THE UNITED REPUBLIC OF TANZANIA
VICE PRESIDENT'S OFFICE



# GUIDELINES FOR INTEGRATING CLIMATE CHANGE ADAPTATION INTO NATIONAL SECTORAL POLICIES, PLANS AND PROGRAMMES OFTANZANIA

DIVISION OF ENVIRONMENT SEPTEMBER, 2012

# FOREWORD

Climate change is a global problem posing challenges to the survival of mankind and sustainable development. It poses a serious risk to poverty reduction efforts and threatens to undo decades of development efforts. The impacts of climate change are and will continue to be more pronounced in poor countries. Severe impacts such as floods, frequent and prolonged droughts, reduced water supply, decline in crop yields, increased vector-borne diseases such as malaria and dengue fever, rising sea level leading to displacement of people and disruption of both terrestrial and marine ecosystems as well as other important natural habitats, are already experienced at various magnitudes.

While climate change has global impacts, poor countries and communities are the most vulnerable because of their high dependence on natural resources that are directly impacted by climate change. They have limited adaptive capacity and in some cases their geographical location contributes to their vulnerability. These are the same countries struggling to deal with poverty and environmental degradation, desertification and waste management challenges.

In Tanzania, the impacts of global warming which is one of the major Climate change symptoms in terms of increased average global temperature; are already evident in almost all sectors of the economy and throughout the country. Given that Tanzania's economic base is dependent on the climate sensitive natural resources, this makes the country highly vulnerable to the adverse impact of climate change.

Some examples of such impacts include: severe and recurring droughts in recent years which have triggered economically devastating power crisis and massive deaths of livestock; severe floods in areas like those happened in Dar es salaam in December 2011, leaving thousands of people displaced; inundation of small islands and intrusion of sea water into fresh water systems in coastal areas of Tanzania mainland and Zanzibar; prolonged droughts in some parts of the country leading to food insecurity. Thus the loss of human, natural, financial, social and physical capital, due to climate change impacts, pose a challenge to the national efforts to attain the Millennium Development Goals (MDGs) and places poverty reduction efforts in jeopardy.

Cognizant of the continued challenges and impacts of climate change, the Government has put in place a number of initiatives. Some of these include the enactment of the Environmental Management Act (Cap. 191) which provides for addressing climate change in a legal basis, development and implementation of the National Adaptation Programme of Action (NAPA), formulation of MKUKUTA II and the National climate change Adaptation Action Plan. In addition, the Government is finalizing the National Climate Change Strategy. There are also various sectoral initiatives that aim at addressing the impacts of climate change and strengthening the resilience of communities.

In order to strengthen the national adaptive capacity to effectively manage the impacts of climate change, integrating climate change adaptation issues into the sectoral policies, plans and programmes is absolutely crucial. Climate change resilient policies and measures

will enable the country to tackle climate change impacts in a more concerted manner.

It is against this background, the Vice President's Office has developed these Guidelines with a purpose of providing practical guidance on how Ministries, Departments and Agencies (MDAs), Local Government Authorities (LGAs) and Non State Actors should integrate climate change adaptation into sectoral policies, plans and programmes.

It is my sincere hope that these Guidelines will be very useful in integrating climate change adaptation issues in respective sectoral policies, plans and programmes. I urge you to use these Guidelines in undertaking the Climate Change integration activities in order to make our development policies and measures climate resilient.

**Dr. Terezya Luoga Huvisa (MP)**
**MINISTER OF STATE – ENVIRONMENT,**
**VICE PRESIDENT'S OFFICE**

# ACKNOWLEDGEMENT

Tanzania is one of the countries that are continuing to suffer from the impacts of climate change and related hazards such as floods and droughts, which have substantially affected economic performance and undermined poverty reduction efforts. Severe and prolonged drought and subsequent poor crop yields in many parts of the country have negatively impacted on Tanzania's efforts to address poverty and food insecurity and has led to severe power shortage in recent years. In order to strengthen the country's adaptive capacity to comprehensively address climate change risks, integration of climate change issues into our sectoral policies, plans and programme is of paramount importance. This intervention would enable the country to address impacts of climate change in a more effective way. In this regard, preparation of these Guidelines is therefore timely and essential opportunity for Tanzania to enhance its ability to deal with climate change and ensure the long-term viability and sustainability of sectoral and development investments.

Successful preparation of these Guidelines is a result of commitment and hard work by many individuals and institutions. It is not possible here to mention them all, but I would like to use this opportunity to assure them of our heartfelt appreciation and that we value their cooperation and support.

I would also like to extend our special thanks to the Government of Japan for providing financial support that enabled preparation of these Guidelines. My sincere appreciations go to the UNDP Country Office for the support in ensuring this task is a success.

Lastly, I thank my colleagues in the Division of Environment, especially; the Director of Environment Dr. J. Ningu and the assistant Director of Environment responsible for Climate change, Mr. R. S. Muyungi, who provided overall guidance and coordination to ensure successful completion of this assignment.

**Sazi B. Salula**
**PERMANENT SECRETARY,**
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# LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| CBOs | Community Based Organizations |
| CCA | Climate Change Adaptation |
| CDM | Clean Development Mechanism |
| CEMO | City Environmental Management Officer |
| CITES | Convention on International Trade of Endangered Species |
| DEMO | District Environmental Management Officer |
| DoE | Division of Environment |
| DPs | Development Partners |
| EAC | East African Community |
| ECF | East Coast Fever |
| EMA | Environmental Management Act |
| FBOs | Faith Based Organizations |
| GCMs | Global Circulation models |
| GBS | General Budget Support |
| LDCs | Least Developed Countries |
| LGAs | Local Government Authorities |
| M&E | Monitoring and Evaluation |
| MDAs | Ministries, Departments and Agencies |
| MDGs | Millennium Development Goals |
| MEAs | Multilateral Environmental Agreements |
| MEMO | Municipal Environmental Management Officer |
| MKUKUTA | Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Tanzania |
| MLDF | Ministry of Livestock Development and Fisheries |

| | |
|---|---|
| MWID | Ministry of Water and Irrigation Development |
| NAPA | National Adaptation Programme of Action |
| NCCFP | National Climate Change Focal Point |
| NCCSC | National Climate Change Steering Committee |
| NEAP | National Environmental Action Plan |
| NEMC | National Environment Management Council |
| NEP | National Environmental Policy |
| NGO/s | Non-Government Organization/s |
| PMO-RALG | Prime Minister's Office - Regional Administration and Local Government |
| PPP | Public Private Partnership |
| REME | Regional Environmental Management Expert |
| RVF | Rift Valley Fever |
| SES | Sector Environment Section |
| SWOC | Strengths, Weaknesses, Opportunities and Challenges |
| TEMO | Town Environmental Management Officer |
| TMA | Tanzania Meteorological Agency |
| UNDP | United Nations Development Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| VPO | Vice President's Office |

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background Information

Climate change is already happening and is expected to have complex, long term consequences to the livelihood, environment and production sectors. The global surface temperature has had an average increase of 0.74 0C in the past century and most of the warming has occurred in the past three decades with eleven of twelve warmest years on record happening since 1995. The adverse impacts of climate change are now far reaching and evident in most parts of the world. The impacts are more pronounced in poor countries with the least adaptive capacity such as Tanzania. It is a serious risk to poverty reduction and threatens to undo decades of development efforts in achieving Millennium Development Goals (MDGs), attaining economic growth, sustainable livelihood and sustainable development.

Tanzania like many other LDCs is among the most vulnerable to the impacts of climate change associated with disasters that includes periods of drought, floods, and outbreaks of diseases in some parts of the country.

Escalations of Climate change impacts particularly in the developing countries require effective adaptation actions. Precautionary and anticipatory adaptation is less costly and more effectively than forced

adaptation. The precautionary approach may be achieved among others, through integrating climate change adaptation into the national sectoral policies, plans and programmes which is inevitable at the moment due to the vulnerability of the priority sectors to the adverse impacts of climate change.

In addressing the impacts of climate change, the government of Tanzania has undertaken several initiatives, including development of Strategy for Urgent Actions on Land Degradation and Water Catchments (2006), National Adaptation Programme of Action (NAPA, 2007); In-depth analysis of climate change impacts on Agriculture, Health and Water sectors (2008); and National Strategy on Conservation of Coastal and Marine Environment, Lakes, Dams and Rivers (2010). Other initiatives include developing Climate Change Technological Needs Assessment and the National Climate Change Strategy.

Supporting integrated and comprehensive approaches to climate change adaptation in Tanzania through development of Guidelines is yet another government efforts that intends to: i) put in place dynamic long-term planning mechanisms that are able to cope with the inherent uncertainties of climate change; ii) strengthen leadership and institutional frameworks that are able to effectively manage climate change risks and opportunities in an integrated manner from the local to the national level; iii) support the adoption of climate resilient policies and measures in priority sectors; iv) expand financing options to meet national adaptation costs at all levels and build knowledge on the adjustment of national development frameworks to fully

incorporate climate change risks and opportunities.
The Environmental Management Act (EMA Cap 191) under section 13-(1) provides the Minister responsible for environment, the overall responsibility for matters related to environment. Section 75(a) of EMA requires the same Minister in consultation with relevant sector ministries to take measures to address climate change particularly climate change adaptation. Sector ministries under section 31-1(c) of EMA are required to ensure environmental concerns are integrated into the ministry or departmental development planning processes in the quest to protect the environment. These Guidelines have been prepared to enable relevant sectors and institutions identify appropriate intervention measures that will address climate change and its impacts so that they are incorporated in relevant policies, plans, strategies and programmes.

## 1.2 Objective of the Guidelines

The objective of these guidelines is to provide practical guidance on how Ministries, Departments and Agencies (MDAs), Local Government Authorities (LGAs) and Non State Actors should integrate climate change adaptation into sectoral policies, plans and programmes.

## 1.3 Justification of the Guidelines

The nature and magnitude of climate change require common, integrated and coordinated approach in addressing the impacts. Lack of national guidelines for integrating climate change adaptation into the existing national sectoral policies, plans and programmes

is among the challenge that hinders respective national sectors to comprehensively address the challenges of climate change. It is for such reasons these, guidelines have been developed.

These Guidelines will contribute to the implementation of the National Environmental Policy (NEP 1997), Environmental Management Act, (EMA Cap 191), National Environmental Action Plan (NEAP), MKUKUTA II (2010), and the Multilateral Environmental Agreements (MEAs). It includes a generic format for preparing sectoral detailed Action Plan that indicates targets, priority actions, expected outputs, indicators, timeframe, cost, key actors and possible sources of funding.

Integrating Climate Change issues into national development policies, plans and programmes ensures consistency between the needs of climate change responses and poverty reduction and economic development.

## 1.4 Scope of the Guidelines

The guidelines provide guidance to facilitate integration of climate change adaptation into sectoral policies, plans, and programmes. The sectors and themes that are covered by these Guidelines include Forestry, Energy, Fisheries, Livestock, Water, Agriculture, Land use, and Health. Most of these sectors are identified by NAPA. The guidelines are intended to be used by MDAs, LGAs and Non State Actors.

## 1.5 Methodology of developing the Guidelines

These guidelines were prepared in a participatory manner by involving different stakeholders. The document was drafted by a team of expert drawn from the Vice President's Office, National Environment Management Council (NEMC), Ministry of Agriculture Food Security and Cooperatives, Ministry of Water, Ministry of Community Development Gender and Children, Ministry of Education and Vocational Training, Ministry of Energy and Minerals and United Nations Development Programme (UNDP). The process of developing the document involved preparation of Terms of Reference, literature review, consultation and preparing the draft document. The document was thereafter subjected to the stakeholder's consultative workshop for discussion and review. The views of stakeholders were incorporated to the draft document to finally come up with these guidelines.

# CHAPTER TWO

## Institutional Framework

### 2.1 Introduction

In Tanzania climate change is addressed in the context of environmental management. This chapter describes issues of policy, legal and institutional arrangement for the implementation and management of environment as they related to climate change

### 2.2 Policy Framework

The overall policy framework for environmental management in Tanzania is the National Environmental Policy, 1997 (NEP). The policy recognizes environment as a cross-cutting issue that requires a holistic approach and multi-level management. In this perspective, the policy addresses climate change by involving different sectors, local government authorities and their respective stakeholders.

### 2.3 Legal Framework

The Environmental Management Act, Cap 191 (EMA) is a legal framework for the enforcement of the environment management in Tanzania. The Act requires different sectors to address climate change in their undertakings. It empowers the sectors to undertake various environmental roles and responsibilities that are relevant to their core functions.

## 2.4 Institutional Arrangement

Environmental management need effective coordination and cooperation among relevant organs of the Government and Non State actors. According to EMA Cap 191 the following institutional arrangement is responsible for environment management in Tanzania and hence climate change. It is summarized in figure 1.

**(a) The National Environmental Advisory Committee**

The committee has been created to advise the Minister Responsible for Environment in the Vice President's Office or any sector Ministry on any environmental matter referred to it. It is stipulated under SS12 of the EMA, 2004.

**(b) Vice President's Office**

The Vice President's Office is the Ministry responsible for environment. The Minister responsible for Environment in the Vice President's Office (VPO) guides and articulates policy guidelines, makes regulations, guidelines, and may designate any institution to perform any function or any activity within a specified timeframe as stipulated by EMA Cap 191. With regard to climate change, the Minister in consultations with relevant sector ministries undertakes to do the followings:-

i. Take measures to address climate change, particularly the impacts of climate change and related adaptation measures;

ii. Issue guidelines periodically to Ministries and any other institutions in order to address climate change and its impacts as a result of global warming;

iii. Require Ministries and independent Government departments to put in place strategies and action plans to deal with climate change and to advise schools and high learning institutions to include matters relating to climate change in their curriculum;

iv. review and approve any measures undertaken to address climate change by any institution, firm, sector or individuals be it foreign or local, including those relating to the use of land, water, forests or any other ecosystem within the United Republic to sequester greenhouse gases; and

v. Project national positions at global level on how to deal with the problem of climate change in the context of the United Nations Framework Convention on Climate Change, and its related Protocol(s).

The Vice President's Office is the National Climate Change Focal Point (NCCFP) for the United Nations Framework Convention on Climate Change (UNFCCC). At the national level there is an established National Climate Change Steering Committee (NCCSC) chaired by the Permanent Secretary in the VPO to provide policy guidance to the National Climate Change Focal Point (NCCFP), ensuring coordinated actions and participation of various sectors and institutions. There is also the National Climate Change Technical Committee chaired by the National Climate Change focal point (NCCFP) which has the role of providing technical advice to the NCCFP, stimulate more coordinated actions by various actors and broaden participation of various actors in addressing climate change.

**(c) The National Environment Management Council (NEMC)**

The functions of the Council among others include carrying out environmental audits, surveys, research; review and recommend to the Minister for approval of Environmental Impact Assessment. NEMC enforces compliance of the National Environmental Quality Standards; initiates procedures for the prevention of Environmental related accidents which may cause environmental degradation, undertakes programmes to enhance environmental education; publishes and disseminates manuals relating to environment management; render advise and technical support to entities engaged in natural resources and environmental management; and performs any other functions assigned to it by the Minister responsible for environment.

**(d) The Sector Ministries**

The functions of each sector Ministry, among others, are to ensure that Climate change concerns are integrated into sector functions. Each sector ministry carries out its functions and duties in accordance to EMA and any other related laws, provided that such laws do not conflict with EMA. The Involvement of Sector Ministries in environment management and Climate Change Adaptation is through a Sector Environment Section (SES) established in each Ministry to ensure that Ministries comply with the EMA.

**(e) The Regional Secretariat**

The Regional Secretariat is composed of a Regional Environmental Management Expert (REME) charged with the

responsibility to advise the Local Government Authorities of that particular region on matters relating to implementation and enforcement of EMA. The REME links the region with the Director of Environment.

**(f) The Local Government Authorities**

Linked to the above institutional arrangements, EMA has vested to the Local Government Authorities the function of environmental management. It has put in place officers and has also designated to some committees certain environmental functions. These officers and committees are as follows:-

**i. Environmental Management Officers**

The law has established four categories of officers; they are; City Environmental Management Officer (CEMO), Municipal Environmental Management Officer (MEMO), District Environmental Management Officer (DEMO) and Town Environmental Management Officer (TEMO). These officers among other duties are responsible for Climate Change Adaptation issues in their area of jurisdiction.

**ii. Environmental Committees**

EMA takes cognizant of the Standing Committees on Urban Planning and the Standing Committees on Economic Affairs, Works and Environment as designated by the Local Government (Urban Authorities) Act, 1982 and Local Government (District Authorities) Act, 1982 and empowers them to be the city, Municipal, District

and town environmental management committees. These committees are also responsible for climate change adaptation.

The following is the systematic presentation of Environmental Management Structure in Tanzania. This also covers Climate Change.

Figure 1: The institutional arrangement for environmental management in Tanzania

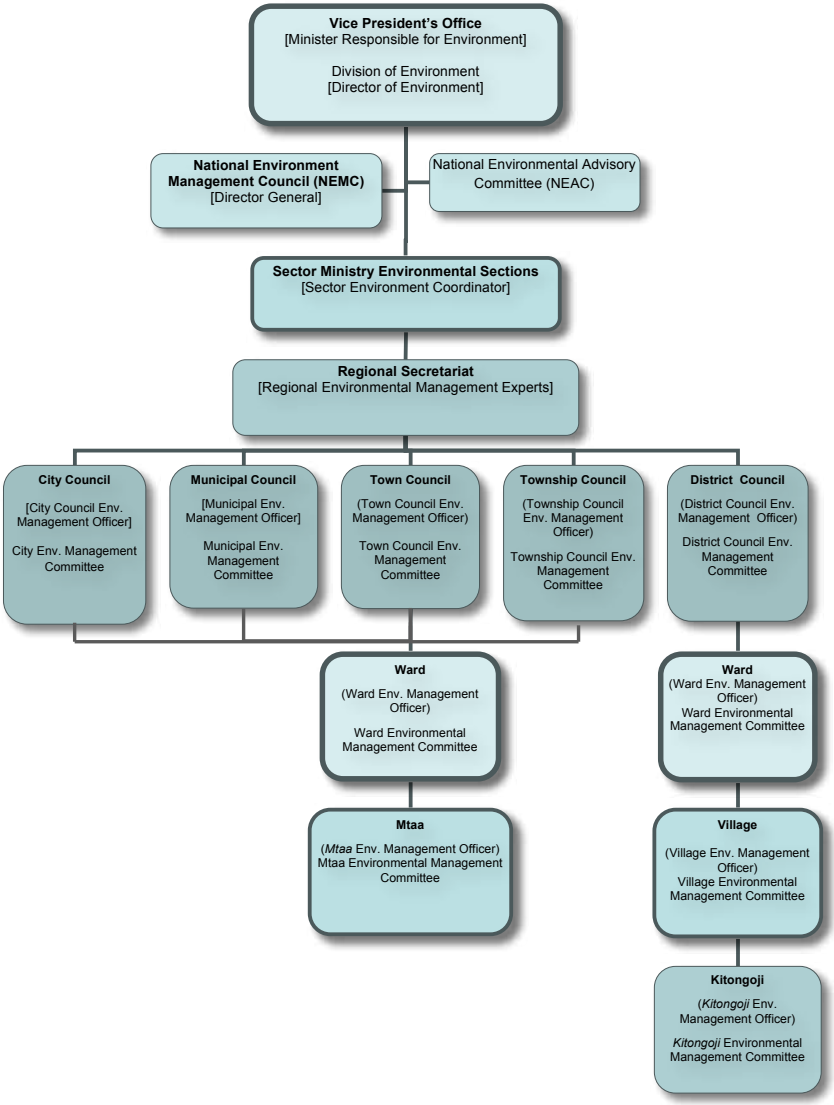


**Figure 1: The institutional arrangement for environmental management in Tanzania**

# CHAPTER THREE

# CLIMATE CHANGE SITUATION ANALYISIS

## 3.1 Climate Change Impacts and Vulnerability

The adverse impacts of climate change are already taking their toll on the livelihoods of the communities. The frequent and severe droughts in many parts of the country have already shown negative consequences on livelihood areas such as food production and water scarcity. In the last 40 years Tanzania has experienced severe and recurring droughts and floods with devastating effects to most vulnerable sectors which include agriculture, forestry, fisheries, energy, health, water, infrastructure, human settlements, and land use. For instance, the droughts of 2003, 2005, 2006, 2008, 2009, 2010 and 2011 seriously affected most of the vulnerable sectors with devastating social and economic implication. In addition, the floods of 2009 and 2011, for instance, were particularly devastating on countries property and infrastructure. Other impact includes sea level rise and melting of Mount Kilimanjaro ice cap impacting negatively on Tourism. Climate change projections indicate that the frequency and severity of extreme weather events will continue to escalate to the extent that is more adverse than it is today. The analysis of specific impacts in each of the key sectors is as follows:

### 3.1.1 Fresh Water Resources

Concerns on climate change and climate variability have created new

demands for scientific, economic and social information to understand their impacts on water resources. Water resources in the country include rivers, lakes, wetlands, springs, reservoirs groundwater aquifers; and many water bodies that are shared with neighbouring countries, although these are not well distributed over the country. Increasing rainfall variability and prolonged droughts cause serious pressure in the country's available water resources. Severe and recurrent droughts in the past few years triggered a decrease in water flows in rivers, hence shrinkage of receiving lakes, declines of water levels in satellite lakes and hydropower dams. Those used to be perennial rivers have changed to seasonal rivers and as a consequence lead to shrinkage or disappearance of subsequent wetlands.

Thus, as water is a finite resource is under pressure because of increasing climate change and variability, degradation due to pollution, over-abstraction, and encroachment of water catchments for various land uses (e.g. agriculture, urbanisation and industrial development). This scarcity and vulnerability has negative impacts on important watershed and recharge areas, as well as wetlands.

Many ecosystems are overwhelmed by an unprecedented combination of climate change related events, such as floods, droughts, land-use change, pollution, siltation, damming and over-exploitation of water resources. Socially, the impacts of climate change on water resources are felt by the whole society regardless of gender. However, where water sources are depleted or quality compromised, women and children are the most affected. On the other hands, in some areas like Kilombero

and Same, floods, landslides and associated waterborne diseases are on the increase and women and children are more impacted.

Predictions of changes of lake levels and hydrological basins due to climate change in Tanzanian have indicated a potential decline of about 0.1-1.2m. Regression and water balance models were used to assess impacts of rainfall variability /climate changes on five Tanzanian lakes. From the assessments the highest changes of about 3m are predicted for Lake Rukwa. The assessment indicated also that 1% decrease of annual rainfall may result in 0.6-5.0% reduction in average discharge, 0.6-4.1% minimum discharge, 0.4-7.5% maximum discharge, and 0-1.6% of Zero Flow Duration. The largest discharge decreases are predicted for Internal Drainage and Lake Victoria while lowest decreases are predicted for Kikuletwa, Ruhuhu and Rufiji (except Great Ruaha). Predicted rainfall increases expected from some Global Circulation models (GCMs) indicate future discharge increases of 8-41% (average discharge), 6-30% (minimum discharge), 0.4-45% (maximum discharge) and decrease of 6-16% (Zero Flow Duration).

### 3.1.2 Coastal and Marine Environment

Major climate change related impacts are a result of increases in sea surface temperatures and associated sea level rise. Some of the impacts are destruction of coral reefs, coastal erosion, submergence of small islands, destruction of coastal infrastructures and human settlement, intrusion of sea water into freshwater wells, and degradation of mangrove.

One of the most striking signs that climate change is the growing incidence of coral bleaching which is due to prolonged exposure of corals to warmer than normal water temperatures. The loss of coral reefs is likely to have impacts on the marine and coastal resources in particular fishes that depend on coral reef ecosystem as breeding, nursery and feeding habitat.

Sea level rise impacts are increasingly manifested by accelerated coastal erosion in many parts of the coastal areas and in some cases destruction of mangroves caused by strong sea waves. It has also lead to intrusion of sea water into fresh water wells and crop fields. This is vivid in Bagamoyo, Pangani, Rufiji and Zanzibar. Other impacts include submergence of small islands like Maziwe in Pangani and Fungu la Nyani in Rufiji; destruction of coastal infrastructures e.g. some beach hotels in northern Dar es Salaam, Pangani wall; and some human settlement. Thus sea level rise can be among the most challenging climate change issues since it threatens the destruction of key coastal infrastructure and costal livelihood of coastal countries.

Climate change also has impact on sea currents and waves due to variations in sea surface temperature. Variation on sea currents and waves is likely to impact fishing activities due to change of water movement pattern favourable for fishing. A vivid example is the low fish catches during south eastern monsoon which is associated with cold waters. This situation could be accelerated by climate change.

### 3.1.3 Agriculture and Food Security

Agriculture is the mainstay of the Tanzanian economy contributing

about 26.5% of GDP, 30 per cent of export earnings and employs about 75% of the total labour force. Over the past decade, the agricultural sector grew at an average rate of 4.4%. The rate of growth in agriculture is higher than the average annual population growth rate of 2.9%, implying growth in incomes. However, the above average agricultural growth rate is insufficient to lead to significant wealth creation and reduction of poverty given the very low level of agricultural development. Attaining poverty reduction would require an annual agricultural growth rate of about 10% (URT, 2009a

Agricultural development is strongly dependent on environmental resources such as land, forest, air, water and other resources. Thus sustainable utilization of these resources is vital for the growth and sustainability of the sector. However, agriculture is vulnerable to the effects of climate change associated with global warming (URT, 2008b, URT, 2009a).

Changing climate has resulted in a general decline in agricultural productivity, including changes in agro-diversity. The prevalence of crop pest and diseases is also reported to have increased, posing more challenge to agriculture. Recent studies by the Tanzania Meteorological Agency (TMA, 2009) indicated that some of the previous highly productive areas such as the southern and northern highlands will continue to be affected by declining rainfall, frequent droughts and significant increase in spatial and temporal variability of rainfall with long term implications in the agricultural sector planning and resources allocation, such as seeds, pesticides and even the shifts in types of agricultural produce (URT, 2009a).

A study by the Ministry of Agriculture, Food and Cooperatives (URT, 2008) to establish strategies for addressing the negative effects of climate change in food insecure areas of Tanzania indicated considerable changes in the types of crops grown in agro-ecological zones with declining production trends. For instance, the study indicated a declining trend in productivity of maize and sorghum that led to the introduction of drought tolerant crops such as cassava in Muheza and Vanilla in Muleba districts.

There is a general perception by the majority of farmers that incidences of crop pests have increased over the past few decades, and that the pests have become more prevalent with time. As a result, emerging diseases such as batobato, BXW (Banana Xanthomonas wilt), Panama, Elihuka, coffee wilt, headsmuts, fusarium wilt, maize streak, cassava mosaic, cassava purple stripes, cassava root rot, and rust particularly in green grams have become more prevalent (URT, 2008). Generally most farmers acknowledge increased plant diseases. Such incidences are locally perceived to have considerably affected the productivity. With changing climate farmers have also observed new diseases at different stages of the plant growth. For instance, in some parts of the country cassava diseases were not serious for many years, but since the 1980s this crop is facing more damage due to increased diseases. Similar experiences are reported for crops like coffee that seem to succumb to increasing incidences of pests and diseases emerging as a result of changing climate. Furthermore, increase in temperatures has led to increased incidences of some of plant species (e.g. Striga spp), a noxious weed particularly for cereal crops; insect pests (e.g. Prostephanus truncatus, and Bemisia tabacci); and vermins such as the mole rats and an increase in the prevalence of crop pests

and diseases which in turn has caused increased demand for pesticides and herbicides.

The National Food Security Policy (1997) recognizes food availability, accessibility and utilization as three major pillars of food security. Improved food security leads to improved human capital that leads to higher agricultural productivity and wages in the labour market. Food security is, therefore a development issue that must be streamlined in the development agenda to ensure a healthy and productive nation. It has been noted however, that food availability is greatly affected by low production and productivity due to factors that are linked to climate change, e.g. high incidence of pests and diseases, and unreliable rainfall that leads to recurrent droughts or floods in some parts of Tanzania. Tanzania's NAPA ranked agriculture and food security as the most vulnerable and important sector that is hardly impacted by climate change and advocated that studies on the impact of climate change in the sector and on food security be a priority activity. Addressing the impacts of climate change for ensured community livelihoods is thus of paramount importance as reiterated by the Heads of State of the East African Community (EAC) in 2010 (EAC, 2010). Aware that climate variability and change is a serious global concern that is increasingly impacting negatively the EAC region's ecosystems, the natural resources productivity, people's livelihoods and indeed all development efforts; and Conscious of the adverse impacts of Climate Change especially on environment, agriculture and food security in the region; the heads of states declared a firm commitment that combating climate change is urgent and should be identified among the priority areas to be addressed in the region, in order to address its negative impacts on the socio-economic development of the region for current and future generations (EAC, 2010).

The assessment of the impact of climate change on food security undertaken by the Ministry of Agriculture, Food and Cooperatives (URT, 2008) revealed that semiarid areas experienced more food shortages and insecurity compared to other districts. Climate related factors significantly contribute to the reported food shortages and insecurity, with much of the food shortage being experienced in years with drought and floods. Major causes for the food shortages included drought, crop pests and diseases, low soil fertility, livestock diseases, and low household incomes.

Evidences have shown that there is a shift of agro ecological zones as results of climate change (AEZ) (URT, 2007). Change in crop performance in some parts of the country may be considered as detective of AEZ shift. In general, there is need to undertake further studies aimed at rigorous review of the AEZ. Present evidence of climate change supporting the shift paradigm is the observed shift in rainfall patterns from bimodal to unimodal rainfall regimes in some areas. For example Manyara and some parts of Morogoro and Kigoma regions which have long been characterised by bimodal rainfall distribution are now experiencing a shift towards unimodal rainfall regime (URT, 2008).

Productivity of most crops seems to have declined due to changing climate, particularly due to the increasing unreliability of rainfall. However, the production of some crops seems to have improved with the changing climate. For example, the productivity of mangoes and oil palm in the western plateau of Tanzania has increased considerably during the last 20 years, than in earlier years. Warming of the environment has favoured production of both mango and oil palm in

these highland areas. The local experience indicates further that some twenty years ago mango and oil palm trees produced only flowers without bearing fruits, because of cold weather but today reasonable harvests can be realised from these crops (Kangalawe et al., 2009). The major concern is however, on how such emerging opportunities could be effectively utilised.

### 3.1.4 Energy

The energy sector in Tanzania is characterized mainly by low per capita consumption of commercial energy in form of petroleum and electricity, and a large dependency on non-commercial energy, particularly biomass energy in form of firewood, charcoal and agricultural and animal residues (Table 1). Biomass energy accounts for 90% of total energy consumption. Over 80% of rural population relies on the energy sources such as wood, charcoal, crop waste and manure for cooking and heating, while kerosene is used for lighting. In comparison with most sub-Saharan Africa countries, the level of access to electricity in Tanzania is still low; with only about 14% of the households having access to electricity. While only 2% of the rural population is currently connected to the national grid.

## Table 1: Potential energy sources and status of exploitation

| RESOURCE | PROVEN TOTAL POTENTIAL | DEVELOPED |
|---|---|---|
| Hydro Power | 4,700MW, (firm Capacity (3,200) | 12% (562 MW) |
| Natural gas | Songosongo-30mill.$m^3$, Mnazi Bay-15mill.$m^3$ | 361 MW |
| Coal | 13200 Million Tons (300 Million Tons at Kiwira Field). | 0.04% /annum |
| Biomass wood | 1.8 Billion, $m^3$ | 2.2% /annum |
| Biomass residues | - Crop residues= 15Million Tons/annum<br>- Animal droppings=25Million Tons/annum<br>- Volatile solids of sisal waste= 0.2Million Tons/annum.<br>- Forest residues=1.1 Million Tons/annum | - About 1,000 biogas digester units of 50m3<br>- 22.75 MW electricity from steam and sisal plants.<br>- 3.5MW from forest residues. |
| Wind | Speed 0.9 – 9.9 m/s | 129 windmills (8.5kWp) Feasibility studies on going |
| Solar | Approximately 215 W/$m^2$/day | More than 2MWelect. |
| Geothermal | About 650MW | Studies are being undertaken. |
| Nuclear | Uranium potential exists but not yet assessed | Not exploited (limited studies) |
| Tidal wave | There are indications of potential | Studies are being undertaken |

Source: URT (2010b)

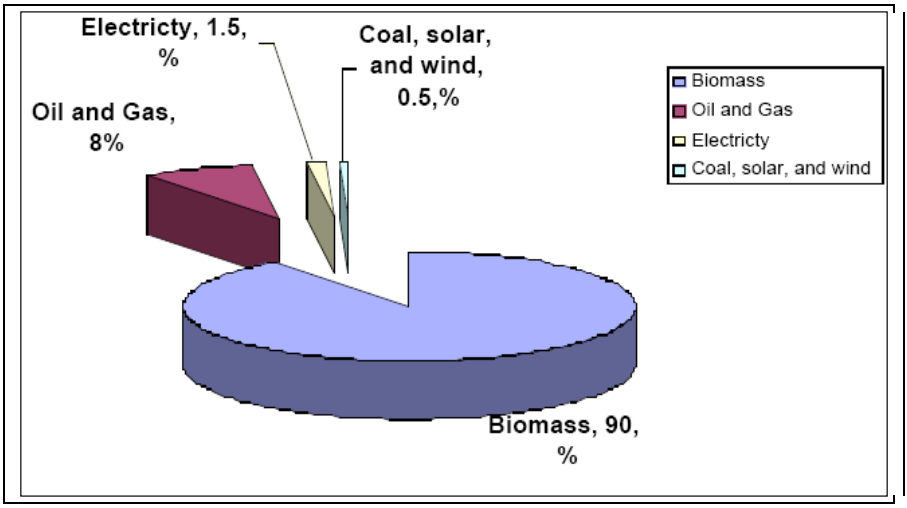


**Figure 2: Energy consumption by sources in Tanzania**

Frequent and persistent droughts evident in the past decade have caused drying up of major hydropower dams, consequently the energy mix has progressively been declining in recent years. With exacerbated impacts of climate change, these traditional sources of energy are under threat. It is estimated that, the grid hydro-thermal power mix will reach 39% hydro and 61% thermal, respectively, by year 2031

As a result of increasing climate variability, over the last years, the country has experienced increasing incidents of recurrent and prolonged droughts with severe implications on hydro power generation. Power rationing and black outs have become a common phenomenon in Tanzania. This affects individuals' household and

industrial income generating activities. Consequently, additional resources which were committed for other development programmes are sometimes being reallocated for thermal electricity generation. This undermines national efforts to attain the Millennium Development Goals and place poverty reduction efforts at jeopardy.

### 3.1.5 Livestock and Rangeland

Most of the ruminant livestock are concentrated in the semiarid areas (Arusha, Dodoma, parts of Iringa, Kilimanjaro, Manyara, Shinyanga, Mwanza, Singida, Mara, Tabora and parts of Rukwa) which are more suitable for livestock than any other form of agriculture. These areas are characterized by relatively low mean annual rainfall with stronger spatial and temporal variability, and therefore not very reliable for production of food and cash crops. Concentration of ruminant livestock in these areas is also attributed to low prevalence of tsetse flies and less competition for land for arable agriculture. However, the sector is affected by various climate change impacts, drought being the most serious as a result of severe and recurrent droughts, particularly in the northern parts of the country.

Changes in the mean temperature and rainfall, and the increased variability of rainfall, have resulted to prolonged length of dry seasons and increased severity of periodic droughts that reduces water and pastures availability for the livestock. It has been noted that warming shortens the growing seasons and, together with reduced rainfall, reduces water availability, and can also increase livestock diseases. On the other hand, this reduced the availability of crop residues, which

are important sources of feed for livestock especially during the dry seasons. Limited availability of pastures and water has often resulted into resource use conflicts between crop cultivators and livestock keepers, particularly in the catchment areas and crater basins.

Availability of animal feed resources for poultry, non-ruminants and other non- conventional animal industry are affected by climate change due to extreme reduction in agricultural and industrial production for products such as seed cakes and molasses.

It has been noted in some parts of the country that climate change, particularly increasing temperature, increased frequency and intensity of wildfires inducing shifts in geographical distribution of biodiversity. For example, non-palatable and toxic plant species are replacing the palatable and nutritious plant species, thus affecting the livestock industry. The intensified wildfires also cause more damage to biomass growth, thereby reducing availability of both pasture and water for livestock. Also, savannah grassland is likely to replace forests and woodlands in many places. While this may have positive impacts on the availability of fodder for the livestock, the reported fires and species changes may limit the quality and productivity of these areas.

Warming is predicted to increase disease vectors which will consequently increase the incidences of vector-borne diseases of livestock such as Trypanosomiasis, East Coast Fever (ECF), Rift Valley Fever (RVF). The increases of livestock mortality due to diseases and starvation (due to droughts) may have considerable impacts on the local economies and the overall community livelihoods, particularly given

the shortages of livestock dips and low financial capacity of people to afford various livestock medications (Kangalawe et al., 2009).

### 3.1.6 Fisheries

The impact of climate change in fisheries is mainly associated with destruction/degradation of fish nursery grounds, breeding and feeding areas. One of the most striking signs that climate change has an impact to marine fisheries is the destruction of coral reefs which is a critical habitat for fishes in the coastal environments. Destruction of coral reefs due to coral bleaching caused by rise of sea surface temperature is among the factors impacting marine fisheries. Sea level rise which is associated with global warming may cause sea water to rise above optimal levels of some corals. Too deep for example, can restrict amount of sunlight needed for coral growth. Further climate change is impacting fish migration patterns thereby affecting fish recruitment and stocks in traditional fishing sites, especially for artisanal fisher folks. Sedimentation in freshwaters is negatively affecting fisheries in fresh water bodies e.g. by destroying breeding and feeding sites. This problem is aggravated by drought and frequent floods resulting from climate change.

### 3.1.7 Forest Ecosystems and Biodiversity

Climate change impacts on forest ecosystems and biodiversity are expected to vary depending on vegetation type. The common impacts to all forests types include loss of biodiversity; disappearance of wildlife habitats, increased risk of bush fires, limited availability of

forest products (timber and non-timber products) and ecosystem shift (e.g. forest to woodlands or woodlands to grasslands). The National Adaptation Programme of Action (NAPA) of 2007 forecasts change to drier forests/ecosystems as a result of climate change, but the impact of change in areas where rainfall is predicted to decrease is less clear. Species that are expected to be more vulnerable are those with limited geographical range and heat intolerant; low germination rates; low survival rate of seedlings; and limited seed dispersal/migration capabilities. However, knowledge on the magnitude of effects on individual species is still limited.

Given the high dependence on forests by large number of population in Tanzania, particularly as source of energy and livelihood, climate change impacts on this sector will affect socio-cultural setting of both urban and rural communities.

Forests and woodlands are the sources for most of the wood and non-wood products. Wood products include timber, poles, firewood and charcoal. Non-wood products include ropes, resins, tie and dye colourings, wildlife, game meat, fruits, traditional/natural medicines, natural vegetables, palm leaves for making baskets/mats, honey and beeswax, mushrooms. Furthermore, forests and woodlands do provide other goods and services to people such as food and water. Also biomass is the main source of fuel for rural population and accounts for 92% of the total energy consumption in the country. A number of intangible benefits also do exist as outcomes of presence of forests and woodlands. Such benefits include unique natural ecosystems and genetic resources, depository of biodiversity, amelioration of climate

(microclimate), carbon sequestration, habitat to wildlife and cultural and religious values (URT, 2008). Increased temperature and changes in rainfall regime will seriously affect the variability of such goods and services from the forestry sector.

According to the IPCC (2007a), any increase in global average temperature above the range of 1.5-2.5°C is likely to result in significant alterations in the structure, function and geographical ranges of ecosystems thus negatively influencing species distribution and survival. Many of the impacts of a changing climate are likely to be species-specific and related to particular ecological aspects of individual taxa, necessitating a species-based management approach. However, some impacts will be important across all, or some, species groups (Berger, 2004). Overall a very high possibility of irreversible losses of biodiversity as a result of such changes in climate are projected with many terrestrial, freshwater and marine species being placed at a much greater risk of extinction than before (Fischlin et al., 2007).

Water shortage for the large mammals especially in the years with low rainfall is one of the main challenges facing the wildlife. The places that naturally used to hold water during the dry season no longer hold water long into the dry season. For instance, water dependent animals especially hippopotamus (Figure 3), crocodiles, buffalos and elephants are often found crowded in few remaining water ponds, for example in the Ruaha and Katuma River systems. Serious lack of surface water in dry seasons of 2003/2004 to 2005/2006 led to considerable hippopotamus and buffalo mortalities (Elisa at al., 2011).

**Figure 3: Hippopotamus congregation in small water pools due to water shortage in the Katavi River system.**

Suffering from lack of water, wildlife physiological functions are impaired and they become easy target to poachers and predators. Thus, with changing climate and associated decrease in water availability due to reduced amounts and altered seasonal distribution of rainfall, the existing water related problems are likely to be compounded. Contagious diseases such as anthrax have been reported in areas where animals concentrate in small water points, for instance, in Ruaha National park (cf. Kangalawe, 2010), which are also shared with domestic animals.

Human-wildlife conflicts are a common occurrence in wildlife areas, especially in years with drought. The main reason for these conflicts was reported to be crop raiding while wild animals roam around in search for pastures and water. The animals commonly involved in these conflicts are hippopotamus, elephants and buffaloes. This may be aggravated with changing climate.

In spite of the numerous benefits and their contribution to socio-economic development, wetlands are facing increasing challenges of climate change, particularly frequent droughts. Furthermore, with increasing evapo-transpiration because of increased temperature, wetland water characteristics will change with catastrophic consequences for the biodiversity within, for example increased pH levels in Lake Natron is affecting the breeding sites of flamingos. The change in pH is associated with increased temperature and changed rainfall regime in the Lake Natron catchment areas. It is most likely that there will be increased encroachment on wetlands due increased drought and desertification as result of climate change.

### 3.1.8 Human Health

The tropical African climate is favourable to most major vector-borne diseases, including malaria, schistosomiasis, onchocerciasis, trypanosomiasis, filariasis, leishmaniasis, plague, Rift Valley fever, yellow fever and tick-borne haemorrhagic fevers. The continent has a high diversity of vector-species complexes that have the potential to redistribute themselves to new climate-driven habitats leading to new disease patterns.

These organisms have different sensitivities to temperature and precipitation.

Vectors, pathogens and hosts reproduce within certain optimal climate conditions and changes in these conditions can modify greatly properties of disease transmission. The most influential climatic factors for vector borne diseases include temperature and precipitation. Extreme temperatures are often lethal to the survival of disease causing pathogens but incremental changes in temperature may exert varying effects. Where a vector lives in an environment where mean temperatures approach the limit of physiological tolerance for the pathogen, a small increase in temperature may be lethal to the pathogen. Alternatively, where a vector lives in an environment of low mean temperature, a small increase in temperature may result in increased development, incubation and replication of the pathogen.

Variability in precipitation may have direct consequences in infectious disease outbreaks. Increased precipitation may increase the presence of disease vectors by expanding the size of existent larval habitat and creating new breeding grounds. In addition, increased precipitation may support growth in food supplies, which in turn support a greater population of vertebrate reservoirs. Alternatively, flooding may force insect or rodent vectors into houses and increase the likelihood of vector-human contact. From a different dimension, heavy rains can contaminate water systems by transporting human and animal faecal products and other wastes in the surface and ground water which are associated with diarrhoeal disease outbreaks.

IPCC (2001) indicates that many vector, food and water-borne diseases are sensitive to changes in climatic conditions. Results of predictive models have shown that under climate change scenarios, there would be a net increase in the geographical range of potential transmission of malaria and dengue fever (Tonnang et al., 2010). IPCC states further that while climate change is unequivocal the impacts will fall disproportionately upon developing countries and the poor persons within all countries, thereby exacerbating inequities in health status and access to adequate food, clean water and other resources. Climate change is likely to also seriously undermine the health-related Millennium Development Goals to reduce child mortality, improve maternal health and combat HIV/AIDS, malaria and other diseases.

In Tanzania there are already reported incidences of epidemic malaria especially in highland areas that were traditionally free from mosquitoes and malaria (Yanda et al., 2006; URT, 2009; Wandiga et al., 2010). Malaria has been common in high temperature and humid lowland areas especially during and after rainy seasons but with changes in temperature and rainfall regimes, the disease has been observed in non-traditional malaria areas such as highland areas of Tanga, Kilimanjaro, Iringa, Kagera and Mbeya, among others, where it was not prevalent before (where the disease is currently limited by temperature). The epidemics in these areas are mostly linked with El Niño events. This is a significantly dramatic increase in malaria spread in a place it was not such prevalent. Whilst indicative, it is estimated that the potential costs to address the increased disease burden in Tanzania could be $20-100 million /year by 2030, rising to $25-160 million/year by 2050 – the range reflecting different climate and

development assumptions (Global Climate Adaptation Partnership and Partners, 2011).

Studies undertaken in the Lake Victoria basin indicate that incidences of other diseases such as cholera have increased as a result of climate change (Yanda et al., 2006; Wandiga et al., 2010). Others experiences (Figure 4) show that prevalence of cholera, has over the past few decades coincided with El Nino events, which are associated with unusually high temperatures. The first cholera outbreak were reported in 1974 and since 1977, cases were reported each year with a case fatality rate (CFR) averaging 10.5% between 1977 and 1992 (WHO, 2008). Prevalence elevates in rainy seasons and becomes even higher during floods (URT, 2006).

Humidity has also been blamed for increased risk of upper and lower respiratory infections in many parts of the country. In dry areas of the country, prolonged dry spells have caused increased outbreaks of respiratory diseases and eye infections. Incidences of food-borne and water-borne diseases such as dysentery, diarrhoea, cholera and typhoid fever are also on the increase due to extreme weather events which affect water quality and make it difficult for people to practice proper personal hygiene.

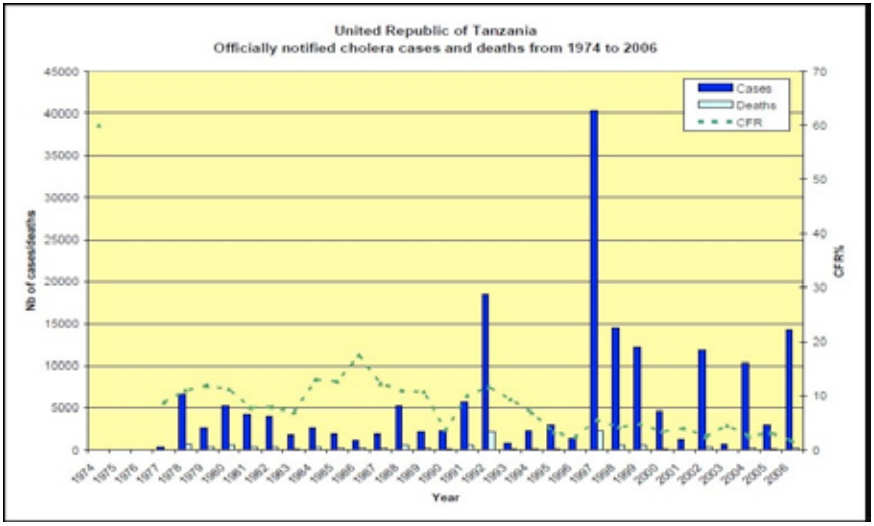


**Figure 4: Officially notified cholera cases and deaths in the United Republic of Tanzania from 1974 to 2006. Source: WHO (2008)**

There are also a wider set of indirect impacts from climate change on health, which are linked to other sectors such as food security and malnutrition through reduced agricultural productivity as a result of changes in soil quality, increased crop and livestock pests and diseases, prolonged drought and water scarcity. Reduced agricultural productivity associated with climate change/variability exposes communities to other health risk factors such as HIV/AIDS. Generally, increased disease incidences due to climate change reduce labour productivity in various development undertakings. Climate change is likely to also increase occupational health risks particularly associated with increasing temperatures at work places.

### 3.1.9 Infrastructure

Increased rainfall due to climate change may cause flood damage to infrastructures such as transport, communications and buildings. In December 2009 and January 2010, unusually heavy rainfall associated with El Niño event saw widespread flooding in Morogoro (Kilosa) and Dodoma (Mpwapwa and Kongwa) Regions which led to severe damage on road, bridges, water dams, railway, electricity poles, drainage networks, water supply, and human settlements. In April 2011 also in Morogoro (Kilombero) region heavy rains caused flood which destroyed six bridges, several roads and several human settlements. In all these cases the costs of addressing the flood situation were enormous.

Sea level rise, coastal inundation can force modification to port facilities with high cost to the government. For example, the Tanzania's Initial National Communication to UNFCCC (URT, 2003) reported that for the Dar es Salaam coastline the estimated loss of important structures is estimated to cost TShs 49.83 billion for a sea level rise of 0.5m and TShs 85.97 billion for a sea level rise of 1.0m. Similar costs are likely to be incurred by other coastal cities of Tanzania. Despite aesthetic value and other unique natural resources which have attracted populations, coastal areas are most vulnerable to climate change due to the anticipated rise in sea level, floods and other consequences. Unfortunately, the impact of sea level rise is already being experienced in Coast Region. In Bagamoyo District, for instance, sea level rise has already resulted into inundation of some traditional water sources (URT, 2007). This indicates how the country will be forced to transfer

a significant amount of annual expenditures to offset the effects of climate change on various infrastructures. The overall impact could be economic loss and growth volatility, reduced reliability of and hydroelectric power.

### 3.1.10 Human settlements

Cities and other human settlements are at the forefront of climate change. Simultaneously, due to their concentration of population and infrastructure, cities are especially vulnerable to the impacts of climate change. In Tanzania, the majority of the settlements in urban and semi urban areas are not planned. In Dar es Salaam City, for instance, the unplanned and unserviced settlements accommodate about 70-75% of the city's population while the planned settlements occupy an area of 25-30% (URT, 2002; UN-HABITAT, 2009:11; URT, 2011). Similar situations exist in other urban areas in the country. In addition, these urban areas are exposed to a wide range of threats related to climate change including sea-level rise and coastal erosion, flooding, drought and water scarcity, and the disruption of hydro-electricity generation. These are exacerbated by poor socio-economic and environmental conditions caused by low levels of economic growth, mismanagement of the process of urbanization, and inadequate social services.

Given the level of economy of the country, the poor are the ones residing in most of these unplanned, hazardous areas. Most of the houses are built without proper arrangement, which make it even difficult to do informal settlement upgrading; this enhances residents' vulnerability to disease, environmental degradation and poor sanitation facilities.

On the East African coast, sea-level rise will increase flooding with potential adaptation including that related to human settlement costs of up to 10% of GDP (IPCC, 2007). For instance, a rise in sea level would aggravate the already existing ecological problems through increased rates of coastal erosion, more persistent flooding, loss of wetlands, increased salinization of groundwater and soil as well as greater influx of diverse pollutants (Awosika et al., 1991). As is the case with infrastructure, sea level rise is likely to have considerable impact on human settlements through inundation of coastal areas as well as coastal erosion. In some areas such as Dar es Salaam the problem of coastal erosion is already widespread. In some areas, the beaches have been gradually eroded by about 200m during the last 50 years due to the strength of headwater waves, resulting in considerable damage to infrastructure and settlements. In Pangani Town, the sea wall that was built to protect the town from ocean currents is gradually being overwhelmed thus threatening the coastal settlements.

Similar effects of sea level rise are reported for islands of Zanzibar, where some settlements were abandoned. In the northern part of Ras Mkumbuu peninsular near Chake Chake there are several submerged ruins believed to represent an ancient commercial and religious centre. The ruins at Ras Mkumbuu included a settlement with a large mosque, a number of elaborate and decorated pillar tombs, several abandoned wells and foundations of houses estimated to date from 14th to 15th century (URT, 2009). While there is no clear explanation regarding the factors that caused these ruins to be submerged, it could have been due climate change and associated sea level rise.

Excessive rainfall has led to frequent flooding in various settlements, causing damage to infrastructure and property and disrupting economic activities. Heavy rainfall have been disrupting and causing substantial losses both socially and economically, including damage to smaller bridges and roads, flooding of homes, schools and the deaths of several children. The Kilosa, Mpwapwa and Kongwa, and Kilombero floods highlighted above are among numerous examples of impacts of climate change on human settlement. In December 2009 and January 2010 the swollen Mkondoa River burst its banks inundating Kilosa town, an incidence that led to the displacement of a total of 23,980 people. In Mpwapwa and Kongwa District another 19,000 persons were displaced (IFRC, 2010). The cost of restoring the infrastructure and services ravaged by floods in Kilosa and Mpwapwa amounted to 329bn/-. The April 2011 floods in Kilombero valley (Morogoro Region) demolished 663 houses in the area and submerged 2,942 others, which made 9,000 people homeless. Their food stores, farms and other infrastructures were destroyed and approximately 2,256 hectare of crops including paddy and maize were destroyed.

Extreme rainfall in January 2008 led to floods displaced hundreds of people and flooded mining pits in Mererani resulting in over 70 deaths. In all these cases the costs of addressing the flood situation were enormous.

On the other hand, human settlements in Tanzania have been experiencing water scarcity for many years. The sight of women carrying water buckets on their heads remains a common occasion, as does that of vendors pushing carts filled with containers of water. Yet even this inadequate supply of water is not provided regularly. Broken

pipes are frequent, and residents sometimes have to go for over three days without water. In many rural areas faced with droughts and water shortage migrations have become a common phenomenon, with people moving with their livestock. In many instances this has been a cause for abandoning their old settlements and establishing new ones in areas with better opportunities. This has particularly been the case with the agro-pastoral communities. Even in urban settlements, there is serious water shortage that predisposes the communities to diseases such as cholera, mainly associated with drinking unsafe water. Climate change is poised to aggravate the situation.

## 3.2 Some existing adaptation activities

Tanzania's economic base is mostly dependent on the use of climate sensitive sectors. With impacts of climate change, dependence on natural resources places our economy at a very high level of vulnerability. Currently, almost all the sectors of the economy are showing a number of signs of climate change vulnerability. Table 2 depicts some of the existing adaptation initiatives for the respective sectors.

Table 2: Some existing adaptation initiatives

| Sector/ Themes | Existing Adaptation Initiatives |
|---|---|
| **Agriculture Sector** | i. Small scale irrigation<br>ii. Research and Development on drought tolerant seed varieties<br>iii Agriculture extension services<br>vi. Crops diversification<br>vii. Water harvesting<br>v. Terracing, contour farming<br>vii. Use of organic manure |
| **Livestock Sector** | i. Cross breeding for resistant breeds<br>ii. Tick and tsetse control<br>iii Livestock extension services<br>iv Livestock marketing infrastructure<br>v Research and development<br>vi Zero grazing<br>vii. Livestock compensation |
| **Forestry Sector** | i. Participatory Forest Management<br>ii Ecosystem conservation of forest biodiversity, water catchment and soil fertility National wide tree planting campaign<br>iii Use of traditional knowledge in forest conservation<br>iv In situ conservation of indigenous species |

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| **Water Sector** | i. Integrated water resource management<br>ii Conjunctive water Use<br>iii Exploitation of underground water<br>iv Inter-basin transfers<br>v Protection of water Catchments<br>vi Rainwater harvesting<br>vii Construction of water dam |
| **Fisheries Sector** | i.Management of geographical areas of concerns and critical habitats,<br>ii. Management of fresh water<br>iii. Monitoring of fisheries habitat and species<br>iv. Integrated data management system in the fisheries sector<br>v. Promoting aquaculture<br>vi. Protection and conservation of aquatic ecosystems<br>vii. Supporting alternative livelihood initiatives for fisheries community |
| **Coastal and Marine Environment** | i.Protection and management of mangroves<br>ii Conservation of lowland coastal forests<br>iii. Protecting the seashore by building barrier sea walls<br>iv. Coastal erosion control<br>v. Promoting sustainable coastal land use planning |

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|---|---|
| | vi. Enhancing protection and conservation of coastal and marine ecosystems<br>vii Supporting alternative livelihood initiatives for coastal communities |
| **Health Sector** | i. Integrated Diseases Surveillance Response System (IDRS) for preventing, mitigating and responding to epidemics.<br>ii . Available Infectious Disease Weekending (IDWE) reports at the Health Centres and District/Regional Hospitals.<br>iii. Emergency Plan Response Unit (EPRU) that coordinate and manage all health related hazards, which include epidemics, accidents, drought and floods<br>iv. Traditional/alternative medicines<br>v. Traditional Medicines Research Unit established at Muhimbili Medical Research Institute |
| **Wildlife Sector** | i. Conservation of Wildlife Resources<br>ii. Establishment of Wildlife Management Areas(WMA) |

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|---|---|
| | iii. Developing appropriate regulatory mechanisms for set aside protected areas where wildlife and natural areas will be conserved<br>iv. Protecting of wildlife corridors<br>v. Research and training development<br>vi. Wildlife conservation awareness activities i.e. publicity<br>vii. The establishment of national parks, forest, game and marine reserves for sustainability of tourism industry. |
| **Industry Sector** | i. Diversification of process lines<br>ii. Importation of raw material and semi processed raw material<br>iii. Application of cleaner production technologies |
| **Energy Sector** | i. Improving and increasing clean thermal power generation<br>ii. Protection of hydropower water catchments<br>iii. Increasing availability of biomass resources<br>iv. Improvement of biomass to energy conversion efficiency<br>v. Increased use of modern biomass to energy technologies<br>vi. Fuel switching |
| vii. | End-use energy efficiency programmes |

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| **Wetlands** | i. Assessment, inventory and monitoring of the types and spatial distribution of the wetland ecosystems and their component<br>ii. Wetland Conservation awareness activities |
| **Human Settlements** | i. Developing plan for Coastal and beach erosion management<br>ii. Preparation of town plans (Central Business District Schemes)<br>iii. Regularization and upgrading of unplanned settlements. This also includes low lying-flood prone areas, wetlands, hilly areas, and coastal areas along the oceans and lakes.<br>iv. Housing Development Plan in different regions of the country. |
| **Tourism** | i. Diversification of livelihood and tourism attraction<br>ii. Promotion of eco-tourism |
| **Land use** | Land use planning and management |

# CHAPTER FOUR

# GENERAL GUIDELINES FOR INTERGRATING CLIMATE CHANGE ADAPTATION INTO SECTORAL POLICIES, PLANS AND PROGRAMMES

## 4.1 Introduction

This chapter provide a step by step practical guide for integrating adaptation issues into sectoral policies, plans and programmes. The steps are sectoral climate change situational analysis; institutional situation analysis; identification of potential interventions for integrating climate change adaptations for sectors; setting up sectoral adaptation action plan; and monitoring and evaluation.

## 4.2 Sectoral Climate Change Situational Analysis: Key areas of analysis

Climate change situation analysis looks at how the sector is impacted, level of vulnerability and adaptive capacity of the sector. This is intended to enable identification of climate change adaptation options of sectoral to be integrated into respective policies, plans and programs. Such analysis has to consider the cross cutting issues such as gender and disabilities. This process has to consider the following:-

**a) Analyze Sectoral Vulnerability to Climate Change**

i. Document the extent and nature of the sectors exposure and sensitivity to changes in climatic patterns both short and long term patterns;

ii. Identify the most important climate variables that the sector may be sensitive to;
iii. Identify sectoral vulnerability indicators; and
iv. Various approaches/tools may be applied in analyzing sectoral vulnerability to climate change. These may include (but not limited to), application of user friendly tools/approaches available in the World Bank Climate Change Knowledge Portal, Literature Review, Expert opinion, Climate Trend Analysis, Strategic Environment Assessment, Evidence Based Approaches, application of global models, regional climate models and national climate change models.

b) Analyze Sectoral Climate Change Impacts

i. Identify and document the past and current climate change impact affecting the sector;
ii. Identify areas (thematic and geographical) impacted and analyze the extent of impacts; and
iii. Identify the challenges and opportunities emanating from climate change impact in sectors.

c) Evaluate Sectoral Climate Change Adaptation Options

i. Identify existing climate change adaptation measures in the sectors
ii. Analyze and review sectoral Policy, Plans and Programmes to identify gaps
iii. Evaluate appropriateness of existing adaptation option for the sectors by:-

- Analyzing and reviewing different studies;
- Identifying and using best practices from other areas; and
- Involving key stakeholders.

## 4.3 Institutional Situation Analysis

Undertake situation analysis on institutional capacity to facilitate sectoral climate change adaptation by considering the following:

a) Institutional Structure in Relation to Environmental Management

i. Provide overview of institutional arrangement including administration, roles, responsibilities, and existence of Sector Environment Section. A sector organization chart (organogram) should be included. Analyse the institution adequacy in relation to realization of climate change adaptation objectives.

ii. Undertake institutional analysis on the strength, weakness, opportunities and challenges using a SWOC analysis approach in terms of human resources, finance, institutional arrangement/organization, technology, legislation and awareness.

b) Involvement of Other Stakeholders

Undertake the analysis of sectoral linkages with and involvement of key stakeholders in climate change adaptation. Such key stakeholders may include Sectoral

Ministries, Local Government Authorities (LGAs), private sector, Non Government Organizations (NGOs), Community Based Organisations (CBOs), Faith Based Organizations (FBOs), Education Institutions and Bilateral, International/Regional Organizations in climate change adaptation.

## 4.4 Potential Interventions for Integrating Climate Change Adaptations

Based on the reviewed Sector Policy, Programmes, Plans and Strategies as well as identified potential sectoral climate change and Institutional Situation Analysis as Clarified in sections 4.2 and 4.3:

i. Provide/suggest potential interventions for climate change adaptation at each level (Policy, Strategy, Plans and Programmes) and measures for enhancing institutional adaptive capacity in areas such as human resources, finance, institutional arrangement/organization, technology, legislation and awareness;

ii. Integrate the proposed interventions into Sectoral Policy, Strategy, Plans and programmes;

iii. Consider other cross cutting issues including gender and disabilities while integrating these interventions into Policy, Plans and Programme;

iv. In the course of integration, reference should be made to various documents such as Tanzania Development Vision, 2025, Five Year Development Plan, 2011, National Strategy for Growth and Reduction of Poverty II, 2010, National Environmental Policy, 1997, Environmental Management Act, Cap 191,

National Adaptation Programme of Action, 2007 National Adaptation Strategy & Action plan, 2009, National Women and Gender Development Policy, 2000 and other relevant sectoral policy documents; and

v. Disseminate/communicate climate change adaptation integrated policy, plan and programmes to key stakeholders.

Table 3 provides examples of some potential interventions for integrating climate change adaptation in various sectoral policies, plans and programmes.

Table 3: Potential Interventions in Integrating Climate Change Adaptation in Various Sectors

| Sector/ Theme | Strategic Interventions | Integration Process | | | |
|---|---|---|---|---|---|
| | | Policy | Strategy | Programmes | Plans |
| **1.Water Resource** | i. Enhancing protection and conservation of water catchments | ✓ | ✓ | ✓ | ✓ |
| | ii. Enhancing exploration and extraction of underground water | | ✓ | ✓ | ✓ |
| | iii. Promoting rain water harvesting | | ✓ | ✓ | ✓ |
| | iv. Enhance coordination of water abstraction and use | | ✓ | ✓ | ✓ |

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|---|---|---|---|---|---|---|
| | iv. | Enhance coordination of water abstraction and use | | ✓ | ✓ | ✓ |
| | v. | Promoting efficiency in water supply and use to ensure adequate and sustainable water supplies to all sectors | | ✓ | ✓ | ✓ |
| | vi. | Enhance management of water sources to improve sanitation and hygiene | | ✓ | ✓ | ✓ |
| | vii. | Promoting water | | ✓ | ✓ | ✓ |
| | | treatment and storage | | | | |
| | viii. | Strengthen coordination in water resources management | | ✓ | ✓ | ✓ |
| **2.Forestry** | i. | Enhancing control of forest fire, disease and pest breakout. | ✓ | ✓ | ✓ | ✓ |
| | ii. | Enhancing conservation of forests biodiversity and control of invasive species. | | ✓ | ✓ | ✓ |

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| | iii. Supporting alternative livelihood initiatives for forest dependent communities | | ✓ | ✓ | ✓ |
| | iv. Promoting establishment of woodlots | | ✓ | ✓ | ✓ |
| | v. Establishing comprehensive monitoring system for forest resources and ecosystem conditions | | ✓ | ✓ | ✓ |
| | vi. Strengthening and up scaling of community based forest management best practices | | ✓ | ✓ | ✓ |
| | vii. Promoting use of alternative construction materials | | ✓ | ✓ | ✓ |
| | viii. Promoting energy efficient technologies. | | ✓ | ✓ | ✓ |
| | ix. Strengthening the use of traditional knowledge in forest management | | ✓ | ✓ | ✓ |

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| | x. | Enhance awareness on forest conservation through publicity | | ✓ | ✓ | ✓ |
| | xi. | Strengthen presidential award on conservation of the catchment and tree planting campaign | | ✓ | ✓ | ✓ |
| **3.Agriculture** | i. | Assessing crop suitability (cropping pattern) for different Agro-ecological zones | ✓ | ✓ | ✓ | ✓ |
| | ii. | Promoting appropriate irrigation systems | | ✓ | ✓ | ✓ |
| | iii. | Promoting early maturing and drought tolerant crops | | ✓ | ✓ | ✓ |
| | iv. | Promoting disease resistant crop varieties | | ✓ | ✓ | ✓ |
| | v. | Enhancing agro-infrastructural (input, output, marketing, storage) systems | | ✓ | ✓ | ✓ |
| | vi. | Promoting appropriate indigenous knowledge practices | | ✓ | ✓ | ✓ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | vii. | Development of crop insurance strategy. | | ✓ | ✓ | ✓ |
| | viii. | Promote effective use of , weather forecasts information, improve data collection networks and early warning system | | ✓ | ✓ | ✓ |
| | ix. | Improve agriculture productivity through increased use of manure and | | ✓ | ✓ | ✓ |
| | | appropriate agriculture input | | | | |
| **4.Health** | i. | Strengthening control systems related to health risks and diseases | ✓ | ✓ | ✓ | ✓ |
| | ii. | Ensuring availability of specialized trained staff and medical facilities for addressing climate-related diseases | | ✓ | ✓ | ✓ |
| | iii. | Enhancing information sharing systems and cooperation with international community in | | ✓ | ✓ | ✓ |

| | | | | | |
|---|---|---|---|---|---|
| | addressing climate change - health related issues | | | | |
| | iv. Strengthen efficient technology in early diagnosis and treatment to climate related diseases | | ✓ | ✓ | ✓ |
| | v. Develop and make use of effective early warning systems and emergency measures at all levels | | ✓ | ✓ | ✓ |
| **5.Energy** | i. Promoting diversification of energy sources | ✓ | ✓ | ✓ | ✓ |
| | ii. Supporting development and utilization of community based mini-hydro power generation | | ✓ | ✓ | ✓ |
| | iii. Promote clean coal for energy generation | | ✓ | ✓ | ✓ |
| | iv. Promoting use of energy efficient technologies | | ✓ | ✓ | ✓ |
| | v. Promoting application of cogeneration in industrial sector | | ✓ | ✓ | ✓ |

| | | | | | |
|---|---|---|---|---|---|
| | vi. Promoting energy plantations to reduce pressure on natural forests | | ✓ | ✓ | ✓ |
| **6.Livestock** | i. Promoting climate change resilient traditional and modern knowledge on sustainable pasture and range management systems | ✓ | ✓ | ✓ | ✓ |
| | ii. Promoting development and implementation of land use plans countrywide | | ✓ | ✓ | ✓ |
| | iii. Enhancing development of livestock infrastructure services | | ✓ | ✓ | ✓ |
| | iv. Promoting development of livestock insurance strategy | | ✓ | ✓ | ✓ |
| | v. Promoting livelihood diversification of livestock keepers | | ✓ | ✓ | ✓ |
| | vi. Enhance integrated rangeland management | | ✓ | ✓ | ✓ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | vii. | Promoting forage harvesting and conservation | | ✓ | ✓ | ✓ |
| | viii. | Enhance pasture seed production | | ✓ | ✓ | ✓ |
| **7.Fisheries** | i. | Enhancing research development and regular monitoring of fisheries habitat and species | ✓ | ✓ | ✓ | ✓ |
| | ii. | Facilitating enhancement and/or development of integrated data management system in the fisheries sector in line with the Convention on International Trade of Endangered Species (CITES) | | ✓ | ✓ | ✓ |
| | iii. | Promoting aquaculture | | ✓ | ✓ | ✓ |
| | iv. | Enhancing protection and conservation of aquatic ecosystems | | ✓ | ✓ | ✓ |
| | v. | Supporting alternative livelihood initiatives for fisheries community | | ✓ | ✓ | ✓ |
| | vi. | Strengthening conservation of endangered species | | ✓ | ✓ | ✓ |

| | | | | | |
|---|---|---|---|---|---|
| **8.Land use** | i. Reviewing and promoting use of land use master plans | ✓ | ✓ | ✓ | ✓ |
| | ii. Exploring and promoting various sustainable land management technologies | | ✓ | ✓ | ✓ |
| | iii. Strengthen the use of land use plans | | ✓ | ✓ | ✓ |

### 4.5 Sectoral Adaptation Action Plan

Develop a detailed sectoral adaptation action plan as shown in Table 4.

Table 4: Template of the sectoral action plan

| Issue | Priority actions | Targets | Expected output | Indicator | Time frame | Unit Cost (Tshs.) | Key Actors | Funding Sources |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | | | | | | | |
| | | | | | | | | |

## 4.6 Monitoring and Evaluation

Provide climate change adaptation performance indicators for monitoring and evaluation purposes. Performance indicators for climate change adaptation have to capture cross cutting issues such as gender and disability. Finally, undertake monitoring and evaluation.

## 4.7 Summary

The process of integrating climate change adaptation can be summarized as depicted in figure 5 and described as follows;

a) Integrating Climate Change Adaptation (CCA) into the national sectoral policies, plans and programmes starts by identifying the problems/CCA gaps by undertaking sector situation analysis.
b) The identified problems/gaps needs to be intervened and integrated into the national sectoral policies, plans and programmes.
c) Thereafter implementation interventions shall be developed and finally monitoring and evaluation interventions shall be undertaken.
d) At the monitoring and evaluation stage you can either exit or continue to identify problem/CCA gaps depending on the information gathered from the field. However at each stage of integration social, economic and political contexts influences the process.

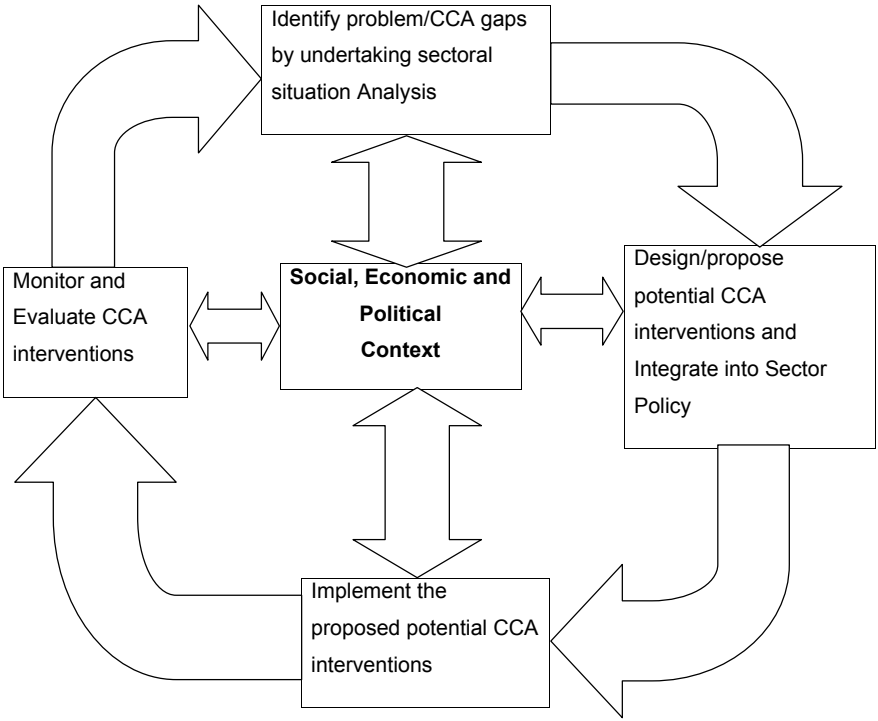


**Figure 5: Climate change adaptation integration processes**

# CHAPTER FIVE

# OPERATIONALIZATION OF THE GUIDELINES

## 5.1 Introduction

This chapter aims at making the guideline operational. It articulates some of the generic activities that need to be undertaken in operationalizing the guidelines. It also describes key actors and their roles in facilitating the operationalization of the guidelines. Some of the key issues that are prioritized for making the guidelines operational include coordination and dissemination, finance mobilization, integration of climate change adaptation into policies, plans and programmes, monitoring, evaluation and reporting of the guidelines.

5.2 Generic activities for operationalizing of the guidelines

The overall coordination and dissemination of the guidelines is the responsibility of the Vice President's Office (VPO). The guidelines will be disseminated to stakeholders such as MDAs, LGAs and Non State Actors through workshops, National commemorations days, VPO website and booklets. The National Climate Change Steering Committee (NCCSC); the National Climate Change Technical Committee (NCCTC) and the Environmental Working Group (EWG) are responsible for overseeing and playing an advisory role in operationalizing the guidelines.

The financing of the guidelines is done through General Budget

Support (GBS). The adaptation interventions are integrated in each MDAs and LGAs through respective Medium Term Expenditure Frameworks (MTEF) for implementation. More resources are expected to be mobilized from international and regional funds, funds under the UNFCCC and Kyoto Protocol, bilateral, individuals and foundations funds.

The integration of the climate change adaptation into respective sectoral policies, plans and programmes is the responsibility of the relevant MDAs. Specifically, the MDAs will undertake climate change situation analysis, identify relevant adaptation activities, prepare projects, programmes, action plans and mobilize funds for integration of climate change adaptation. The Prime-Minister's Office-Regional Administration and Local Government (PMO-RALG) will work closely with Local Government Authorities (LGAs) through their various departments in collaboration with lined sectoral ministries to implement the climate change adaptation interventions at local level. The Civil Society Organisations are encouraged to cooperate with the Government in implementing the guidelines through various projects or programmes. The private sectors either individually or in collaboration with the Government in public-private partnership (PPP) arrangement are encouraged to implement innovative projects or programme to address climate change adaptation.

The Development Partners (DPs) either bilaterally or through their multilateral arrangements are invited to support the Government to operationalize these guidelines by building capacity in term of technical and financial support.

The overall responsibility for monitoring, evaluating and reporting of the guidelines is under VPO. The progress towards operationalizing of the guidelines will be tracked and reported periodically. The MDAs and LGAs are responsible for monitoring, evaluating and reporting to VPO on progress made in the integration climate change adaptation in their respective policies, plans and programmes annually.

# APPENDIXES

## APPENDIX I: DEFINITIONS OF KEY TERMINOLOGIES AND CONCEPTS

**Climate:** Climate encompasses the statistics of meteorological conditions, that is, temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle count and other meteorological elements in a given region over long periods of time (usually 30 years).

**Climate change:** A change of climate, which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere, and which is additional to natural variability, and observed over comparable periods of time.

**Climate variability:** Variations in the mean state and other statistics (such as standard deviations, the occurrences of extremes, etc) of the climate on temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).

**Capacity building:** Capacity building and capacity development for climate change refers to the development or strengthening of personnel skills, expertise, and relevant institutions and organizations to reduce GHG emissions and/or to reduce vulnerability and adapt to climate-related impacts.

**Adaptation:** Adaptation to global warming refers to actions aimed at coping with climatic changes that cannot be avoided and at reducing their negative effects. Adaptation measures include the prevention, tolerance or sharing of losses, changes in land use or activities, changes of location and restoration.

**Kyoto Protocol:** The Kyoto Protocol is an international binding agreement linked to the United Nations Framework Convention on Climate Change. It was adopted at the 3rd Conference of the Parties to the UNFCCC in Kyoto, Japan. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions . the first commitment period aimed at reducing amount to an average of five per cent against 1990 levels over the five-year period 2008-2012. Second commitment period will end by 2017 and this will be the end of the Kyoto Protocol.

**UNFCCC:** Is a non-binding global agreement on climate change, which sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. It was adopted in Rio de Janeiro, Brazil in June 1992.

**Global warming:** The intensification of the greenhouse effect, which results from anthropogenic actions, where the consequence is an increase in the concentration of greenhouse gases, aerosols and their predecessors in the atmosphere. These absorb and retain part of the infrared radiation emitted by the Earth's surface, thus increasing

the average temperature on the planet and causing adverse climatic phenomena.

**National Adaptation Programmes of Action (NAPAs):** As defined in Article 4.9 of the UNFCCC, and further provided for by Decision 5/CP.7 of the 7th Conference of the Parties (COP) to the UNFCCC, provide a process for Least Developed Countries (LDCs) to identify priority activities that respond to their urgent and immediate needs to adapt to climate change – those for which further delay would increase vulnerability and/or costs at a later stage.

**Intergovernmental Panel on Climate Change (IPCC):** Is a body or institution formed jointly by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1989 to provide broad and balanced information about climate change.

**Clean Development Mechanism (CDM):** As defined in Article 12 of the Kyoto Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one metric ton of CO2, which can be counted towards meeting Kyoto targets. It is one of the three flexible trading mechanisms under the Protocol (the others being Emissions Trading-ET, and Joint Implementation-JI).

**Vulnerability:** The degree of susceptibility to the negative effects of climate change. It is a function of the type, magnitude and frequency

of climate events to which a system is exposed to (exposure) as well as sensitivity and capacity for adaptation (adaptive capacity).

**Resilience:** The ability of a system to adapt to climate change, whether by taking advantage of the opportunities, or by dealing with their consequences.

**Sustainable development (Sustainability):** Is development which meets the needs of current generations, without compromising the ability of the future generations to meet theirs.


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