lusaka, Western, North-western and Central provinces. - training fish farmers through a 3-week residential course in Aquaculture	food security situation of the communities
National Aquaculture Research and Development Centre (NARDC)	To establish aquaculture research in the Department of Fisheries	- started as far back as 1995 in Mwekera near Kitwe on the Copper-belt - basic and applied research in the following areas: fish seed propagation; fish feed formulation; and pond environment.	Aquaculture will contribute to the improvement of livelihoods of people
Rural Aquaculture Programme (RAP)	to increase Aquaculture production through improved extension service	- supported by American Peace Corps and provides Volunteer Extension Agents who work in communities and support aquaculture expansion - conducts training of Peace Corps Volunteers for 3 months in technical aspects of Aquaculture and identified local languages. - Posting of volunteers and actual execution of extension programmes by volunteers in rural posts	Aquaculture will contribute to the improvement of livelihoods of people
Support to Agriculture in Eastern Province	To carry out infrastructure development and supports research and extension in Aquaculture production in Eastern Province	Providing extension services; rehabilitation of experimental ponds; procurement of field and laboratory equipment adjustments; and conducting research trials on selected farms in various fish production systems.	Aquaculture will contribute to the improvement of livelihoods of people
Poverty Reduction Programme (PRP)	Aquaculture component of the programme aims at increasing aquaculture and fisheries production in resource poor rural communities so as to reduce poverty.	Main activities of the fisheries component include the following: establish and operationalise a fish farmer out grower scheme in Lusaka Province; dam fish restocking in Southern Province; support to annual fish ban in Luapula Province; fish farmer training and fish seed procurement in North-western Province; pond construction and stocking in Central Province.	Aquaculture will contribute to the improvement of livelihoods of people
CLIMAFISH	To assess the impact of Climate Changes on the ecology of Lake Tanganyika with a view to assessing the impact of current global warming	- carries out limnological studies and plankton studies so as to ascertain the effect of climate on fish populations vis-à-vis plankton production. - Sited in Mpulungu on the	The study will help in how to maintain the right fish populations in the lake that is a

	on the biodiversity of the area.	shores of Lake Tanganyika and is supported by the Belgium Government	source of livelihoods for fishing communities
Ecology and Behaviour of Fish in Lake Tanganyika	To study the behaviour of fish so as to understand and ascertain species composition in different habitats and in response to fishing pressure.	- Assessing fish biodiversity. - Supported by Kyoto University in Japan and University of Bern (Switzerland).	The study will help to respond to fishing pressure thereby ensuring that fish is available for the vulnerable fishing communities

3.4.2 Human health

Improved health is an urgent and immediate need in Zambia for purposes of curbing loss of life and livelihoods, increasing economic output and meeting the targets of the MDGs as spelt out in FNDP.

Existing Public Health Strategies

The national health priorities and the relevant strategies are presented in Tables 3.5 and 3.6, respectively, below.

Table 3.5: National Health Priorities of the Fifth National Development Plan (2006 -2010)

Priority Area	Objective
Child health and nutrition	To reduce the mortality rate among children of under five years of age.
Integrated reproductive health	To reduce the Maternal Mortality Ratio (MMR).
HIV/AIDS, TB and STIs	To halt and begin to reduce the spread of HIV, TB and STIs through effective interventions.
Malaria	To reduce incidence and mortality due to malaria.
Hygiene, sanitation and safer water	To promote and implement appropriate interventions aimed at improving hygiene and access to acceptable sanitation and safer water.
Epidemics	To improve public health surveillance and control of epidemics.
Human resources	To train, recruit and retain appropriate and adequate staff at all levels.
Essential drugs and medical supplies	To ensure availability of essential drugs and medical supplies at all levels.
Infrastructure and equipment	To ensure availability of appropriate infrastructure and equipment at all levels.
Systems strengthening	To strengthen existing operational, financing and governance systems for effective delivery of health services.

Table 3.6: Public Health Sector Strategies for the Period 2006 – 2010 under the FNDP

Programmes	Objectives	Strategies	Relevance to NAPA
Malaria Control and Prevention	To reduce morbidity and mortality due to malaria in the general population	<ul style="list-style-type: none"> • Scaling up access and usage of insecticide-treated nets and indoor residual spraying; • Improving laboratory diagnosis for malaria; • Scaling up prevention of malaria during pregnancy through intermittent presumptive treatment; • Scaling up the use of Coartem to the private sector and community health workers; • Strengthening national, provincial and district health 	Currently, there is random and delayed deployment of existing interventions due to limited financial and human resources, resulting in over 4 million cases of malaria annually. However, malaria is a climate sensitive disease whose outbreaks are associated with increased rainfall and temperature. Consequently, one of the options to improve the adaptive capacity to malaria is to integrate into existing measures a climate-based early warning

		<p>systems' capacity to plan, implement and manage malaria control efforts; and</p> <ul style="list-style-type: none"> • Developing and implementing an IEC system for families to prevent and control malaria. 	system for malaria to enable communities where malaria outbreaks are forecasted to occur.
Environmental health	To reduce the incidence of water and vector-borne diseases	<ul style="list-style-type: none"> • Strengthening capacity in enforcement of environmental health policies and legislation; • Promoting the establishment of new and strengthening of existing Water, Sanitation and Hygiene Education (WASHE) at national, provincial, district and sub-district levels; and • Strengthening coordination and management of environmental health at all levels of care. 	The current state of environmental health, especially in shanty townships and rural areas, is poor enough to constitute a major health risk factor that is responsible for increased outbreaks of diseases during droughts and floods. This is because the existing environmental health policies, laws and measures have not integrated climate risk management and they lack adequate institutional mechanisms for effective community-based application. The NAPA must, therefore, mainstream climate risk management into environmental health policy and practice. At community level, the aim is to climate-proof sanitation, drainage and water supply facilities
Nutrition	To contribute to the reduction in morbidity and mortality among the general population through improved provision of nutrition	<ul style="list-style-type: none"> • Strengthening the National Food and Nutrition Commission for optimal coordination of nutrition programmes and activities; • Promotion of optimal feeding practices for infants and children • Promotion of maternal nutrition in pregnancy and lactation; • Provision of support to micronutrient deficiency prevention and control • Strengthening the growth monitoring and promotion programme; • Provision of information on balanced diet including food aid management services to in and out patients; and • Strengthening the school health programme. 	Malnutrition has long been recognized as a serious public health problem in Zambia. Indicators for nutritional status of children aged under five years for the period from 1990 to 2003 show an increase in the prevalence of stunting (chronic malnutrition) from 39.6 to 49%. This has been attributed to the prevailing high food insecurity levels and inadequate dietary diversity in the country. Droughts and floods invariably wipe out food resources and thus act to worsen the existing malnutrition levels. Adaptation measures must include options for long-term food security and diversity, even under conditions of extreme weather events. Food security measures must also be integrated with environmental health options as food alone will not prevent disease in an unhygienic environment.
Integrated Disease Surveillance	To significantly improve public health and surveillance and control of epidemics	<ul style="list-style-type: none"> • Strengthening the country's capacity to conduct effective surveillance for both communicable and non-communicable diseases. • Strengthening laboratory 	Disease surveillance provides a means of detecting unusual patterns in disease prevalence and thus constitutes an integral part of any fully-fledged climate-based early warning system of infectious

		<p>capacity and involvement in confirming pathogens and monitoring drug sensitivity.</p> <ul style="list-style-type: none"> • Reviewing Health Management Information Systems 	diseases
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3.4.3 Natural resources

Existing programmes under natural resources that are relevant to NAPA include the Integrated Land use Management project under the Forestry Department, the Natural Resources Management Component under the Environment and Natural Resources Management Department and the SADC Biodiversity Support Programme.

Table 3.7: Existing programmes under Natural resources

Programme/Project	Objectives	Activities	Relevance to NAPA
Integrated Land use Management	<ul style="list-style-type: none"> - Assist land use institutions in developing and strengthening their capacity to collect, compile, process and disseminate reliable and update information on land use to policy makers. - Assist land use institutions to plan and carry out pilot national land use assessments. 	<ul style="list-style-type: none"> - Carry out land use assessments, monitor resources and manage related information - Carry out training of national staff in land use assessment techniques - Reconstruct land use and cover map - Collect field data on land use resources - Review national priorities on land use resources 	Better managed land use resources will reduce the release of Carbon dioxide to the atmosphere one of the green house gases. Further, improved land management will assist the vulnerable groups in adaptation to climate change
The DANIDA Natural Resources Management Component	<ul style="list-style-type: none"> - Enhance income opportunities and resource management - Test and share innovative approaches and partnerships in resource management and poverty alleviation - Improve capacity of government and civil society institutions to support sustainable natural resources management 	<ul style="list-style-type: none"> - Promotion of sustainable agricultural practices through support for conservation farming and agroforestry. - Carry out land use planning for Mumbwa game Management Area - Establishment of income generating activities based on sustainable use of natural resources 	Sustainable use of natural resources will assist in reducing the threat posed by climate change. Innovative approaches in resource management will assist local communities to adapt to effects of climate change
SADC Biodiversity Support Programme.	<ul style="list-style-type: none"> - Establish capacity and institutional mechanisms for the SADC members to collaborate in regional biodiversity conservation 	<ul style="list-style-type: none"> - Establish and support national and regional expert groups - Develop regional biodiversity strategy - Preparation of innovative financing mechanisms for biodiversity conservation 	Improved biodiversity conservation in the region will help in addressing causes and effects of climate change

4.0 CRITERIA FOR SELECTING PRIORITY ACTIVITIES

The intended outcome of the NAPA process is to produce a list of priority activities which are amenable to Zambia's development goals and poverty reduction strategies, while at the same time enhancing the adaptive capacity of the vulnerable communities against a backdrop of climate change and variability. These activities are options for addressing the actual and potential adverse effects of climate change. These same options should simultaneously contribute positively to the adaptive capacity of the vulnerable communities. Thus, the potential NAPA document as per the UNFCCC requirement should be evaluated in light of national perspectives – the national development priorities such as poverty reduction strategies, MDGs, and other multilateral environment agreements. In essence, the NAPA activities should be assessed in the context of their contribution to the national sustainable development goals and the need to target the vulnerable groups with no capacity to respond to the adverse effects of climate change.

4.1 Prioritization of the Adaptation Measures

The unranked or unprioritized list of adaptation measures identified for offsetting climate-related hazards/risks is indicated in Table 3.2. In total, there are about thirty nine adaptation measures or options which were identified from the key sectors to address the adaptation needs. It is obvious from this list that no amount of resources available will address all the options. Thus, further scrutiny and screening of the options was necessary to shorten the list through priority targeting. The resultant list is the priority adaptation options which can be considered for financial support by the UNFCCC secretariat and other developmental partners.

4.2 Criteria for Selecting Potential Adaptation Options

The criteria developed for screening potential options is based on the need to address convincing threats of climate and climate change. Thus, a set of agreed criteria was used for screening of the options via a multi-criteria analysis (MCA)⁴ procedure. The MCA uses multiple criteria and has been suggested and illustrated in the LDC Expert Group (LEG) annotations of the NAPA guidelines. This analysis approach was adopted and applied to the activities for screening. This step involved narrowing down the list according to the selected criteria.

In accordance with requirements of the UNFCCC that each host country defines its sustainable development goals and aspirations, Zambia took a multi-stakeholder approach in arriving at the definition of sustainable development. The options for assessing the sustainable development element of identified projects were developed by the Centre for Energy, Environment and Engineering Zambia (CEEEZ) and endorsed by the NAPA working group. The definition of sustainable development in Zambia was endorsed by the NAPA Working Group Committee.

The process for elaboration of sustainable development involved a combination of Rating and Normal Ranking approaches. The rating approach gave appropriate weighting to the three broadly agreed upon principles of sustainable development goals, namely economic, environmental and social. Indicators related to each of these principles were then identified in relation to the indicators agreed upon earlier. The normal approach then weighed each indicator in each given category after which the total marks accrued were proportionally

⁴ See Yamba, F.D., and E. Matsika. (2002) *Sustainable Development Goals and Indicators from Clean Development Mechanisms (CDM) Perspectives*. Lusaka: Centre for Energy, Environment and Engineering Zambia Limited.

related to a percentage of a given category. The NAPA Working Group recommended and used the following weighting for the main principles:

- Economic 33.3%
- Environmental 33.3%
- Social 33.3%

The rationale behind this weighting is that economic development is taken as the driving force. Nevertheless, such development should be equally carried out in an environmentally friendly manner and thus improve the social life. Regarding the weighting of indicators under each principle, the normal ranking criteria on a scale of 1 to 9, where 1 = **Weakly important**; 3 = **Less Important**; 5 = **Moderately Important**, 7 = **More Important**; and 9 = **Extremely Important** in terms of its impact or contribution.

The assessment was undertaken during the national workshop by a large group of stakeholders grouped by sectors. Each member of each sector group was requested to assess the project individually based on the identified indicators upon which basis an average mark was given for each indicator.

Below is a list of projects as prioritized.

- Strengthening of early warning systems to improve services to preparedness and adaptation to climate change in all the sectors (agriculture, health, natural resource, and energy)
- Promotion of alternatives sources of livelihoods
- Adaptation of the Effects of Drought in the context of Climate Change in Agro-Ecological Region I of Zambia
- Management of critical habitats
- Promote natural regeneration of indigenous forests
- Adaptation of land use practices (crops, fish, and livestock) in light of climate change
- Maintenance and provision of water infrastructure to communities to reduce Human-Wildlife Conflict
- Eradication of Invasive Alien Species
- Capacity building for improved environmental health in rural areas
- Climate-proofing sanitation in urban areas

The actual score and rankings are provided in Appendix I. The detailed logical framework for each of these projects is give in Appendix II.

5.0 THE NAPA PREPARATION PROCESS

The need to support the LDCs to develop NAPA was agreed at COP7 to the UNFCCC. The NAPA is a low-cost consultation initiative and is a vehicle under which the country would communicate its urgent and immediate developmental needs in relation to the adverse effects of climate change. The Zambia NAPA proposal was approved by the GEF in December 2003, with UNDP as the implementing agency. To kick start the NAPA, the GEF allocated \$197,500 and the Government provided in-kind contribution amounting to \$12,500. Actual implementation on the ground started with the recruitment of the NAPA Coordinator in July 2005.

The process followed in Zambia in formulating the NAPA involved the following stages: (1) Identification of stakeholders and stakeholder institutions to participate in NAPA process which then culminated into an inception workshop for the participation of the identified stakeholders; (2) Vulnerability assessments were then conducted through stakeholder consultations in the targeted vulnerable areas; (3) This process was facilitated by Project Management Unit (PMU) in MTENR and consultants with relevant experience in agriculture, natural resources, human health, energy and climate change. This resulted in production of synthesis reports for use in the NAPA. These reports were presented to the NAPA working group for validation and approval; (4) CEEEZ was requested to present the selection criteria which they developed and was endorsed by NAPA working group. This criteria was later used for prioritization and ranking of the proposed projects at a national workshop. Some of these steps are discussed below.

5.1 Building of the NAPA Technical Teams and Committees

Establishment of the Project Management Unit: This was established after the NAPA Coordinator assumed office in July 2005. A part-time Project Assistant was allocated to the PMU but later withdrawn by the Department. The work plan and budget was reviewed and approved by the NAPA committee.

Establishment of the NAPA Working Group: Following the recruitment of consultants in January 2006, the climate change technical group was formed to act as a NAPA Working Group. This technical group provided technical assistance and support to NAPA.

Establishment of a National Steering Committee: Following the inaugural meeting of the National Steering Committee (NSC) held in February 2006, stakeholders resolved to establish a NSC to be known as the Environment and Natural Resources National Steering Committee (ENRNSC). The Permanent Secretary - MTENR or its designate was the Chairperson. Membership of 20-25 members was drawn from a range of public, NGO and private sector organizations (Box 2). At its first sitting, the committee debated and agreed upon the Terms of Reference of the ENRNSC. Its main responsibility was mainly to spearhead the implementation of all projects in the MTENR including the NAPA through the

Box 2

- **Lead Ministry –MTENR-**
Chair & relevant departments
- Ministry of Finance and National Planning
- Ministry of Lands
- Ministry of Agriculture and Cooperatives
- Ministry of Energy and Water Development
- Ministry of Mines and Minerals Development
- Zambia Meteorological Department
- Environmental Council of Zambia (ECZ)
- Zambia Wildlife Authority
- National Institute of Science and Industrial Research (NISIR)
- Zambia National Farmers Union
- Wildlife and Environmental Conservation of Zambia
- Gender in Development-Cabinet Office
- Energy and Environmental Concerns for Zambia
- Timber Producers Association of Zambia
- Zambia Alliance of Women

provision of strategic oversight and policy guidance.

Recruitment of Consultants to Assist in the Formulation of the NAPA: Five consultants recruited in January 2006 to work with the PMU in the formulation of the NAPA. They assembled the NAPA synthesis reports and identified adaptation options for inclusion in the NAPA.

5.2 Participatory Vulnerability Assessment

This process involved carrying out rapid participatory vulnerability assessments in two of the targeted provinces of eastern and Southern provinces. These provinces fall within the Agro-ecological regions I and II which are most vulnerable to droughts and to a lesser extent floods especially in the low-lying areas. The purpose of the assessment was to identify problems/vulnerability, impacts, and understand the vulnerable communities' adaptive capacities to climate change.

5.3 Criteria Selection and Prioritization Process:

The criteria for the selection of NAPA priority activities were agreed upon by the NAPA Working Group. As the DMMU and MACO were not represented at this meeting, it was agreed that further efforts be made to meet with the two institutions. The NAPA coordinator visited and consulted with representatives of the two institutions separately. Thirty eight adaptation options were identified. Out of this twenty seven projects were proposed. However during the workshop where prioritization was done some of these projects were merged. As a result, only fifteen projects were actually prioritized and ranked by sector using the MCA analysis procedure.

5.4 Transparency

The NAPA formulation process involved the participation of many stakeholders –senior government officers in key ministry, representative of NGOs, civil societies, academicians, the private sectors, and vulnerable communities. This process ensured transparency and consensus building in integrating strategies and plans in the document. The process entailed the following:

1. *Country Drivenness:* Zambian economy has suffered greatly due to the impact of climate change – drought and floods. Most affected individuals are the vulnerable communities who depend on rain-fed agriculture for their livelihoods. The government is committed to ensuring that the vulnerable communities are supported with safety-net programmes which would enhance their adaptive capacity to cope with adverse effects of climate change. Government also recognizes the importance of NAPA to steer and help the country adapt and mitigate problems related to climate change. In addition the government is committed to complement and support the NAPA initiatives as articulated in the FNDP. The government is also committed to work towards the domestication of international environmental conventions such as CITES, CBD, UNCCD, Ramsar Convention, and Convention for the Protection of World Heritage during the same period. Thus, the NAPA is seen to complement the efforts of the government in contributing to the security of the vulnerable Zambians by ensuring that incapacitated and low capacity households have sufficient livelihood security to meet basic needs, and are protected from the worst impacts of risks and shocks are a result of climate change.

2. *Government Endorsement:* The draft NAPA document will be shared with members of the Cabinet Office and Special Parliamentary Committees responsible

for environment and agriculture. This is necessary in order to obtain concurrence before endorsement of the document by higher level authority of the Government Republic of Zambia.

3. *Monitoring and Evaluation:* The programmes under NAPA with financial support from the GEF will utilize the same M&E procedures as those for all GEF projects but with modification to ensure speedy accomplishments of results. A number of key stakeholders will be involved in the monitoring of the projects together with GEF and UNDP as the implementing agency. Depending on the nature of the project and the timeframe, the projects under NAPA will have detailed monitoring and evaluation plans. These plans will include but not limited to the following:
 - Annual monitoring, including long-term indicators and targets
 - Mid-term evaluation
 - Baseline survey to establish pre-project activities values
 - Review of M&E and incorporation of lessons learned.
 - End of year report/ or terminal report.

6.0 CONCLUDING REMARKS

Climatic hazards caused by climate change and extreme weather events are a threat to economic growth and development of Zambia. Droughts and floods, in particular, adversely impact on food security, water, health, energy and the sustainable livelihoods of rural communities. With over 70% of the population living below poverty line, Zambia's vulnerable communities do not have sufficient capacity to cope with, or adapt to, the impacts of extreme weather events. Therefore the need to develop adaptation measures for addressing climate change should be high priority for Zambia.

The NAPA document presents the bare minimum number of activities that must be implemented with urgency in order to enable vulnerable 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 communities and areas, and hopefully will ensure sustainable livelihood for these communities.

The next most important activity is to develop the identified projects into full projects proposals which can then be submitted to GEF and other cooperating partners for funding and implementation.

There were several areas that the NAPA could not cover because of both time and financial constraints. There is need for further research in order to determine the exact extent to which climate change impacts wildlife and its habitat. The other area that would benefit from further research is health.

Finally the NAPA must be seen as a road map for the country to seriously embark on incorporating effects of climate change in the national development agenda

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APPENDIX I

RECOMMENDATION ON ASSESSMENT OF SUSTAINABLE DEVELOPMENT FROM ZAMBIA'S NATIONAL DEVELOPMENT PERSPECTIVE

It was agreed that the process of prioritizing projects should be based on a multi-criteria analysis (MCA) involving a combination of Rating and Normal Ranking approaches. This is based on a criteria developed for CDM Projects by Centre for Energy, Environment and Engineering (CEEEZ)⁵.

The rating approach gives appropriate weighting to the three broadly agreed upon principles of sustainable development goals, namely economic, environmental and social. Indicators related to each of these principles are then identified in relation to the indicators agreed upon. The normal approach then weighs each indicator in each given category after which the total marks accrued are proportionally related to a percentage of a given category. The NAPA Working Group recommends and uses the following weighting for the main principles:

Economic	33.33%
Environmental	33.33%
Social	33.33%

The rationale behind this weighting is that economic development is taken as the driving force. Although economic development is the most effective way to adapt, the NAPA focuses on society. Such development should be equally carried out in an environmentally friendly manner and thus improve the social life. Regarding the weighting of indicators under each principle, the normal ranking criteria on a scale of 1 to 9 is used; where 1 = Weakly important; 3 = Less Important; 5 = Moderately Important, 7 = More Important; and 9 = Extremely Important in terms of its impact or contribution.

The assessment is undertaken by a subcommittee comprising ten members of the NAPA Working Group. Each member was requested to assess the project individually based on the identified indicators upon which basis an average mark is given for each indicator.

Given in Tables 1 and 2 are the assessment of sustainable development indicators, and the overall assessment for eligibility for a NAPA project.

⁵ Yamba, F.D., and Matsika E. (2002) *Sustainable Development Goals and Indicators from Clean Development Mechanisms (CDM) Perspectives*. Lusaka: Centre for Energy, Environment and Engineering Zambia Limited.

Table 1: Assessment for Sustainable Development of a NAPA Project based on the Normal Ranking Methodology

INDICATOR	RANKING (NORMAL)					Total
	1	3	5	7	9	
	Weakly important	Less Important	Moderately Important	More Important	Extremely Important	
Economic						
1. Impact of economic growth 2. Impact on MDGs 3. Synergies with MEAs 4. Cost effectiveness – economically sustainable 5. Promotion of SMEs						
Sub - total						
Environment						
1. Reduce negative impacts on the environment 2. Enhance environmental integrity 3. Impact on MDGs						
Sub total						
Social						
1. Reduce poverty to enhance adaptive capacity 2. Impact on wealth creation 3. Impact on health 4. Improvement to local infrastructure 5. Improved livelihoods 6. Impact on MDGs						
Sub total						

Table 2: Overall Assessment for Meeting Criteria for Sustainable Development of a NAPA Project based on the Rating Methodology

INDICATOR	MARKS OBTAINED	REPRESENTATIVE WEIGHTING (%)	TOTAL (%)
Economic		33.33	
Environmental		33.33	
Social		33.33	
Total		100	

Recommendation:

It was agreed that the threshold for project eligibility be set at 60%. This is because NAPA projects are supposed to bring immediate local benefits. The top rated projects will be funded under the LDC, while other funding sources will be sought for the remaining as long as they are rated above the 60% threshold.

A total of fifteen projects were recommended for prioritization. The scores obtained for each project best on the selection criteria and waiting are as given in the table below.

PROJECT TITLE	Principle	SCORE
Maintenance and Provision of Water Infrastructure to Communities to reduce Human-Wildlife Conflict	ECONOMIC ENVIRONMENT SOCIAL TOTAL	9.0 21.0 41.0 71.0
Eradication of Invasive Alien Species	ECONOMIC ENVIRONMENT SOCIAL TOTAL	10.1 27.1 33.8 71.0
Promote of natural regeneration of indigenous forests	ECONOMIC ENVIRONMENT SOCIAL TOTAL	8.5 25.4 39.1 73.0
Management of Critical Habitats	ECONOMIC ENVIRONMENT SOCIAL TOTAL	27.4 27.0 23.4 77.8
Promotion of Alternatives Sources of Livelihoods	ECONOMIC ENVIRONMENT SOCIAL TOTAL	24.3 20.4 43.0 87.7
Adaptation of the Effects of Drought in the context of Climate Change in Agro-Ecological Region I of Zambia	Economic Environment Social TOTAL	26.4 27.74 27.28 81.42
Adaptation of land use practices (crops, fish, and livestock) in light of climate change	Economic Environment Social TOTAL	25.0 27.57 20.11 72.68
Strengthening of early warning systems to improve services to preparedness and adaptation to climate change	Economic Environment Social TOTAL	22.02 27.94 25.24 88.5
Use of renewable energy sources: biomass	Economic Environment Social TOTAL	25.8 20.57 19.33 59
Hydroelectricity generation and inter-basin water transfer	Economic Environment Social TOTAL	18.76 17.49 19.62 55.87
Energy management	Economic Environment Social TOTAL	28.66 18.0 21.0 56.4

Project Title	Principle	Score
Building a multi-sectoral capacity to deal with the health impacts of climate variability and change	Economic	17.10
	Environment	19.05
	Social	16.14
	TOTAL	52.29
Climate-proofing sanitation in urban areas	Economic	15.2
	Environment	21.00
	Social	25.22
	TOTAL	61.42
Capacity building for improved environmental health in rural areas	Economic	17.30
	Environment	21.31
	Social	25.18
	TOTAL	63.79
Improving the resilience of chronically ill people to climate change	Economic	14.20
	Environment	20.00
	Social	21.06
	TOTAL	55.26

APPENDIX II**LIST OF RECOMMENDED PROJECTS AND PROGRAMMES**

Option 1. Title	Adaptation of the Effects of Drought in the context of Climate Change in Agro-Ecological Region I of Zambia				
2. Rationale/ Justification	<p>Assessments that were undertaken as part of the NAPA process indicate that climate change will increase vulnerability especially in arid regions, which typically correspond to Agro-Ecological Regions (AER) I and II in Zambia. The NAPA has highlighted that areas suitable for staple crops, such as maize production in these regions are likely to reduce by more than 80%. Within these regions, since the 1980s, there has also been a tendency for the later onset and earlier withdraw of rains, as well as an increased occurrence of drought years. At the national level, yield changes and other impacts under climate change scenarios suggest frequent shortages of grain. Vulnerability assessments on the economic costs of climate change on agriculture in Zambia undertaken by the World Bank, with support from FAO and the University of Pretoria, indicate that these regions will exhibit severe deficits at critical periods of the cropping calendars. Such deficits could result in severe yield decrease for specific crops such as maize. Based on a CO₂ doubling scenario in these regions, some estimates predict a yield reduction of approximately 66% under rain-fed conditions but only about 16% under irrigated conditions. Currently, less than 5% of arable land in Zambia is irrigated. With changes in rainfall patterns, the average length of the growing season length for maize is also likely to become shorter, with models predicting an approximate reduction in the length of the season of 20%. From an agro-climatic perspective, maize (the main national staple) is already somewhat marginal in AER I, as annual rainfall is commonly insufficient for the crops sown. While agricultural systems are already quite close to the limits of their coping ranges, simulations of future climate change in AEZ I show that maize yields are likely to fall even further under both rain-fed and irrigated conditions.</p> <p>The proposed intervention “Adaptation of the agriculture sector to climate-induced water deficits in Zambia” will complement current agricultural policies and development support programmes. This NAPA follow-up project will contribute towards integrating climate-induced risk management of water resources within the agricultural sector. It will contribute towards improving adaptive capacities of key stakeholders (policy makers, and local communities) to overcome key water availability challenges under worsening climatic conditions</p>				
3. Description	<p>Overall Objective To reduce the vulnerability of those depending on rainfed agriculture practices to anticipated rainfall shortages in the face of climate change including variability.</p> <table> <tr> <td>Activities</td> <td> <ol style="list-style-type: none"> 1. Pilot irrigation and water management systems introduced 2. Training communities on how to maintain and manage irrigation systems in the context of climate change, including variability 3. Capacity building of farmers on water management practices 4. Provide extension support and marketing (supported with co-financing) 5. Provision of credit (supported with co-financing) for irrigation schemes </td> </tr> <tr> <td>Inputs</td> <td> <ul style="list-style-type: none"> • Technical expertise through out the lifecycle of the project • Office equipment, computers, and accessories, • Vehicles, • Irrigation equipment/system • Human (including consultants), and financial resources • Other small equipment </td> </tr> </table>	Activities	<ol style="list-style-type: none"> 1. Pilot irrigation and water management systems introduced 2. Training communities on how to maintain and manage irrigation systems in the context of climate change, including variability 3. Capacity building of farmers on water management practices 4. Provide extension support and marketing (supported with co-financing) 5. Provision of credit (supported with co-financing) for irrigation schemes 	Inputs	<ul style="list-style-type: none"> • Technical expertise through out the lifecycle of the project • Office equipment, computers, and accessories, • Vehicles, • Irrigation equipment/system • Human (including consultants), and financial resources • Other small equipment
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	Short-Term Outputs	Efficient integrated climate forecasting information system Capacity building, education and public awareness
	Potential Long-Term Outputs/Outcomes	Measures to reduce impact of climate change, including variability (e.g. drought/flood) on food supply introduced (e.g. irrigation, and risk spreading institutions). Improved communication and utilization of climate information ranging from seasonal forecasts to longer-term projections
4. Implementation	Institutional Arrangement	MACO is expected to be the lead agency to be involved in the proposed initiative and will be the executing agency. Other relevant stakeholders include MTENR, MEWD, ECZ, Water Development Board, Local government institutions at provincial and district level, NGOs, Research institutions, Cooperating partners in conjunction with ZAWA and CBO will have to again play a major role in ensuring that communities are encouraged to participate, Multilateral institutions Current water users, in particular emergent and traditional farming households
	Risks and Barriers	Eroded soils in many regions, lack of capacity for improved agricultural techniques, and challenging baseline climatic conditions, the potential inadequate capacity on the part of the GRZ to implement (at least part of) the National Irrigation Plan in region I as part of a strong and committed development policy, and the inadequate financial capacity and political will on the part of the GRZ to invest in the rural sector in the target area for project continuation and replication.
	Evaluation and Monitoring	The implementers will monitor the project with the participation of other stakeholders. The MTENR will assume the responsibility of evaluating the project to ensure that it conforms to terms and delivery of results on a regular basis
	Financial Resources	\$3,000,000

Option 2. Title	Strengthening of early warning systems to improve services to preparedness and adaptation to climate change							
2. Rationale/ Justification	<p>Over the years climatic data has been provided to Ministry of Agriculture and Cooperatives and Civil Aviation. The data provided to MACO has not been provided in a more user friendly manner such that those that need this information do not get the full benefit of it at all. If Climatic data can be provided to all stakeholders in a manner that is easily usable by them a lot of the impact of climatic calamities that affect the country could be reduced.</p> <p>It has also been shown that the health delivery system suffers from inadequate distribution of medical facilities, shortage of medical drugs and congested medical facilities during times of epidemics. In this country, epidemics are usually underway before the authorities are notified and epidemic control measures put in place. All these shortcomings translate into high morbidity and mortality amongst Zambians. It is, however, known that the early identification of an epidemic permits adequate planning and implementation of effective interventions to control the disease and reduce the resulting morbidity and mortality in the human population. It has been demonstrated elsewhere (WHO, 2005) that climate information can be used to improve epidemic prediction and therefore has the potential to improve disease control. In fact the Integrated Disease Surveillance and Response (ISDR) programme of Zambia under the Ministry of Health aims to strengthen the country's capacity to conduct effective surveillance for both communicable and non-communicable diseases through integrated data collection and improved monitoring systems. This project aims to complement the activities of ISDR with the purpose of ensuring a timely and effective response for preventive measures (ITNs and insecticides) and medicines in the affected areas.</p> <p>It is therefore important to strengthen early warning services and advance planning for periods of adverse climate variations in a form suited for practical application by users at all levels including local communities</p>							
3. Description	<p>Overall Objective Develop the use of compatible standards and systems; encompassing relevant data and stations; including remote areas; use and disseminate modern technology for data collection, transmission and assessment Strengthening systematic observations of meteorological and hydrological services, and capacity building, education and public awareness</p> <table border="1"> <tr> <td>Activities</td><td> 1 Develop infrastructure for early warning advanced planning purposes 2 Establishment of a National Climate Centre 3 Collect the required climate, environmental and health data 4 Conduct field surveys in representative localities to identify climatic and non climatic disease risk factors 5 Establishment of an effective climate data management system 6 Human capacity for regular monitoring of climate stations for data quality 7 Devise an effective information dissemination process to all sectors that may be affected by climate change </td></tr> <tr> <td>Inputs</td><td>Research personnel, field survey maps, GIS software, satellite imageries, Digital camera</td></tr> <tr> <td>Short-Term Outputs</td><td>Infrastructure made operational Physical presence Systems put in place Monthly/Annual reports System put in place Climate based early warning system for diseases</td></tr> </table>		Activities	1 Develop infrastructure for early warning advanced planning purposes 2 Establishment of a National Climate Centre 3 Collect the required climate, environmental and health data 4 Conduct field surveys in representative localities to identify climatic and non climatic disease risk factors 5 Establishment of an effective climate data management system 6 Human capacity for regular monitoring of climate stations for data quality 7 Devise an effective information dissemination process to all sectors that may be affected by climate change	Inputs	Research personnel, field survey maps, GIS software, satellite imageries, Digital camera	Short-Term Outputs	Infrastructure made operational Physical presence Systems put in place Monthly/Annual reports System put in place Climate based early warning system for diseases
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	Potential Long-Term Outputs/Outcomes	Infrastructure developed National Centre constructed Systems developed Human capacity developed Dissemination information system developed Reductions in morbidity and mortality of the affected populations and timely supply of medical drugs
4. Implementation	Institutional Arrangement	The lead organization will be the ZMD and will be supported by researchers and personnel from the Health, Disaster Management and Mitigation Unit (National and District levels), Central Statistical Office, Universities/Research Institutions and NGOs. The Ministry of Health can even integrate this project into its Integrated Disease Surveillance programme and use the Epidemic Preparedness Committees to spearhead this project at national, provincial, district and community levels The lead institution has to be the ZMD. Other collaborative institutions include MACO, MTENR, MOH, Research institutions
	Risks and Barriers	There are no major barriers and risks anticipated except for possibly the availability of financial resources and satellite imageries, as well as the usual coordination difficulties associated with multi-stakeholder/disciplinary projects
	Evaluation and Monitoring	The lead organization will establish monitoring and evaluation protocols based on indicators for assessing the performance and impact of the project. It is also important to evaluate the cost-effectiveness of this intervention
	Financial Resources	US\$1,800,000

Option 3. Title	Promotion of alternatives sources of livelihoods to reduce vulnerability to climate change/variability to communities living around GMAs									
2. Rationale/ Justification	Climate change will adversely affect the livelihoods of resource-poor rural communities. These are communities experiencing extreme poverty and constitute the most vulnerable groups. The promotion of alternative livelihood sources will contribute to improving community resilience to climate change on their livelihoods through the growth of diverse sources of alternative cash income.									
3. Description	<p><i>Overall Objective</i> To initiate alternative livelihood sources for communities in and around protected areas</p> <table border="1"> <tr> <td>Activities</td><td>Promotion of Income-Generating Activities (IGA) and other alternative livelihood sources Setting up micro credit facilities targeting women beneficiaries Establishment of household woodlots for firewood/poles/timbers</td></tr> <tr> <td>Inputs</td><td>Community based Organizations (CBOs), ZAWA and local communities will play the most important roles Financial institutions, Cooperatives and women's clubs</td></tr> <tr> <td>Short-Term Outputs</td><td></td></tr> <tr> <td>Potential Long-Term Outputs/Outcomes</td><td>Increased alternative sources of livelihood around national parks and GMAs</td></tr> </table>		Activities	Promotion of Income-Generating Activities (IGA) and other alternative livelihood sources Setting up micro credit facilities targeting women beneficiaries Establishment of household woodlots for firewood/poles/timbers	Inputs	Community based Organizations (CBOs), ZAWA and local communities will play the most important roles Financial institutions, Cooperatives and women's clubs	Short-Term Outputs		Potential Long-Term Outputs/Outcomes	Increased alternative sources of livelihood around national parks and GMAs
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Short-Term Outputs										
Potential Long-Term Outputs/Outcomes	Increased alternative sources of livelihood around national parks and GMAs									
4. Implementation	Institutional Arrangement	MTENR in conjunction with ZAWA and CBO will have to again play a major role in ensuring that communities are encouraged to participate								
	Risks and Barriers	If communities are not willing to engage in alternative livelihood sources Government unwillingness to guarantee revolving credit fund and unwillingness of community of women to participate Communities unwillingness to participate in the programme								
	Evaluation and Monitoring									
	Financial Resources	\$175,000 will be required								

Option 4. Title	Management of critical habitats	
2. Rationale/ Justification	Improving knowledge and understanding on critical habitats will contribute to timely interventions and their proper management in the event of climate induced droughts or floods. The major activity in this project is the study identifying these habitats and establishing the likely impacts of climate change and the required mitigation measures as part of a broad strategic framework of game management	
3. Description	<p>Overall Objective To manage critical habitats in National Parks</p> <p>Activities Collect data to establish critical habitats in National Parks To sink boreholes for watering points for animals in the parks Dredging of watercourses and lagoons of sand to increase volume of available water to animals To construct/improve tracks to act as firebreaks in parks</p> <p>Inputs Scientists, financial and other logistical support will be required to accomplish the tasks.</p> <p>Short-Term Outputs Study Reports Number of sited functioning boreholes Number of dredged channels and water bodies Number of tracks constructed or repaired</p> <p>Potential Long-Term Outputs/Outcomes Availability of data indicating critical habitats Maps giving coordinates of location of boreholes Increased capacity of water bodies to hold more water for longer period Reduced incidents of wild fires in parks</p>	
4. Implementation	<p>Institutional Arrangement ZAWA, MTENR Department of Water Affairs (DWA) communities</p> <p>Risks and Barriers Study fits in strategic operational plans of institution Easy mobilization of equipment from DWA Water bodies will improve access to waterholes by many animals in times of drought Existing fire management practices have not implemented such activities</p> <p>Evaluation and Monitoring The Forestry department and ZAWA will carry out the monitoring of the project</p> <p>Financial Resources US\$1,400,000</p>	

Option 5. Title	Promote natural regeneration of indigenous forests								
2. Rationale/ Justification	Indigenous forests in Zambia have played a key role in providing timber and non-timber products for communities around forest reserves and the nation at large. The climate change impact on forests is the reduced capacity of the regeneration of Miombo due to temperature increase. The climate change adaptation measure is to lift some pressure on the Miombo forests (deriving from cutting for fuelwood), since with reduced regeneration capacity, Miombo will sustain the pressure. Without such intervention, there would be increased rate of Miombo degradation due to climate change and less natural resources for communities that rely on them for their livelihoods.								
3. Description	<p><i>Overall Objective</i> To promote regeneration of indigenous forests</p> <table border="1"> <tr> <td>Activities</td><td>Promotion of natural regeneration of indigenous woodlands Prevention of wild fires by building fire barriers Promotion of alternative sources of energy</td></tr> <tr> <td>Inputs</td><td>Human and financial resources will be needed</td></tr> <tr> <td>Short-Term Outputs</td><td>Number of hectares under protection for regeneration and monitoring</td></tr> <tr> <td>Potential Long-Term Outputs/Outcomes</td><td>Hectares of regenerated forests under the project</td></tr> </table>	Activities	Promotion of natural regeneration of indigenous woodlands Prevention of wild fires by building fire barriers Promotion of alternative sources of energy	Inputs	Human and financial resources will be needed	Short-Term Outputs	Number of hectares under protection for regeneration and monitoring	Potential Long-Term Outputs/Outcomes	Hectares of regenerated forests under the project
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Evaluation and Monitoring	MTENR through Forestry department.								
Financial Resources	Us\$1,000,000								

Option 6. Title	Adaptation of land use practices (crops, fish, and livestock) in light of climate change
2. Rationale/ Justification	<p>Poverty in Zambia is wide spread, with 73% of the population living below poverty. Over 60% of Zambians live in rural areas, with the majority depending on subsistence rain-fed agriculture, and relying on a single maize harvest for their livelihoods. This makes them very vulnerable to climate related natural calamities and disasters, such as floods and droughts, which directly affect agricultural productivity. The current agricultural practices used are no longer sustainable in the face of the limitations imposed by climate change, and there is urgent need for adaptation to avoid food insecurity, malnutrition diseases and worsening of people living with HIV.</p> <p>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; water management, crop and livestock production, growing of crop varieties and fruit trees and rearing of animal breeds that are drought tolerant, using agro-forestry practices, fish farming and processing, market access and cross cutting issues such HIV/AIDS, gender and the environment.</p>
3. Description	<p>Overall Objectives</p> <ul style="list-style-type: none"> To enhance awareness and training among stakeholders To enhance improved food security, income generation and business opportunities in all agricultural sectors To identify species best suitable for aquaculture under changing climatic conditions due to global warming <p>Activities</p> <ul style="list-style-type: none"> Development of dissemination and training materials on land use practices Review of the National Agriculture Policy Creating awareness about the new land use practices through workshops and seminars Training on new land use practices Introduction of sound Land Use Planning Introduction of crops that are more suitable to the changing climate pattern Conduct fish farming trials in each catchment area and agro-ecological zone Identify species suitable for aquaculture in each area Assess the impact of extreme variations in precipitation on aquaculture systems. Monitoring and Evaluation <p>Inputs</p> <ul style="list-style-type: none"> Research materials, human and financial resources will be required <p>Short-Term Outputs</p> <ul style="list-style-type: none"> Training materials available, communities sensitized and talking about the new policy, communities sensitized and talking about the new practices, practice by communities, presence of executing personnel, Number of fish farming trials undertaken Number of areas, stations and agro ecological zones where species have been identified, Number of fish farming systems available and adopted

	Potential Long-Term Outputs/Outcomes	Achievement of food security through the adoption of agriculture practices and crop/livestock choices that are more suitable to the changing availability of natural resources Environmental benefit, with a sustainable natural resource management, adapted to new conditions imposed by climate change.
4. Implementation	Institutional Arrangement	The key institutions will be MACO, ZNFU, Traditional leaders, consultants and key informants in communities.
	Risks and Barriers	Information not readily available to be converted into appropriate agricultural materials No Government support in terms of policy changes, and communities not responding positively
	Evaluation and Monitoring	
	Financial Resources	US\$1,200,000

Option 7. Title	Maintenance and provision of water Infrastructure to communities to reduce Human-Wildlife Conflict								
2. Rationale/ Justification	<p>It was noted that there was need for integrated land management to ensure that watershed areas were not at risk to tree felling (for charcoal or firewood), that rivers and fisheries resources were protected and landscapes were preserved to support wildlife habitats. In extreme drought situations, animals and people come head-to-head competing for available water resource. The maintenance and expansion of existing water infrastructures in communities around parks will ensure the provision of access to potable water for communities living in and around protected areas. This will contribute to the reduction of human-wildlife-conflicts</p> <p>Further discussions identified three sources of risk associated with land management and invariably to wildlife management, namely:</p> <ul style="list-style-type: none"> ▪ Poverty and hunger – especially reflected in food insecurity of communities living in and around the Game Management Areas; ▪ Lack of wage income – or alternative sources of livelihoods to subsistence farming; and ▪ Heightened potential for Human-Wildlife Conflict (HWC) when droughts/floods affect these regions and their communities. 								
3. Description	<p><i>Overall Objective</i> To provide access to potable water for communities living in and around protected areas</p> <table border="1"> <tr> <td>Activities</td><td>Sinking boreholes and repairing existing water infrastructures in communities around parks</td></tr> <tr> <td>Inputs</td><td></td></tr> <tr> <td>Short-Term Outputs</td><td>Number of communities having access to potable water supplies</td></tr> <tr> <td>Potential Long-Term Outputs/Outcomes</td><td>Number of boreholes sunk and water facilities repaired</td></tr> </table>	Activities	Sinking boreholes and repairing existing water infrastructures in communities around parks	Inputs		Short-Term Outputs	Number of communities having access to potable water supplies	Potential Long-Term Outputs/Outcomes	Number of boreholes sunk and water facilities repaired
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Institutional Arrangement	ZAWA, Department of Water Affairs - Communities								
Risks and Barriers	Access to water facilities at the moment is problematic								
Evaluation and Monitoring									
Financial Resources	US\$ 75,000								

Option 8. Title	Eradication of Invasive Alien Species									
2. Rationale/ Justification	Invasive alien plant species compete and sometimes supplant indigenous plant species. Their removal is an important element in the management forests which are being depleted by deforestation. Engaging communities in these activities will also provide opportunities for alternative sources of livelihoods									
3. Description	<p><i>Overall Objective</i> To eradicate invasive plant species</p> <table border="1"> <tr> <td>Activities</td><td>Removal of alien species such as mimosa pigra, lantana camara etc</td></tr> <tr> <td>Inputs</td><td></td></tr> <tr> <td>Short-Term Outputs</td><td>Mapping of alien species in critical habitats</td></tr> <tr> <td>Potential Long-Term Outputs/Outcomes</td><td>Number of hectares cleared of alien species</td></tr> </table>		Activities	Removal of alien species such as mimosa pigra, lantana camara etc	Inputs		Short-Term Outputs	Mapping of alien species in critical habitats	Potential Long-Term Outputs/Outcomes	Number of hectares cleared of alien species
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Financial Resources	US\$ 1,000,000									

Option 9. Title	Capacity building for improved environmental health in rural areas
2. Rationale/ Justification	<p>In rural Zambia today, the main health risk factors, responsible for the current heavy burden of disease, include inadequate safe water supply, poor sanitation and nutrition. According to the Fifth National Development Plan of Zambia (2006 – 2010), access to safe water supplies was estimated at 37% of the population in rural areas, while the sanitation coverage was only 4%. On the other hand, 70% of the population is food insecure. Shifts in temperature and precipitation regimes under climate change can influence the distribution and magnitude of the burden of climate-sensitive diseases in given localities. However, climate change affects human health through complex causal pathways which include water supply, sanitation and agricultural systems. Hot temperatures favour the multiplication of pathogens. Droughts reduce the quantity and quality of water supplies causing food shortages, reductions in personal and domestic hygiene for the people and reduction of the dilution capacity of raw water supply sources for pathogens. Sanitation facilities become sources of infection through reduced personal hygiene and proliferation of excreta-contaminated flies. On the other hand, floods wipe out food crops and wash away faecal matter from sanitation facilities into drinking water sources. Under-nutrition weakens the immune response system of the affected individuals and thus makes them susceptible to infectious diseases.</p> <p>The NAPA vulnerability assessment revealed that hot and dry conditions were associated with increased clinical cases of diarrhoea, non-pneumonia respiratory infections and dysentery. Additionally, the report of the Zambia Vulnerability Assessment Committee revealed that a total population of 1,232,661 persons was in need of food assistance in the drought-hit districts during the 2004/05 drought, while 43 and 48.8% of the children in these areas suffered from diarrhoea and cough, respectively. On the other hand, the 2006/07 floods left over 400,000 persons in need of food aid for a period of over 8 months and in 78% of the affected areas with a population of 1,012,540 persons, there was water contamination from faecal matter because the floods had led to the collapse of toilets and flooding of unprotected domestic water sources. In the rural settings of Zambia, where rain-fed agriculture is the main source of income and food, extreme weather events result into a simultaneous deprivation of water, food and health, including income for the purchase of medicines and transportation to health facilities. The situation is further compounded by the fact that rural communities are currently devoid of any mechanisms for climate risk management and have to depend on government and other external agents for emergency assistance, which is usually short-lived.</p> <p>The additionality costs due to this adaptation measure stem from the following:</p> <ul style="list-style-type: none"> • Developing community-based institutional mechanisms for the implementation of climate-resilient sanitation, water and food supply systems. • Modification or replacement of existing sanitation, water and food supply practices with climate-resilient options. • Simultaneous introduction and expansion of climate-resilient sanitation, water and food supply options into rural communities. <p>This is because in the context of human health in Zambia, climate variability negatively impacts water, sanitation and food systems simultaneously and a single intervention in isolation may result in a negligible reduction in overall disease burden.</p> <p>This NAPA project is intended to be a “no-regrets” adaptation option, implying that it has multiple benefits that can make the affected sectors more resilient to today’s climatic conditions and thus can help in adapting to future changes in climate.</p>
Overall Objective	To improve the health, water and food security of rural populations

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3. Description	Activities	The main activities include the following, water and agricultural engineers, technologists, medical personnel, community leaders, Assess the climate variability and health risk factors in relation with regard to health, food and water security and product development strategies for improving health, water and food security under climatic extremes in the affected areas
	Short-Term Outputs	Knowledgeable and skilled rural personnel and improved water supply and food production technologies Empower communities with knowledge, skills and technologies required for integrated and sustainable health, food and water security.
	Potential Long-Term Outputs/Outcomes	Reductions in morbidity and mortality of the affected populations, improved and sustainable access to water and food and increased resilience to climatic hazards
	Institutional Arrangement	The lead organization will be the Ministry of Tourism, Environment and Natural Resources (MTENR) and the project can be incorporated into the ongoing Natural Resources Management activities either in the Natural Resources or Forestry Departments. However, the project is community-based and MTENR must coordinate and mobilize all the necessary resources and possibly introduce the project in one pilot area.
	Risks and Barriers	The main barrier anticipated can be the difficulty of changing cultural beliefs and behaviours; however, this can be overcome with the necessary training and advocacy
	Evaluation and Monitoring	The lead organization will establish monitoring and evaluation protocols based on indicators for assessing the performance and impact of this multi-phased project
	Financial Resources	\$3,000,000 to be sourced from donors, UNFCCC agencies and/ or Government budget

Option 10. Title	Climate proofing sanitation in urban areas
2. Rationale/ Justification	The NAPA human health vulnerability assessment demonstrated that urban areas are the most vulnerable to diarrhoeal diseases as evidenced by relative clinical cases of diarrhoea in Lusaka and the Copperbelt. Moreover, the 2005/06 heavy precipitation (floods) resulted in over 5,000 cases of cholera and recorded in Lusaka. Cholera cases were also reported in the towns of Ndola, Mazabuka and Kafue. In all these towns of Zambia, cholera cases were common in shanty-township areas. Historically, cholera epidemics have occurred in Zambia during years of heavy precipitation and flooding. According to the health authorities in Zambia, the transmission route for cholera and other diarrhoeal diseases involves the flooding of pit-latrines and aqua-privy toilets that are used in these shanty townships and flood waters then carry the faecal matter into unprotected water sources and to wherever they spread. In fact during floods of 2006/07, the main health threat emanated from the collapse of toilets in schools and communities and the spread of faecal waste into water sources.

	This adaptation option, therefore, aims to introduce into slums latrine designs that are flood-proof. This should be accompanied by measures to regulate control flood-water flows by constructing additional drainage channels, deepening and widening existing drainage, and improved management of solid prevent blockages of drains.	
3. Description	<p><i>Overall Objective</i> To prevent outbreaks of water-borne diseases in urban shanty compounds by flood-proofing sanitation facilities</p> <p>Activities</p> <ul style="list-style-type: none"> • Conduct a situational analysis of sanitation and drainage systems in selected shanty compounds of Zambia. • Conduct a technology assessment of suitable sanitation and drainage options for the selected areas. • Produce designs for the selected sanitation and drainage technologies. • Install the selected sanitation and drainage technologies in the affected localities • Evaluate the impact of the improved sanitation and drainage technologies. <p>Inputs</p> <p>The main inputs include research personnel, architects, engineers and town planners, building technologists, construction materials, and transport.</p> <p>Short-Term Outputs</p> <p>Improved sanitation technologies</p> <p>Potential Long-Term Outputs/Outcomes</p> <p>Reductions in morbidity and mortality of the affected populations and creation of hygienic living conditions for slum dwellers as prescribed by the relevant MDG targets</p>	
4. Implementation	Institutional Arrangement	The lead organization will be the Ministry of Local Government and Housing, including the relevant urban municipalities in the provinces of Lusaka, Southern, Eastern, Central and North-Western. The Ministry of Health must implement the health aspects of this project. In fact this project can be coupled to the ongoing Pre-paid Urban Water Supply Schemes currently being implemented by the Ministry of Local Government and Housing.
	Risks and Barriers	The main barrier anticipated can be the difficulty of securing financial contributions from end-users due to the prevailing high poverty levels in these slums. This can be overcome if all the costs are covered by the project. Accordingly, the project can commence initially in one pilot area.
	Evaluation and Monitoring	The lead organization will establish monitoring and evaluation protocols based on indicators for assessing the performance and impact of the project. It is also important to evaluate the cost-effectiveness and disease-prevention impact of this intervention
	Financial Resources	The estimated budget for this project is US\$ 2,000,000 and can be sourced from donors, UNFCCC agencies and/or government budget.

