



UNITED REPUBLIC OF TANZANIA
VICE PRESIDENT'S OFFICE
NATIONAL CLIMATE CHANGE STRATEGY



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Division of Environment

FOREWORD

Climate change is an emerging global challenge to sustainable national development. The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, 2007 provides that most of the warming of our climate is very likely due to increasing greenhouse gas (GHG) concentrations in the atmosphere resulting from human activities, including but not limited to the burning of fossil fuels in power stations for electricity and in vehicles, as well as in industrial processes.

The IPCC report also concluded that the temperature has risen by approximately 0.74°C and the sea level has increased by 17cm over the past 100 yrs, and further projects that global temperatures will rise by 1.1 to 6.4°C over 1990 levels, while global mean sea levels will rise by 18 to 59cm by around 2100, depending on future scenarios of varying global emission levels. Temperature extremes, heat waves and heavy rainfall events are projected to become more frequent.

For a country like Tanzania, whose economic growth and sustainability depends on climate sensitive economic sectors, environmental sustainability and economic growth will continue to be key drivers of socio-economic development. As a diverse country with abundant natural resources it is important that such resources be safeguarded by ensuring their sustainable use and management amidst the changing climate. At the same time it will be important to achieve synergies across the various national level policy objectives on environmental sustainability, economic competitiveness and energy security through the use of available climate change opportunities in the various key economic sectors.

The National Climate Change Strategy presents Tanzania with an opportunity to address climate change adaptation and participate in the global efforts to reduce GHG emissions in the context of sustainable development. This Strategy outlines initiatives to build a critical mass of climate change experts to address adaptation challenges and proactively exploit available international financial and technical resources to address climate change, thereby enhancing Tanzania's participation in international climate change discussions.

This Strategy also reiterates Tanzania's commitment to address climate change in consideration of the fact that the country is highly vulnerable to the impacts of climate change. The challenge of climate change mitigation requires the commitment and participation of all countries, under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC). Tanzania can effectively participate provided there is adequate and sustained support.

All countries have to play a role in addressing climate change consistent with their unique national circumstances. Tanzania will do its part, in particular by improving the energy availability to reduce deforestation, improve energy diversification and efficiency of her major energy consuming sectors, including, power generation, manufacturing,

and transportation. Tanzania is also committed to national and global research efforts on climate change and the development and adoption of clean energy technologies, such as wind, geothermal and solar. However sustainable production and use of charcoal will remain central to ensuring the availability of affordable and reliable energy sources in the country. With over 33.5 million hectares of forestry reserves and sizable rural land under forest cover, Tanzania's commitment to the conservation of its forests is timely, considering that these contribute to sustainable development and act as a sink of GHG.

Studies show that Tanzania is vulnerable to the increased climate variability and climate change. The development of an effective strategic and institutional framework is crucial to enhance the country's expertise, governance, technological and infrastructural capacities. Although some of the existing environmental planning in the context of the Environmental Management Act, 2004 addresses certain aspects of climate change, enhancement of climate change existing governance strategies and institutional arrangements is still required to address all aspects of climate change mitigation and adaptation. Studies related to Tanzania's vulnerability to climate change including, the Quick Scan on the Impacts of Climate Change, 2009; Sector Analysis for the Preparation of the National Adaptation Programme of Action, 2007; In-Depth Analysis of Climate Change Mitigation Options and Opportunities in the Forestry Sector, 2009; and the Initial National Communication to the UNFCCC, 2003, as well as the national Reducing Emissions from Deforestation and Forest Degradation (REDD) process, have contributed to a better understanding of present and future impacts of climate change.

There are several co-benefits to climate change actions, for example, Tanzania's efforts to ensure energy availability provide mitigation opportunities, most notably in energy generation, industry, transportation, waste management and forestry sectors. This will in the long run reduce air pollution, resulting in cleaner air particularly in urban settings.

Notably, unless both financial and technological support is provided to Tanzania to exploit existing renewable energy potentials, such as geothermal, solar and wind, the country shall be reliant on conventional fossil fuels and wood fuels to meet its energy needs. Financial and technical support will also be required to promote and build climate resilience and sustainable economic growth.

Climate change actions may also generate economic opportunities, for example, in the clean energy and energy efficiency service sectors. Notably, energy efficiency shall assist to reduce energy consumption costs at a domestic and industrial level. At the national level, this helps to reduce Tanzania's dependence on imported fossil fuels, thereby enhancing national energy security as well. In addition reduction in energy consumption will contribute positively to business by increasing profit margins.

The government of Tanzania in conjunction with other key stakeholders shall work closely to develop in an environmentally sustainable manner compatible with economic growth to continue to address current and future impacts of climate change, regularly review the adequacy of existing adaptation measures, identify new measures as

necessary, and establish national systems to actively monitor and manage these impacts. Furthermore, existing mitigation options present an opportunity for Tanzania to participate in reducing global emissions, so as to foster its national development goals and objectives.

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ACKNOWLEDGEMENT

The development of this National Climate Change Strategy has enlisted the assistance, participation and cooperation of various key stakeholders and experts in both the public and private sector and I would like to acknowledge their efforts.

It would be impossible to list all whose support and comments proved valuable in preparing this Strategy, however, I would like to take this opportunity to thank all the sectoral ministries, government departments, local government authorities, research and academic institutions, private sector, non-governmental organizations, civil society and other institutions for participating in the development of this Strategy. Their proactive commitment to contribute in one way or another in the collation of baseline information, participatory stakeholder consultations (formal and informal) and building a national consensus for this Strategy captures the national aspirations of the country to address the impacts of climate change.

Special recognition is extended to the team of experts Eng. L. Kyaruzi; P. Ndaki; E. Adam; C. Shengena; C. Msangi; Dr. L. Changá; Prof. R. Kangalawe; T.W. Massoy; Eng. T. Ngulika; Eng. P. Marwa; F. K. Manyika; P. Kisina; W. Mrema; A. Tillya; E. Kibona; J. Kubena; and A. Mapinduzi who worked diligently under the leadership of the Assistant Director of Environment responsible for Climate Change R.S. Muyungi. The general guidance of the Director of Environment, Dr. Julius Ningu that has made this work possible is also highly appreciated. I also recognize and acknowledge contributions from other stakeholders and development partners at various stages during development of this Strategy.

Finally, I wish to thank the Government of the Kingdom of Denmark, for financing the development of this Strategy.

Sazi B. Salula
PERMANENT SECRETARY
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EXECUTIVE SUMMARY

This Strategy has been developed in response to the growing concern of the negative impacts of climate change and climate variability on the country's social, economic and physical environment. Its overall aim is to enhance the technical, institutional and individual capacity of the country to address the impacts of climate change. The Strategy covers adaptation, mitigation and cross-cutting interventions that will enable Tanzania the benefit from the opportunities available to developing countries in their efforts to tackle climate change. These opportunities were recognized under the Copenhagen Accord, Cancun Agreement and Durban Platform for Enhanced Action, and they include technology transfer to developing countries under the proposed Technology Mechanism; opportunities offered by the Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) Mechanism; and financing for both adaptation and mitigation activities under the proposed 'Fast Start Climate Funding' (of up to USD(\$) 30 billion in 2012), rising gradually to USD(\$) 100 billion annually by 2020 and last but not least, the Green Climate Fund, whose aim is to promote the paradigm shift towards low emission and climate resilient development pathways by providing support to developing countries to limit their greenhouse gas (GHG) emissions and adapt to the impacts of climate change.

Climate may change more rapidly than expected and is expected to have complex, long term consequences for the environment, and for our production systems. The adverse impacts of climate change are now far reaching and evident in most parts of the world. It is a serious risk to poverty reduction and threatens to undo decades of development efforts. The impacts are more pronounced in poor countries such as Tanzania with the least adaptive capacity.

The IPCC Fourth Assessment Report, 2007, confirmed an increase of mean temperature of approximately 0.74°C and the sea level rise of about 17cm over the past 100 years. Further projections also provide that sea levels will continue to rise for at least another century due to thermal expansion, even if GHG concentrations could be reduced (Meehl et al., 2007). If GHG concentrations remain at the constant levels of the year 2000, global temperature is likely to rise from 0.3°C to 0.9°C per decade. Mitigation to climate change is therefore of paramount importance to limit adverse temperature increases. It is imperative that the public sector and all major stakeholders have a central role to plan, implement, enforce, monitor and evaluate the implication of climate change through strategic interventions, plans and programmes (Ehler, C.N., et al., 1997), to be implemented at national level.

The development of this strategy responds to the above needs by ensuring that there is more coordination and complementarity between key economic sectors in implementing climate change activities. Moreover this Strategy makes it easier for the country to benefit from global climate change mitigation and adaptation opportunities while contributing significantly to the international community efforts to address climate change. International cooperation as a key tool in addressing climate change challenges at national and regional level.

The approach and methodology employed in the development of this Strategy involved extensive literature review and analysis, which was undertaken to identify the linkages between climate change, natural resource management and socio-economic systems. This was augmented by national consultations with various stakeholders ranging from zonal workshops which were undertaken to collect and collate views from individuals at community level, create awareness on climate change impacts and the need for a Strategy to harmonize on-going and future activities. The five zonal workshops were conducted in: Mtwara representing the Southern zone (31 January - 2 February 2011); Arusha representing the Northern zone (6 - 9 March 2011); Mwanza representing the Lake Zone (26 - 29 May 2011); and Mpanda representing the Western zone (20 - 21 June 2011). Additionally, the national stakeholder workshop held in January 2012 with representation from the private sector, public sector, development partners as well as the academia was undertaken to support the validation of the final draft of this Strategy.

A multidisciplinary team of experts was selected and worked closely with the National Climate Change Focal point, the Division of Environment, Vice President's Office (VPO) to prepare initial drafts of this Strategy. The team was drawn from various governmental ministerial departments and agencies (MDAs), research institutions, academia and civil society. The team also received, reviewed and integrated stakeholders' views in the Strategy. The team of experts held a number of working sessions towards accomplishment of this document.

The goal of the Strategy is to enable Tanzania to effectively adapt to climate change and participate in global efforts to mitigate climate change with a view to achieving sustainable development in line with the Five Years National Development plan; the Tanzania Development Vision 2025, as well as national sectoral policies. It is expected that this Strategy will reduce vulnerability and enhance resilience to the impacts of climate change. The implementation of the Strategy will enable the country to put in place measures to adapt to climate change and mitigate GHG emissions in order to achieve sustainable national development through climate resilient pathways.

The specific objectives of this Strategy are:

- a) To build the capacity of Tanzania to adapt to climate change impacts.
- b) To enhance resilience of ecosystems to the challenges posed by climate change.
- c) To enable accessibility and utilization of the available climate change opportunities through implementation.
- d) To enhance participation in climate change mitigation activities that lead to sustainable development.
- e) To enhance public awareness on climate change.
- f) To enhance information management on climate change.
- g) To put in place a better institutional arrangement to adequately address climate change.
- h) To mobilize resources including finance to adequately address climate change.

The Strategy is divided into four (4) chapters:

Chapter 1 (Introduction): This Chapter provides essential background information on climate change, including Tanzania's actions to address climate change by ratifying the UNFCCC and the Kyoto Protocol, the supporting environmental management framework and the general existing national policies in relation to promotion of climate resilience and economic growth. It also contains a brief overview of global climate change interventions, opportunities and challenges, as well as provides rationale for the development of this Strategy, including the need to develop a comprehensive framework that takes into account the national adaptation and mitigation needs at all levels of development and a monitoring and evaluation framework to ensure the achievement of proposed strategic interventions. The development and implementation of this Strategy will contribute significantly to the country's efforts to adapt and mitigate to the impacts of climate change. Additionally, this Strategy provides a broader nationally based guidance on the integration of climate change activities into national development initiatives by establishing platforms for continued research and development (R&D) on climate change, as well as empowering the government to take appropriate measures to address climate change impacts by enforcing statutory requirements as stipulated in the Environmental Management Act, Chapter 191 of the Laws of Tanzania (EMA), among others.

Chapter 2 (Country Situational Analysis): This Chapter provides the country's situational analysis and profile which includes geographical location, physical features and climatic conditions; social economic status of the country including summary performance of various sectors of the economy. It also contains relevant information on climate trends and projections (temperature and rainfall), which is demonstrated through the analysis of recent climatological data and observational evidence from local communities signalling the increased effects of climate variability and climate change. For instance, there has been observed increased temperature over the highland areas, as well as decreasing rainfall amounts and seasonal shifts in rainfall patterns in most parts of the country. The chapter contains information on time series analysis of both mean annual maximum and minimum temperature, which have revealed significant increase in temperature trends in all meteorological stations across the country as depicted by temperature trends from a few randomly selected stations. It is demonstrated in this chapter that due to climate change, mean annual temperature for Tanzania is projected to increase by 1.7°C in North Eastern areas of the country and by 2.5°C in Western parts of the country. The frequency and severity of extreme climatic events in the last 40 years, notably drought and floods have been demonstrated and more than 70% of all natural disasters in Tanzania are hydro-meteorological, and are linked to droughts and floods. The environmental and ecological impacts of these on agriculture, livestock, wildlife, infrastructure, industry, human settlement and social services such as, energy and water are demonstrated.

The chapter further outlines climate change initiatives, both adaptation and mitigation being undertaken in Tanzania, which are implemented in line with national development initiatives geared towards reducing poverty and supporting sustainable economic

development at a national and community level. The linkage between this Strategy and other important national development initiatives is made. For instance the links with implementation of existing national policies including the National Environmental Policy 1997, EMA, Tanzania's Vision 2025; the Millennium Development Goals (MDGs); the National Strategy for Growth and Reduction of Poverty II (MKUKUTA II); Tanzania Five Years Plan (2011-2015) is made. Tanzania's Vision 2025, among other things, aims at attaining high quality livelihood for its people and development of a strong and competitive economy. Some of the strategies toward attaining these objectives are: (i) ensuring food self-sufficiency and security; (ii) universal access to safe water; (iii) eradicating abject poverty; (iv) reduction in infant and maternal mortality rates; (v) increasing economic growth rate by 8% per annum or more; (vi) attainment of macroeconomic stability; and (vii) provision adequate physical and social infrastructure. Climate change governance is undertaken within the context of the National Environmental Policy of 1997 and the EMA and other related policies and legislations.

Chapter 3 (*The Climate Change Strategy*): This Chapter contains the goal, objectives and scope of this Strategy. It details the strategic adaptation, mitigation and cross-cutting interventions in key economic sectors. Adaptation is emphasized as the highest priority for Tanzania being an Least Developed Country (LDC). Adaptation strategies identified in this section are built on and extend beyond National Programme of Adaptation to climate change (NAPA) as they have been prepared in a strategic approach that covers key sectors of social-economic growth of the country. The overall objective of this Strategy is to enable Tanzania to effectively adapt to climate change and participate in global efforts to mitigate climate change with a view to achieving sustainable development in the context of the Tanzania Development Vision 2025, Five Years National Development plan, as well as national cross sectoral policies in line with established international climate change agenda.

Although the country is not obliged to reduce GHG emissions, since it has minimal contribution to global GHG concentrations, this Strategy establishes a case for achieving sustainable development while participating in mitigation initiatives, such as the Clean Development Mechanism (CDM), Nationally Appropriate Mitigation Actions (NAMAs), REDD+, and other carbon markets or trading activities.

This Strategy has identified the need to build the capacity of key economic sectors and relevant institutions to address climate change adaptation and mitigation. Cross-cutting issues, including the establishment and implementation of awareness creation programmes to sensitize the public on climate change impacts, as well as adaptation and mitigation options; establishment of adequate research capacity for various R&D and training institutions to address issues related to climate change; building sufficient capacities of social facilities to address climate change related health risks; supporting acquisition of appropriate disaster risk management technologies (for example, enhancing early warning systems and weather forecasting systems); and promoting effective documentation of indigenous knowledge on climate change adaptation and mitigation in diverse sectors.

Chapter 4 (Implementation Arrangements): This Chapter outlines the implementation arrangements required to effectively implement this Strategy. The National Climate Change Technical Committee (NCCTC) and National Climate Change Steering Committee (NCCSC) will guide the coordination and implementation of this Strategy. The NCCTC shall provide technical advice to the National Climate Change Focal Point (NCCFP), while the NCCSC shall provide policy guidance and ensure coordination of actions as well as cross sectoral participation.

Notably, the Strategy will follow the government financial management guidelines and systems established under the Ministry of Finance to ensure effective resource and financial mobilisation. However, special arrangement will be made to cope with emerging complexity in accessing additional financial support for addressing climate change. Although the actual cost of implementing this Strategy has not been established, the key determinant in estimating the cost of climate change impacts can be indirectly derived from the climate change interventions outlined, that is, adaptation mitigation, capacity building and cross-cutting interventions. Without an accurate and static future scenario, it is difficult to cost the necessary strategic actions needed to address climatic changes. This challenge is demonstrated by a UNFCCC report that provides a range as opposed to specific numbers that estimate the additional funding needed for adaptation by 2030. The report projects a need equivalent to between USD (\$) 49 to 171 billion per annum globally (UNFCCC, 2007)¹.

Moreover a recent study² estimates that the cost of building adaptive capacity and enhancing resilience against future climate change in Tanzania is USD (\$) 100 to 150 million per year. The Stockholm Environment Institute report³ projects that an that additional USD (\$) 500 million per year (but probably more) is required to address current climate risks, in reducing future impacts and building resilience to future climate change. The report further states that aggregate models indicate that net economic costs could be equivalent to a further 1 to 2 % of GDP per year by 2030. With such uncertainty, it is difficult to arrive at a definitive cost of executing this Strategy.

A less inaccurate formula for arriving at the cost of implementing the action plan of this Strategy is to estimate the cost of climate change interventions outlined herein for each sector, together with on-going programmes. This will involve: (i) rating line activities based on sensitivity to climate change impacts on a four point scale (that is, no impact; low impact; medium impact and high impact); (ii) estimating a climate mark-up factor for each rating; (iii) applying the climate mark-up factor to each line budget item and; (iv) escalating annual cost to account for inflation.

The climate mark-up indices are comparable to those used in the UNFCCC report on investment and financial flows to address climate change. No impact, low-impact, medium-impact and high-impact correspond to a mark-up of 0%, 5%, 10% and 15%

¹ UNFCCC (2007), Investment and Financial Flows to Address Climate Change, Climate Change Secretariat, Bonn

² SEI 2010: The Economics of Climate Change in the United Republic of Tanzania

³ SEI 2010: The Economics of Climate Change in the United Republic of Tanzania

respectively. Additionally, the United States average inflation rate of 2%⁴ can be used to escalate the subsequent annual estimates after the base year since the indicative budget estimates are in US dollars terms, or if the costs are in Tanzania shillings (TShs) the prevailing inflation rate in the country will be used.

The Strategy will follow government standard monitoring and evaluation processes and procedures. The monitoring plan has been designed to ensure that the Vice President's Office in conjunction with other key stakeholders are empowered to monitor this Strategy at three levels: (i) input; (ii) process; and (iii) output. At the input level VPO will focus on determination of the cost effectiveness of the activities, projects and programmes to be undertaken. This is will be undertaken through review of reports periodically submitted by sectors programmes and projects to the VPO. At the process level VPO shall review and analyse the success of climate change mainstreaming in existing and planned activities which have been and/or are about to be implemented within the given time frame in the country through key economic sectors. The output level shall be determined by the achievement of the interventions and actions in the direction of the desired results.

⁴ US Federal Reserve System (2012), Historical data, US Annual Inflation available at <http://www.federalreserve.gov/econresdata/statisticsdata.htm>

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ACROYNYMS

AEZ	Agro-Ecological Zones
AF	Adaptation Fund
AfDB	Africa Development Bank
AGF	African Green Fund
AWG-KP	Ad Hoc Working Group on Further Commitments of developed countries (Annex 1 Parties) under the Kyoto Protocol
CBD	Convention on Biological Diversity
CCIAM	Climate Change, Impacts, Adaptation and Mitigation in Tanzania
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CIF	Climate Investments Funds
CO ₂	Carbon Dioxide
COP	Conference of the Parties
COSTECH	Tanzania Commission for Science and Technology
CS	Cabinet Secretariat
CSOs	Civil Society Organizations
DART	Dar es Salaam Rapid Transit Agency
DAWASA	Dar es salaam Water and Sewage Authority
DAWASCO	Dar es Salaam Water and Supplies Company
DNA	Designated National Authority
DoE	Division of Environment
DPs	Development Partners
EAC	East African Community
ECF	East Coast Fever
EEZ	Exclusive Economic Zone
EMA	Environmental Management Act
ESRF	Economic and Social Research Foundation
ET	Emission Trading
EWG	Environmental Working Group
FAO	Food and Agricultural Organisation of United Nations
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHGs	Greenhouse Gases
GIZ	German Technical Cooperation Agency
HFCs	Hydrofluorocarbons
IFAD	International Fund for Agricultural Development
IMS	Institute of Marine Sciences
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
UWSA's,	Urban Water Supply and Sanitation Authorities
TRL	Tanzania Railways Limited
TAA	Tanzania Airports Authority
TEMESA	Tanzania Electrical, Mechanical and Electronics Services Agency

TAZARA	Tanzania Zambia Railway Authority
KP	Kyoto Protocol
LDCF	Least Developed Countries Fund
LDCs	Least Developed Countries
LEG	Least Developed Countries Expert Group
LGAs	Local Government Authorities
MAFC	Ministry of Agriculture, Food Security and Cooperatives
MCDGC	Ministry of Community Development, Gender and Children
MCST	Ministry of Communication, Science and Technology
MDAs	Ministries, Departments and Agencies
MDB	Multilateral Development Banks
MDGs	Millennium Development Goals
MEM	Ministry of Energy and Minerals
MFAIC	Ministry of Foreign Affairs and International Cooperation
MIT	Ministry of Industry and Trade
MKUKUTA II	Mkakati wa Pili wa Kukuza Uchumi na Kuondoa Umaskini Tanzania
MLFD	Ministry of Livestock and Fisheries Development
MLHHS	Ministry of Lands, Housing and Human Settlements Development
MNRT	Ministry of Natural Resources and Tourism
MoEVT	Ministry of Education and Vocational Training
MOF	Ministry of Finance
MOHSW	Ministry of Health and Social Welfare
MOT	Ministry of Transport
MoW	Ministry of Water
MTEF	Medium Term Expenditure Framework
N ₂ O	Nitrous Oxide
NAMAs	Nationally Appropriate Mitigation Actions
NAPA	National Adaptation Programme of Action
NAPs	National Adaptation Plans
NCCFP	National Climate Change Focal Point
NCCS	National Climate Change Strategy
NCCSC	National Climate Change Steering Committee
NCCTC	National Climate Change Technical Committee
NCF	National Climate Change Fund
NDC	National Development Cooperation
NEMC	National Environment Management Council
NF ₃	Nitrogen trifluoride
NFP	National Forest Programme
NFRA	National Food Reserve Agency
NHC	National Housing Corporation
NIMR	National Institute for Medical Research
NSGRP II	Second National Strategy for Growth and Reduction of Poverty
PAF	Performance Assessment Framework
PES	Payment for Ecosystem Services
PMO	Prime Minister's Office
PMO-RALG	Prime Minister's Office-Regional Administration and Local Government

PO	President's Office
POPs	Persistent Organic Pollutants
PPP	Public Private Partnership
PS	Private Sector
RAHCO`	Reli Assets Holding Company
R&D	Research and Development
REA	Rural Energy Agency
REDD	Reduced Emissions from Deforestation and Forest Degradation
REPOA	Research on Poverty Alleviation
SCCF	Special Climate Change Fund
SF	Special Fund
SF6	sulphur hexafluoride
SSA	Sub-Saharan Africa
SUA	Sokoine University of Agriculture
SUMATRA	Surface and Marine Transport Regulatory Authority
TAA	Tanzania Airports Authority
TANAPA	Tanzania National Parks
TANESCO	Tanzania Electricity Supply Company
TANROADS	Tanzania Roads Agency
TBS	Tanzania Bureau of Standards
TFDA	Tanzania Food and Drugs Agency
TIC	Tanzania Investment Centre
TIRDO	Tanzania Industrial Research and Development Organisation
TMA	Tanzania Meteorological Agency
TNA	Technology Needs Assessment
TPA	Tanzania Ports Authority
TPDF	Tanzania people's Defence Force
TRL	Tanzania Railways Limited
UDSM	University of Dar es Salaam
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
URT	United Republic of Tanzania
VETA	Vocational Education and Training Authority
VPO	Vice President's Office
WHO	World Health Organization
WMO	World Meteorological Organization

DEFINITION OF TERMS AND TERMINOLOGIES

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.

Adaptive capacity: The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

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

Carbon markets/trading: An international market regime in which carbon emission reductions allowances or credits are bought and sold.

Clean Development Mechanism (CDM): As defined in Article 12 of the Kyoto Protocol, allows a country with an emission-reduction or emission-limitation and commitments 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 mechanisms under the Protocol (the others being Emissions Trading-ET, and Joint Implementation-JI).

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 activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

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).

Conference of the Parties (COP): Is the “Supreme Body” of the Convention, that is, the highest decision making authority. It is a meeting of all the parties that have ratified or acceded to the Convention.

Emissions: means the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time.

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 earth and causing adverse climatic phenomena.

Greenhouse gases (GHGs): Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emits infrared radiation. The Kyoto Protocol deals with six anthropogenic greenhouse gases, namely; carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulphur hexafluoride (SF₆) and two groups of gases: hydrofluorocarbons (HFCs e.g. HFC-23), and perfluorocarbons (e.g. CF₄) and Nitrogen trifluoride (NF₃).

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 1988 to provide broad and balanced information about climate change.

Kyoto Protocol: The Kyoto Protocol is an international legally 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.

Mitigation: Mitigation refers to efforts that seek to prevent or slow down the increase of atmospheric GHG concentrations by limiting current and future emissions and enhancing potential sinks for greenhouse gases

National Adaptation Plans (NAPs): These are medium and long term national plans to enable LDCs and other developing countries adapt to climate change.

National Adaptation Programmes of Action (NAPAs): Is an initiative to enable Least Developed Countries (LDCs) identify priority activities that respond to their urgent and immediate needs to adapt to climate change

Nationally Appropriate Mitigation Actions (NAMAs): Refers to set of policies and actions undertaken by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, aimed at achieving a deviation in emissions relative to 'business as usual' emissions.

Reducing Emissions from Deforestation and Forest Degradation plus (REDD+): Is a mechanism that seeks to reduce emissions of GHGs from deforestation and forest degradation as well as to enhance forest carbon stocks. REDD+ currently operates under the voluntary carbon markets, but will likely be entrenched in a future climate change agreement under the UNFCCC.

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

Sink: Any process or activity that removes greenhouse gases or aerosols and their precursors from the atmosphere (or that does not result into further emissions).

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

Technology transfer: A broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organisations and research/education institutions

United Nations Framework Convention on Climate Change (UNFCCC) ‘The Convention’: 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 recognises 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.

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).

1. INTRODUCTION

This Strategy has been developed in response to the growing concern of the negative impacts of climate change and climate variability on the country's social, economic and physical environment. Its overall aim is to enhance the technical, institutional and individual capacity of the country to address the impact of climate change. The Strategy covers adaptation, mitigation and cross-cutting interventions that will enable Tanzania to benefit from the opportunities available to developing countries in their efforts to tackle climate change. These opportunities were recognized under the Copenhagen Accord, Cancun Agreement and Durban Platform for Enhanced Action, and they include technology transfer to developing countries under the proposed Technology Mechanism; opportunities offered by the Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) Mechanism; and financing for both adaptation and mitigation activities under the proposed 'Fast Start Climate Funding' (of up to USD (\$) 30 billion in 2012), rising gradually to USD (\$) 100 billion annually by 2020, and last but not least, the Green Climate Fund, whose aim is to promote the paradigm shift towards low emission and climate resilient development pathways by providing support to developing countries to limit or reduce their greenhouse gas emissions and adapt to the impacts of climate change.

1.1 Background

It is widely agreed by the global community that the world's climate is changing and will continue to change at unprecedented rates. Climate change is increasingly becoming a global concern as it poses a challenge to sustainable livelihoods, economic development and global security. This concern is based on scientific findings and observational evidence provided in existing United Nations reports, IPCC reports and other related documents on impacts of climate change. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) shows an increase of global average air and ocean temperatures leading to wide spread melting of snow and ice, as well as rising global average sea level (IPCC, 2007; Norcia, 2008). The IPCC report also projects a further increase of mean temperatures to approximately 0.74°C and sea level increase at approximately 17cm.

Notably, the risks associated with climate change are already evident in various economic sectors essential for Tanzania's livelihood and sustenance, including water resources, energy generation, food security, ecosystems/biodiversity and human health. In the most vulnerable communities, the impacts of climate change pose a direct threat to people's survival. Climate change is already having significant impacts in developing countries and will affect their ability to achieve the Millennium Development Goals (MDGs) (IPCC, 2007; UNDP, 2008⁵). Recent studies project that the frequency and intensity of extreme weather events will increase, causing severe socio-economic consequences particularly to the marginalised groups in society.

⁵ UNDP (2007). Human Development Report 2007/2008: Fighting climate change: human solidarity in a divided world. Palgrave Macmillan, New York.

Developing countries, such as Tanzania, are particularly vulnerable because of their high dependence on climate sensitive livelihood activities and low adaptive capacity.

Dealing with climate change is an economic necessity to avoid serious disruption to global and national socio-economic development. While adaptation is an overriding priority for developing countries like Tanzania, mitigation is also a concern. Economic assessments indicate that the cost of inaction will exceed the cost of taking early action (Stern, 2006⁶). The participation of Tanzania in global efforts to mitigate climate change provides an opportunity for Tanzania to build climate resilience and promote sustainable economic growth. Recent development in climate change discussions, including the Cancun Agreement has shown that Nationally Appropriate Mitigation Actions (NAMAs) in developing countries are important contributions to global mitigation efforts, provided such actions are supported technologically, financially and with appropriate capacity building.

Tanzania's ratification of the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol in 1996 and 2002 respectively, is a step towards ensuring that climate change issues are addressed at the national level. The ultimate objective of the UNFCCC is to achieve stabilization of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. To effectively meet the objectives of the UNFCCC, the international community subsequently adopted the Kyoto Protocol to provide legally binding emission reductions commitments for developed countries, in addition to those included in the UNFCCC. Owing to the high costs involved to reduce the emissions by developed countries domestically, three flexible mechanisms were established under the Kyoto Protocol to assist the developed country parties to meet their commitments. The mechanisms are: (i) Emission Trading (ET); (ii) Clean Development Mechanism (CDM); and (iii) Joint Implementation (JI).

At a national level, the implementation of the UNFCCC and Protocol is further supported by the existing environmental frameworks in the country, namely the National Environment Policy (1997) and the Environment Management Act No. 20 of 2004. Both environmental arrangements endeavour to maintain sustainable environmental coordination and natural resource management. Additionally, the implementation of the various adaptation and mitigation initiatives, programmes, strategies and plans (Table 3) demonstrates the national commitment in addressing the impacts of climate change. This Strategy will strengthen implementation of such climate change initiatives and enhance national contributions to the overall national socio-economic development agenda.

In subsequent Conference of Parties (COPs) various Working Groups were established to enhance the implementation of the UNFCCC. For example, COP 11 of UNFCCC held in Montreal, Canada in 2005 established an Ad Hoc Working Group on Further Commitments of developed countries (Annex I Parties) under the Kyoto Protocol (AWG-KP) on the basis of Article 3.9 of the Protocol, which mandated the consideration of Annex I Parties' further commitments at least seven years before the end of the first commitment period. In addition, during COP 13 held in

⁶ Stern, N. (2006). What is the economics of climate change? *World Economics* 7(2): April-June 2006.

Bali, Indonesia in 2007, established an Ad Hoc Working Group on Long-term Cooperative Actions on the implementation of the Convention (AWG–LCA) and mandated it to formulate an agreed outcome on how to enhance long-term cooperative actions after two years. Furthermore, in 2011 the Ad Hoc Working Group on the Durban Platform (ADP) for Enhanced Action was established to develop another legally binding instrument or an agreed outcome with legal force under the UNFCCC applicable to all Parties.

In the context of the UNFCCC and Kyoto Protocol, climate change at global level presents a number of opportunities including the following:

- a) transfer of technology through implementation of mitigation related activities, such as REDD+ CDM and NAMAs;
- b) financial support through available funding opportunities under the UNFCCC, Kyoto Protocol, as well as various other multilateral and bilateral arrangements;
- c) transformation of the energy sector through initiatives, such as NAMAs, which if implemented effectively can support adequate generation and availability of energy in the country;
- d) enhance national and local initiatives to conserve forests and biodiversity through programmes, such as REDD+ and NAMAs in the forest sector; and
- e) enhance international cooperation between sovereign countries and various organizations.

While the international community is proactively addressing climate change challenges pursuant to the UNFCCC agenda, a number of challenges remain unaddressed. These include increasing GHG emissions, limited access to finance, insufficient technology transfer and development, low adaptive capacity, inadequate institutional arrangement, poor information management and low level of climate change awareness.

Greenhouse gas increase: Despite having the Kyoto Protocol in place, GHGs emissions continue to increase and many developed countries have not adequately taken stringent measures to reduce emissions in line with scientific findings and recommendations of the Protocol and related climate discussions.

Access to finance: For developing countries to address climate change challenges adequate financial support is necessary. The international community however, has not been able to allocate and make available sufficient financial resources for this purpose. In addition, some of the resources are provided in the form of loans which adds more difficulty to developing countries. Repayment of climate change related loans is difficult due to increasing global interest and inflation rates, which is further compounded by climate change impacts affecting climate sensitive sectors which correspond to key economic development drivers.

Technology transfer and development: For countries like Tanzania to be able to adapt and undertake appropriate mitigation actions, accessing appropriate clean technologies is a prerequisite, however, there are barriers in such endeavours. Most of these technologies are very expensive to acquire and with restrictive intellectual property rights of ownership. It is important therefore, for the international community

to remove such barriers and make such technologies readily available to LDCs to enable them to successfully address the impacts of climate change.

Adaptive capacity: Enhancing global adaptive capacity has been the most important area in addressing climate change. However the adaptive capacity of developing countries, including countries like Tanzania, remains a challenge. Adaptation to climate change requires various technical resources, such as clean technologies, financial resources, expertise, as well as appropriate institutional arrangements to build an enabling environment for climate resilience.

Institutional arrangements: Addressing climate change should be undertaken with a long term perspective. This will enable Tanzania to build resilience and achieve sustainable development. The challenge is that there is an inadequate institutional arrangement to effectively address climate change. As a result there is a need to strengthen the existing national institutional frameworks to enhance the conducive environment for addressing long term climate change adaptation, resilience building and achieving sustainable development.

Low level of information and awareness: Although numerous efforts have been undertaken to raise awareness on climate change at global, regional and national levels, not every individual has sufficient knowledge and information of the problem posed by climate change and the reactive/proactive measures required to address the problem. More efforts are still needed to enhance climate information sharing and raise the public awareness on climate change.

Climate change and security: While the challenges of climate change relate mainly to sustainable development, there is an emerging security dimension. The economic growth of developing countries, particularly LDCs, depend on climate sensitive sectors such as agriculture, livestock, forestry, water, tourism, transport, energy and health. The impacts of climate change shall adversely affect vulnerable sectors causing possible resources conflict within countries, and across borders for transboundary resources. That said it is important for developing countries policy makers and experts at national level, to understand the climate change security dimension and the related geopolitics issues. The findings of the IPCC demonstrate that even if by 2050 emissions would be reduced to below half of 1990 levels, a temperature rise of up to 2°C above pre-industrial levels will be difficult to avoid. Such a temperature increase will pose serious security risks that would increase if global warming continues. Unmitigated climate change beyond 2°C will lead to unprecedented sustainable development impacts and security concerns as it is likely to trigger a number of tipping points that would lead to further accelerated, irreversible and largely unpredictable climate changes. The measures to adapt to the unavoidable effects of climate variability need to work in conjunction with addressing national issues (due to increased resource conflict) and international security threats (due to climatic geopolitics) created by climate change.

Climate change is best viewed as a threat multiplier which exacerbates existing trends, tensions and instability. The core challenge is that climate change threatens to overburden countries and areas which are already fragile and conflict prone such as pastoral-farmer interfaces. It is important to recognize that the risks are not just of a humanitarian nature; they also include political and security risks that directly affect

the global geopolitics that could have influence national level interests. For example, the attainment of the MDGs for LDC countries like Tanzania would be at considerable risk, because the adverse effects of climate change could undermine years of national development efforts. There is also need to enhance capacity for approaches related to conflict prevention, disaster crisis management and post-disaster conflict reconstruction as it relates to climate change. Additionally LDC countries, such as Tanzania, should understand climate change geopolitics from a security perspective and strengthen the capacity of security systems in this regard.

1.2 Rationale for the Climate Change Strategy

The impacts of climate change are already being felt across the country and are projected to increase both in frequency and severity leading to severe socio-economic implications. Tanzania' ability to address the current and projected impacts of climate change is strongly hindered by a number of climatic and non-climatic factors. Non-climatic factors include poverty, inadequate institutional arrangement, lack of adequate financial resources, lack of sufficient human resource and technological capacities, low awareness and lack of adequate climate change information management.

Notably, climatic factors such as incidences of sporadic extreme weather events (such as, prolonged droughts and heavy floods), are increasing in many parts of the country with severe consequences on livelihoods, food production, water access and energy generation. The recent food shortages resulting in widespread hunger, water scarcity and acute power shortages signify the vulnerability of the country to impacts of climate change. Analysis of climate change projection indicates that Tanzania will continue to face future development challenges as a result of increased climate variability and climatic changes.

That said the rationale for this Strategy is to provide an enabling mechanism that will enable the country to effectively address the impacts of climate change and support national adaptation as well as mitigation initiatives. The development of this Strategy is an important milestone for the country in providing a framework that will facilitate and harmonize national efforts to address climate change.

1.3 Methodology

The process for the preparation of this Strategy commenced in 2008 when the VPO implemented the project to strengthen national capacity to adapt to the impacts of climate change. The process was performed in two phases, namely: (i) consultation with key stakeholders; and (ii) work by multidisciplinary expert's team.

The consultation phase included assessments of locally based climate change impacts conducted in six thematic areas in selected regions of Tanzania, including Zanzibar, and zonal consultative workshops. Assessments of locally based climate change impacts were undertaken in 2008/2009, in six thematic areas in selected

regions of Tanzania, including Zanzibar (URT, 2009⁷). The overall objective of these assessments was to reveal and document both the key locally based impacts of climate change and their cultural, socio-economic and environmental implications to the local communities and to the country as a whole. These assessments further sought to collect and consolidate pictorial and textural materials that could facilitate comparability of the past and present physical environment so as to reveal the magnitude of change where possible. The assessment addressed the impacts of climate change on health, coastal environment, water resources, crop and livestock production systems, animal and plant diseases and pests, and biodiversity. The assessments were undertaken using four main techniques: public meetings, field observations, secondary data, focus group discussions and interviews with key informants at regional and district levels, selected institutions, and households in selected villages. Moreover, zonal workshops were used as dialogue sessions with stakeholders from the private and public sectors where initial ideas on the process of preparing the National Climate Change Strategy were collected and discussed. Five workshops were conducted between January and June 2011, in southern zone (31 January-2 February 2011) in Mtwara; northern zone (6-9 March 2011) in Arusha; Lake Zone 26-29 May 2011) in Mwanza; and western (20-21 June 2011) in Mpanda. Consultation on final draft was also undertaken through a national stakeholder workshop held in January 2012 with representation from the private, public sector, NGOs/CBOs development partners as well as the academia.

The second phase involved formation of a multidisciplinary team of experts comprising of members from various government MDAs, research institutions, academia and selected NGOs with a special task of preparing this strategy. The team of experts working with the National Climate Change Focal point, held a number of working sessions towards accomplishment of the task. The team made use of the data and relevant information gathered during the preliminary assessment and zonal workshops. Furthermore a rigorous literature review was undertaken to identify key linkages between climate change and various natural and social systems and how such systems respond to climate change impacts. Literature on how other countries have prepared their strategies was also consulted.

The draft Strategy was then subjected for review by civil society organisations, private sectors, development partners and Climate Change Technical and Steering Committee, among others, through national stakeholder workshops. Relevant comments from all stakeholders were then incorporated in this Strategy.

2. COUNTRY SITUATIONAL ANALYSIS

2.1 Country Profile

2.1.1 Geographical Location

Tanzania is located south of the Equator, lying mostly between latitudes 1 and 12°S, and longitudes 29° and 41°E. It is constituted by Tanzania Mainland and Zanzibar with a total area of 945,087 km² comprised of land area of 883,749 km² (881,289 km² mainland and 2,460 km² Zanzibar), and 59,050 km² of inland water bodies and

⁷ United Republic of Tanzania – URT (2009). Climate Change Impacts Assessment Report - 2009. Vice President's Office - Division of Environment, Dar es Salaam

part of the Indian Ocean. Tanzania mainland encompasses island of Mafia (518 km²) while Zanzibar comprises islands of Unguja (1,666 km²) and Pemba (795 km²) as major islands. There are numerous smaller islands both in the mainland and Zanzibar. Tanzania shares borders with Kenya and Uganda to the north; Rwanda, Burundi and Democratic Republic of Congo to the west; Zambia and Malawi to the south-west, Mozambique to the South; and the Indian Ocean to the East (Figure 1).



Figure 1: Map of Tanzania

2.1.2 Main Physical features

There is a wide variety of physical features extending from a narrow coastal belt of the western Indian Ocean with sandy beaches to an extensive plateau with altitude ranging from 1000 to 2000 meters above sea level. The plateau is fringed by narrow belts of highlands, including Mount Meru (4,566m), Mount Kilimanjaro (5,895m) the highest mountain in Africa, and other mountain ranges such as Livingstone, Kipengere, Udzungwa, Uluguru, Nguu, Usambara and Pare. Tanzania has several fresh water bodies, including Lake Victoria, the largest in Africa; Lake Tanganyika, the longest and deepest in Africa; and Lake Nyasa. The country also has many large rivers, draining into nine drainage basins. The major rivers include Rufiji, Kagera, Mara, Ruaha, Pangani, Ruvuma and Malagarasi. The nine water basins are Wami-Ruvu, Pangani, Lake Victoria, Lake Nyasa, Lake Tanganyika, Lake Rukwa, Rufiji, Ruvuma and the internal drainage basin around Singida.

Tanzania is also traversed by the spectacular Great Rift Valley system with two arms. The western arm in which Lake Nyasa, Tanganyika and Rukwa fall in runs along the western part of the country, while the eastern crosses in the central part with Lake Eyasi, Manyara and Natron in it. There are also other spectacular physical features including the diverse vegetation types such as extensive savannah and bushy vegetation that are fringed by narrow belts of forested highlands, the Itigi thickets, the Masai steppes, the miombo woodlands covering a greater part of the land area, and the mangrove systems along the coast. These ecosystems are famous habitats for diverse types of wildlife.

2.1.3 Climatic Condition

The climate in the country is diverse as a result of proximity of the ocean and inland lakes; wide altitudinal range, which governs temperature; and latitude. It is characterized by two main rain seasons namely the long rains and the short rains which are associated with the southward and northwards movement of the Inter-Tropical Convergence Zone. The long rains (Masika) begin in the mid of March and end at the end May, while the short rains (Vuli) begin in the middle of October and continues to early December. The northern part of the country including areas around Lake Victoria Basin, North-Eastern Highlands and the Northern Coast experience a bimodal rainfall regime. Central, South and Western areas have a prolonged unimodal rainfall regime starting from November, continuing to the end of April. In general, annual rainfall varies from 550 mm in the central part of the country up to 3690 mm in some parts of south-western highlands (Chang'a et al., 2010). Spatial distribution of mean annual rainfall is presented in Figure 2. Most of the country receives less than 1,000mm, except the highlands and parts of the extreme south and west where 1,400 to 2,000mm can be expected. Average rainfall in the central regions is around 600mm.

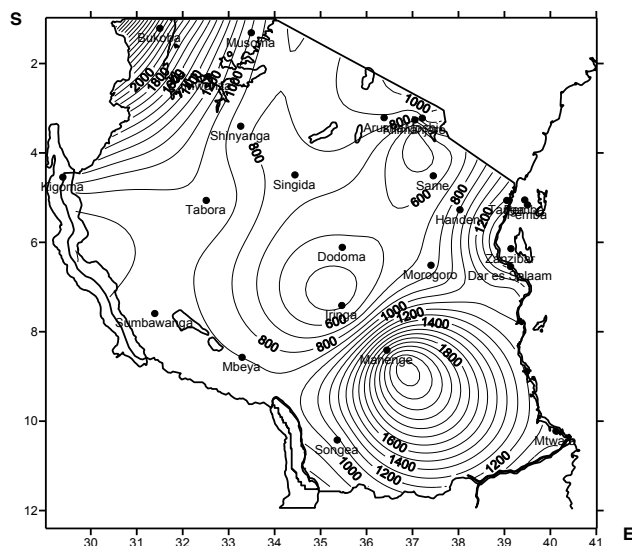


Figure 2: Spatial distribution of mean annual rainfall (1970 – 2000)

Source: Technical Team 2012

Temperature varies according to the geographical location, relief and altitude. Along the coast and in the off shore islands the average temperature ranges between 27°C and 29°C, while in the central, northern and western parts temperatures range

between 20 and 30°C. Temperatures are higher between the months of December and March and coolest during the months of June and July. In the Southern highlands and mountainous areas of the north and northeast, temperature occasionally drops below 15°C at night (URT, 2008⁸), and in the cold months in June and July sub-zero temperatures can also be experienced. Spatial patterns of mean annual maximum (Tmax) and minimum temperature (Tmin) are presented in Figure 3 and Figure 4 respectively. Distribution of Tmin is identical to that of Tmax, lower values of Tmin are centered on south-western and north-eastern highlands. Mbeya, Igeri, Arusha, Moshi and Kilimanjaro are the coolest areas characterized by mean annual Tmin values which are less than 15°C. Coastal areas including Dar es Salaam, Tanga, Mtwara, Zanzibar and Pemba are characterized by relatively higher values (> 20°C) of mean annual Tmin (Figure 3).

Based on altitude, precipitation and temperature pattern, dependable growing seasons and average water holding capacity of the soils and physiographic features, Tanzania has seven agro-ecological zones as presented in Annex 1.

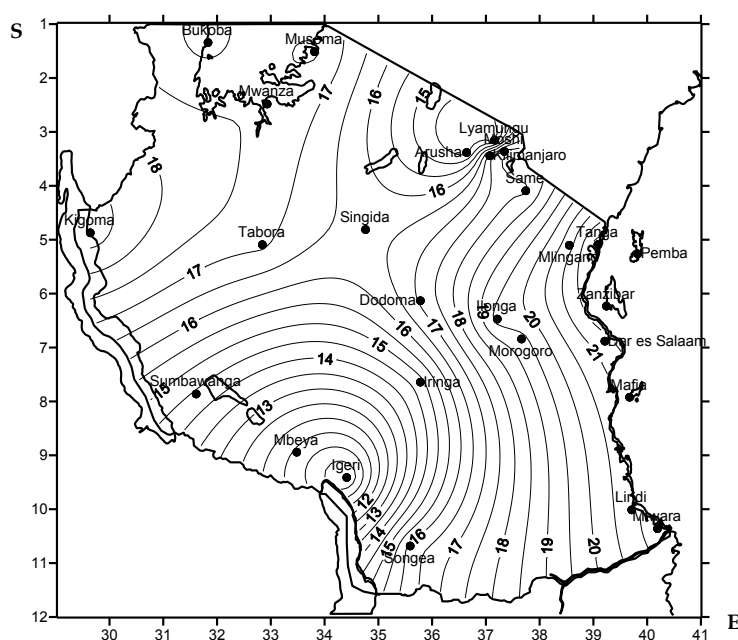


Figure 3: Mean annual minimum temperature (°C)

Source: Technical Team 2012

2.1.4 Natural Resources and economic activities

Mineral sector

Tanzania is endowed with large deposits of gold, diamond, tanzanite, ruby, tin, copper, nickel, iron, phosphate, gypsum, coal, natural gas, uranium and oil. Mining involves large and small scale, both of which are potential. In 2007, the sector grew at about 15% annually, but dropped to 2.5% in 2008 and to a further 1.2% in 2009

⁸ URT (2008). State of the Environment Report 2008. Vice President's Office, Division of Environment, Dar es salaam.

due to decline in export of diamonds and gold production. The contribution of mining and quarrying sub activities to Gross Domestic Product (GDP) decreased marginally from 3.4% in 2008 to 3.3% in 2009 (URT,2010)⁹. Nevertheless it is expected the mining sector to increase to 3.2% by 2015 (MKUKUTA II, 2010).

Forestry sector

Tanzania has a total area of about 94.5 million hectares out of which 88.6 million hectares are covered by landmass and the rest is water bodies. The country has a total of 35.3 million hectares of forests (see Figure 9) out of which 16 million hectares comprise of reserve forests, 2 million hectares are forests in national parks and the rest, 17.3 million hectares (49% of all forestland), are unprotected forests in general land. This is one of the highest forest cover in the Eastern and Southern Africa. The forests contribution to the national GDP is estimated to be between 2.3% and 10% of the country's total GDP. This contribution is underestimated because of unrecorded consumption of wood fuels, bee products, catchment and environmental values and other forest products¹⁰. The forest sector act as a carbon sink, absorbing all emissions produced at national level and more, making Tanzania a net sink of GHGs.

Wildlife sector

The wildlife sector has an important contribution to the national development, mainly from activities of tourism such as photographic sceneries, wild animal hunting and licensing of trophy business. The sector is rapidly growing. For instance, in 2009, receipts from wildlife sector increased to TShs 23,575.7 million from TShs 18,387.4 million in 2008, equivalent to an increase of 22% (URT, 2010). This sector like other sectors of the economy is constrained by the impacts of climate change. Many species around the country are affected by the combined impacts of climate factors, anthropogenic factors such as the encroachment, land fragmentation and destruction of natural habitats. Such changes in natural habitats may alter wildlife distribution patterns, and compounded by climate change, such situation may increase conflict for resources. This may be the case particularly amongst migratory species, which use a network of sites, and may constrain their ability to adapt to changes. Conversely, anthropogenic factors are likely to exacerbate the impacts of climate change on wildlife. For example, increased water abstraction for rice irrigation upstream Katuma River system has already contributed significantly to water shortage for wild animals in Katavi National Park (Elisa at al., 2011¹¹). A similar experience is also reported for the Great Ruaha River ecosystem.

Wetlands sector

Wetlands in Tanzania cover 10% of the total land area, of which 5.5% is presently for the four Ramsar sites. Among them include Malagarasi-Moyovosi (32,500 km²), Lake Natron Basin (2250 km²), Kilombero valley floodplain (7,950 km²) and Rufiji-Mafia-Kilwa (5,969.7 km²). Millions of people depend on wetlands for fishing and related livelihood activities (Dixon, 2003; MNRT, 2003). They are also important ecosystems, which in their natural state play an important role in the water cycle through numerous functions. By way of ground water recharge, wetlands and filter

⁹ The economic survey 2009

¹⁰ See: <http://www.tanzania.go.tz/naturalresources.html>

¹¹ Elisa at al., 2011

underground aquifers for potable water. The same would then move out of the aquifer to become surface water through Ground water discharge. Wetlands also store large volumes of rain water which subsequently run slowly into rivers. This diminishes the destructive effects of flooding downstream. As for coastal areas, wetland vegetation such as mangroves stabilizes shorelines by reducing the energy of waves, currents, or other erosive forces.

Agriculture and food security sector

Agriculture is the mainstay of the Tanzanian economy contributing about 23.7% of GDP in the year 2011, 30.9% 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, 2009a¹²).

The agricultural sector comprises of crops and livestock sub sectors. Policy wise, the agricultural sector relates to crop production taking into account the synergies with other closely related policies like that of livestock, marketing and irrigation. On average, crop production contributes about 19.0% of GDP and grows at 4.1% (URT, 2008a¹³) while livestock production contributed about 5.9% of the GDP and grow at 4.3%. Food crop production is growing at a rate of about 2.8%, accounting for about 65% of agricultural GDP while cash crops account for about 10%. Maize is the most important crop accounting for over 20% of total GDP. Food and cash crops account for about 70% of rural incomes.

Tourism sector

Tanzania's tourism sector is among the sectors with great economic potential. The country has many tourist attractions that include 14 national parks and 31 game reserves with large herds of wildlife, such attractions, include Ngorongoro Conservation Area, as well as Serengeti and Ruaha National Parks - Tanzania's largest national parks. Other tourist attractions include mountains, islands, beaches, historical sites, cultures and traditions, some of which are world heritage sites such as Mountain Kilimanjaro, the highest mountain in Africa while Kilwa Kisiwani, Songo Mnara and Zanzibar are among the most beautiful islands in the world. The sector contributes about 17.5% in GDP (MNRT, 2011). Notably tourism performance shows that the number of international visitors has increased from 501,669 in 2000 to 770,376 in 2008. Likewise, receipts accruing from international visitors have increased significantly from USD (\$) 376.1 million to USD (\$)1,269.68 million within the same timeframe.

Energy sector

Tanzania is well endowed with enormous and diversified energy resources potential for immediate, medium and long term electricity needs of the country (Table 1).

¹² United Republic of Tanzania - URT (2009a). Climate change and agriculture policy brief. Vice President's Office, Division of Environment, Dar es Salaam

¹³ United Republic of Tanzania - URT (2008a). Economic Survey, 2007. The Ministry of Finance and Economic Affairs, Dar es Salaam

These sources include hydropower, natural gas, solar, wind, biogas, coal reserves, biofuel, wood fuel, and geothermal. Despite existence of these huge potential, only a small fraction of it has been exploited. Currently, the most exploited energy source is wood fuel because it is considered both cheap and accessible to the poor majority in both rural and urban areas. Generally, the energy sector in Tanzania is characterized 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 (Figure 11). Biomass energy accounts for 90% of total energy consumption. Over 80% of rural population rely 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. In addition, only about 2% of the rural population is currently connected to the national grid.

The electric energy mixture is comprised of both hydro and thermal generation units. The hydro capacity is comprised of six major hydro plants with a total capacity of 562 MW (545 MW available capacities). Currently, the grid hydrothermal mix is estimated at 60% hydro and 40% thermal, respectively.

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	<ul style="list-style-type: none"> - Crop residues= 15Million Tons/annum - Animal droppings=25Million Tons/annum - Volatile solids of sisal waste= 0.2Million Tons/annum. - Forest residues=1.1 Million Tons/annum 	<ul style="list-style-type: none"> - About 1,000 biogas digester units of 50m³ - 22.75 MW electricity from steam and sisal plants. - 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

Source: URT (2010b¹⁴)

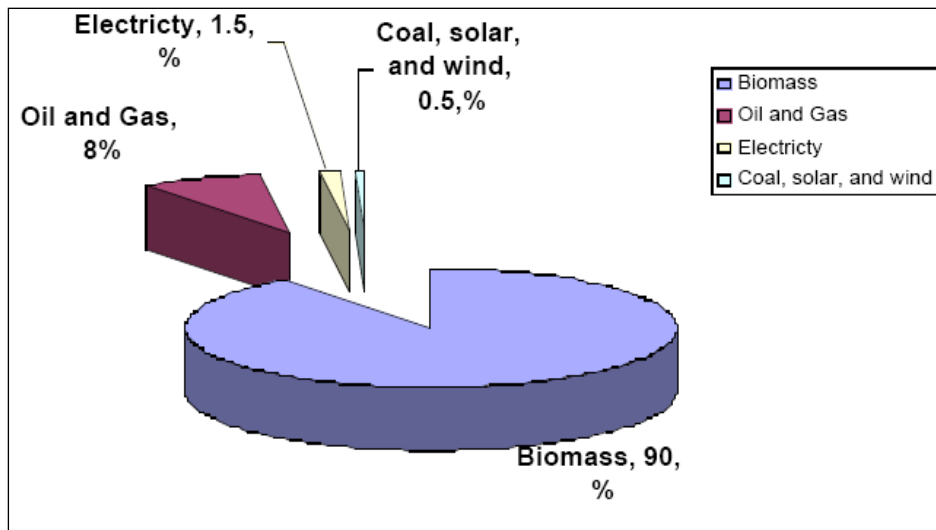


Figure 4: Energy consumption by sources in Tanzania

Source: URT (2010b)

Industry sector

Industrial manufacturing activities in Tanzania are relatively small and at an infancy stage, contributing to about 8.6% of the GDP in the last decade (Table 1). Most industrial development in Tanzania is either light manufacturing industries or agro-processing plants and mills located mainly in urban centres. Small-scale industries concentrate in agro product processing for value addition and are scattered throughout the cities and municipalities; and some are located in residential areas. In 2000 there were 36 registered industries and other businesses and by 2007 the number had increased to about 262 registered and business. Data on industrial growth to date and its contribution to the national GDP is found in Table 1.

Dar es Salaam is Tanzania's main administrative, industrial and commercial City. The city accommodates about 40% of the total industrial manufacturing units in the country and contributes about 45% of Tanzania's gross industrial manufacturing output (UN-HABITAT, 2009). The city is endowed with a major harbour and is an epicentre for manufacturing. In Dar es Salaam, for instance, large-scale industries are located in the designated industrial areas of Nyerere road, Ubungo and Mikocheni.

Livestock sector

Tanzania ranks third in terms of numbers of livestock in Africa, and the sector has a good contribution to the national economy. The livestock sector contributed about 4.7% of the GDP in 2007 and 4.0% in 2009, where about 40% originated from beef production, 30% from milk production and another 30% from poultry and small stock

¹⁴ United Republic of Tanzania - URT (2010b). Energy consumption by sources in Tanzania. Ministry of Energy and Minerals – MEM, Dar es Salaam.

production (URT, 2009b, 2010a¹⁵). Tanzania is estimated to have about 18.5 million cattle, 13.1 million goats, 3.6 million sheep, 1.2 million pigs and 30 million local chickens (Ministry of Livestock Development and Fisheries, Statistical Year Book, 2005). Approximately 95% of ruminant livestock in Tanzania are kept under traditional production systems depending mostly on pastures and crop residues as the main feed resources. In this system, limited inputs such as feed additives, supplementary feeds are offered. This system produces about 93% of the milk and 99% of the meat consumed in the country.

Fisheries sector

Marine fisheries contribute about 15% of the total fish production in the country with the rest coming from freshwater. The annual marine fish catches increased from 36,684 tonnes in 1993 to 44,838.2 tonnes in 2009, while the corresponding quantities for freshwaters were 294,782 and 299,729 tonnes in 1993 and 2009 respectively. The contribution of fisheries both fresh water and marine to the GDP varied from 1.7% in 1998 to 1.4% in 2009 (URT, 2010a).

Infrastructure sector

Ports

Tanzania Ports Authority (TPA) administers a diverse system of Tanzania's mainland sea and inland water ways. The major sea ports are Dar es Salaam, Tanga and Mtwara while smaller sea ports are Kilwa, Lindi, Mafia, Pangani; Bagamoyo and Mikindani. The lake ports are formally operated by the Marine Services Company Limited (MSCL) under TPA mandate and are situated on Lake Victoria, including Mwanza North and South Ports, Nansio, Kemono Bay, Bukoba and Musoma; Lake Tanganyika, including Kigoma and Kasanga; and Lake Nyasa including Itungi Port, Manda Liuli and Mbamba Bay.

Railway Network

Tanzania Railway systems have a total track length of 3,676km out of which 2,701km are owned by Rail Asset Holding Company (RAHCO) and operated by Tanzania Railways Limited (TRL). The remaining 975km are operated by the Tanzania - Zambia Railway Authority (TAZARA) co-owned by the governments of Tanzania and Zambia. TAZARA network covers a total track length of 1860km out of which 975km are on the Tanzania side and the remaining 885km on the Zambia side. The two railway systems link 14 out of the 22 regions on the mainland.

a) RAHCO

The RAHCO network has a gauge of 1,000mm and consists basically of two main lines. The Central line running from Dar es Salaam to Tabora (840 km) and from Tabora to Kigoma (411 km) and a major branch from Tabora to Mwanza (378 km); and the Tanga line which starts from Tanga to Moshi and Arusha with total length of 438km. The two lines are connected by a link line between the Ruvu Junction Station on the Central line and Mnyuzi Junction on the Tanga line (188 km). Also, the system has four branch lines, that is, Kilosa-Kidatu (107 km), Kaliua-Mpanda (214

¹⁵ URT (2009b). Climate change and livestock policy brief. Vice President's Office, Division of Environment, Dar es Salaam; and URT (2010a). The Economic Survey 2009. The Ministry of Finance and Economic Affairs, Dar es Salaam

km), Manyoni-Singida (115 km), and Kahe-Border (16 km). The RAHCO railway has a design capacity of carrying 5 million tons of freight per annum.

b) TAZARA

TAZARA operates a railway line between the port of Dar es Salaam and New Kapiri Mposhi in Zambia over a distance of 1860km of which 975km are on the Tanzanian territory. TAZARA has a gauge of 1,067mm, which conforms to other Central and Southern African railway networks. The railway has a design capacity of carrying 5.0 million tons of freight per annum, that is, 2.5 million tons in each direction and 3.0 million passengers per annum.

Air Transport

Tanzania has a total of 368 aerodromes which are owned, managed and operated by different entities. Tanzania Airports Authority (TAA) owns, manages, operates and develops 58 airports. There are four international Airports namely, Mwalimu Julius Kambarage Nyerere Airport, Kilimanjaro Airport, Mwanza International Airport and Zanzibar Airport. Out of four International Airports, two of them are managed by TAA (namely Mwl. J. K. Nyerere and Mwanza International Airports). Zanzibar International Airports is managed by The Revolutionary Government of Zanzibar. Kilimanjaro A has been leased to a private operator since 1998.

Road Network

In Tanzania, road transport is the dominant mode and accounts for over 80% of passenger traffic and over 95% of freight traffic. The trunk and regional roads in Tanzania are estimated to be 34,263.1 km, out of which trunk roads are 12,205.4 km, regional roads 21,979 km and designated roads 78.6 km. This classification is based on the Road Act, 2007 and subsequent re-classification of roads in 2009, 2010 and 2012. The trunk road network is 12,786 km of which 42.8% are paved. The regional road network is 21,105 km of which only 3.9% are paved. The district, urban, and feeder road network is 52,241 km of which only 1.5% is paved and 5,796km are unclassified rural and community roads. The road network density in Tanzania is 96.5m per square km (or 5.0 m per square km for paved roads). Tanzania has one of the lowest road densities in Africa, for example, Kenya has 261.9m and Uganda 330.8m according to statistics in 2007. This means a large part of Tanzania is inaccessible. The inaccessibility, especially in the rural areas, makes travel cumbersome and expensive.

Pipeline Transport

Tanzania has three long-distance pipelines: the TAZAMA Pipeline is the first with a distance of 1,710km transporting crude oil from Dar es Salaam to Ndola refinery terminal in Zambia; the second pipeline with a distance of 232 km, including a submarine part transports gas from Songo-Songo Island to Dar es Salaam; and the third pipeline with a distance of 28km transports gas from Mnazi Bay Field to the power generation facility in the Mtwara region. There is a short distance pipeline network in Dar es Salaam that connects each depot of oil marketing companies to the Kurasini Oil Jetty (of the Dar es Salaam Port).

TAZAMA Pipeline

The TAZAMA Pipeline with a distance of 1,710 km of 8 inch (200 mm) and 769 km of 12 inch (300mm) loops transports crude oil from the single point mooring at the outer anchorage of Dar es Salaam port in Tanzania through TIPER refinery that is not operational in Dar es Salaam to the Indeni Refinery Facility at Ndola in Zambia. The pipeline was designed for a throughput of 1.1 million metric tonnes per annum. Currently the optimum operating capacity is 700,000 metric tons per annum. The diameter of pipeline varies between 8 and 12 inches (and 300 mm).

2.1.5 Population Dynamics

Based on the 2002 Population and Housing Census, the country was reported to have about 34,569, 232 people: 33,584,607 from mainland Tanzania with an annual average intercensal growth rate (1988 to 2002) of 2.9% (URT, 2002b). By 2011 the country had about 44.5 million people (of which 21.9 million were males and 22.6 million were females)¹⁶. The average household size was estimated at 4.9 and the population density was estimated to be 39 persons per sq.km.

Rapid urbanization is a common phenomenon in many cities in developing countries. Whilst urban population was only 4% of the national population of Tanzania at independence in 1961, it rose to 23% during the 2002 national population census and is projected to be about 34% for this year. With this trend it is estimated that by the year 2030, 50% of the national population will be urbanized through natural growth, inward migration and transformation of rural settlements into urban centres. However history shows that over the years of pre- and post-independence of many developing countries the difference in livelihood between urban and rural areas has catalyzed rural-urban migration. Recently, climate change and other extreme weather events have caused instability in peasantry activities in rural areas hence aggravating rural to urban migration.

2.1.6 Economic

On average over the last decade, the economy of Tanzania rose from 4.1% in 1998 to 7.4% in 2008. Growth was strongest in the services and manufacturing sector (with annual growth rates of 7.5% and 8% respectively), but was weaker in the agricultural sector (4.4% growth since 2000). The rate of economic growth however has been fluctuating over the past few years. The GDP in real terms grew by 7.1% in 2010, compared to 6.0% in 2009. In 2011, the real GDP declined to 6.4% compared to 7.1% in 2010. The slowdown in growth for 2009 was attributed to the impact of the global financial crisis as well as the 2008/09 drought which affected agricultural production, hydro power generation as well as industrial production; all of which have a significant share of total GDP. However, the growth rate of electricity and gas, communication and education sub-economic activities increased (URT, 2010¹⁷). Table 2, gives a comparison of shares of GDP percentage by kind of economic activity

¹⁶ Economic Survey, 2011

¹⁷ URT (2010). The Economic Survey 2009. Ministry of Finance and Economic Affairs, Kiuta, Dar es Salaam

Table 2: Shares of gross domestic product (%) by kind of economic activity

ECONOMIC ACTIVITY	2001	2002	2003	2004	2005	2006	2007	2008	2009
Agriculture, Hunting and Forestry	29.0	28.6	28.7	29.5	27.6	26.2	25.8	25.7	24.6
Crops	21.4	21.4	21.8	22.4	20.5	19.2	19.0	19.0	18.4
Livestock	5.0	4.8	4.7	4.8	5.0	4.8	4.7	4.7	4.0
Hunting and Forestry	2.5	2.4	2.3	2.3	2.2	2.2	2.1	2.0	2.2
Fishing	1.7	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.4
Industry and construction	18.0	19.6	21.0	20.8	20.8	20.8	21.2	21.0	22.0
Mining and quarrying	1.8	2.1	2.4	2.6	2.9	3.2	3.5	3.4	3.3
Manufacturing	8.4	8.3	8.3	8.1	7.9	7.8	7.8	7.8	8.6
Electricity, gas	2.2	2.0	1.9	1.8	1.7	1.5	1.6	1.7	1.7
Water supply	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Construction	5.2	6.8	8.0	7.9	7.8	7.8	7.8	7.7	7.9
Services	45.5	44.2	42.7	42.0	42.5	43.3	43.3	43.8	43.6
Trade and repairs	13.0	12.4	12.0	11.4	11.0	11.4	11.5	11.6	11.8
Hotels and restaurants	2.8	2.6	2.4	2.3	2.5	2.6	2.7	2.6	2.3
Transport	5.4	5.0	4.8	4.6	4.4	4.3	4.2	4.2	5.0
Communications	1.2	1.2	1.3	1.5	1.7	2.1	2.3	2.5	2.1
Financial intermediation	1.5	1.7	1.7	1.6	1.7	1.7	1.6	1.6	1.7
Real estate and business services	10.3	9.7	9.4	9.1	9.5	9.6	9.5	9.6	9.0
Public administration	7.0	7.2	7.2	7.7	8.0	8.0	7.9	8.2	8.1
Education	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.4
Health	1.3	1.5	1.4	1.4	1.5	1.5	1.6	1.5	1.6
Other social and personal services	0.9	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6
Gross value added before adjustments	94.2	94.1	94.0	93.7	92.3	91.7	91.6	91.6	91.6
Less FISIM	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-1.0	-1.0	-1.2
Gross value added at current basic prices	93.3	93.3	93.1	92.8	91.4	90.7	90.7	90.6	90.4
Add Taxes on products	6.7	6.7	6.9	7.2	8.6	9.3	9.3	9.4	9.6
GDP (At current market prices)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: URT (2010a¹⁸)

2.2 Climate Trends and Projections

Analysis of recent climatological data and observational evidence from local communities are overwhelmingly indicating some signals of increased climate variability and climate change over most parts of the country. Increasing temperature, notably over highland areas are observed in most parts of the country, late rainfall onset and early withdraw (cessation), decreasing rainfall amount and seasonal shift in rainfall patterns are becoming more common. Most parts of the country, particularly the Central and Northern Zones, which are semi-arid are very vulnerable to climate variability and they will be more vulnerable to the projected increase in frequency and amplitude of extreme climate events (URT, 2007¹⁹).

¹⁸ United Republic Of Tanzania - URT (2010a). The Economic Survey 2009. The Ministry of Finance and Economic Affairs, Dar es Salaam

¹⁹ URT (2007). National Adaptation Programme of Action (NAPA)

The projection of rainfall and temperature due to global climate change for Tanzania have been discussed by Paavaola (2003), Matari et al. (2008), in the Initial National Communication to the UNFCCC , 2001 and in the 2007 NAPA. Results from time series analysis of temperature, rainfall and relative humidity from few selected stations are presented below.

2.2.1 Temperature

Time series analysis of both mean annual Tmax and Tmin has revealed significantly increasing temperature trends in all meteorological stations across the country. Figures 5 and 6 depict temperature trends from few selected stations. The increased temperature trend is more pronounced in mean annual Tmin (Figures 6) as compared to mean annual Tmax (Figure 5). Due to climate change, mean annual temperature for Tanzania is projected to increase by 1.7°C over north eastern areas of the country and by 2.5°C over Western parts of the country (Figure 7).

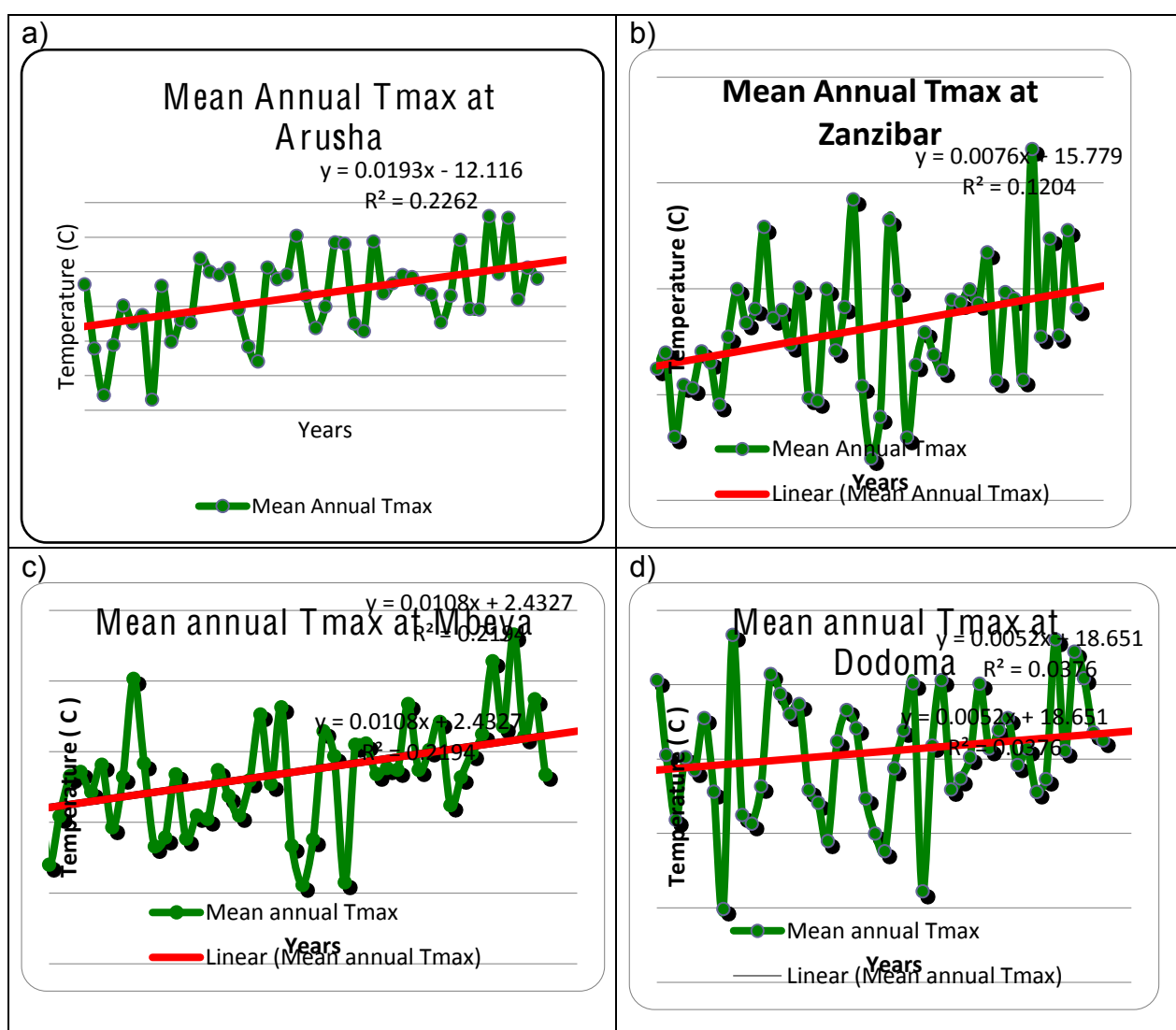


Figure 5: Mean annual maximum temperature trend at a) Arusha, b) Zanzibar, c) Mbeya and d) Dodoma stations

Source: Matari et al. (2008)

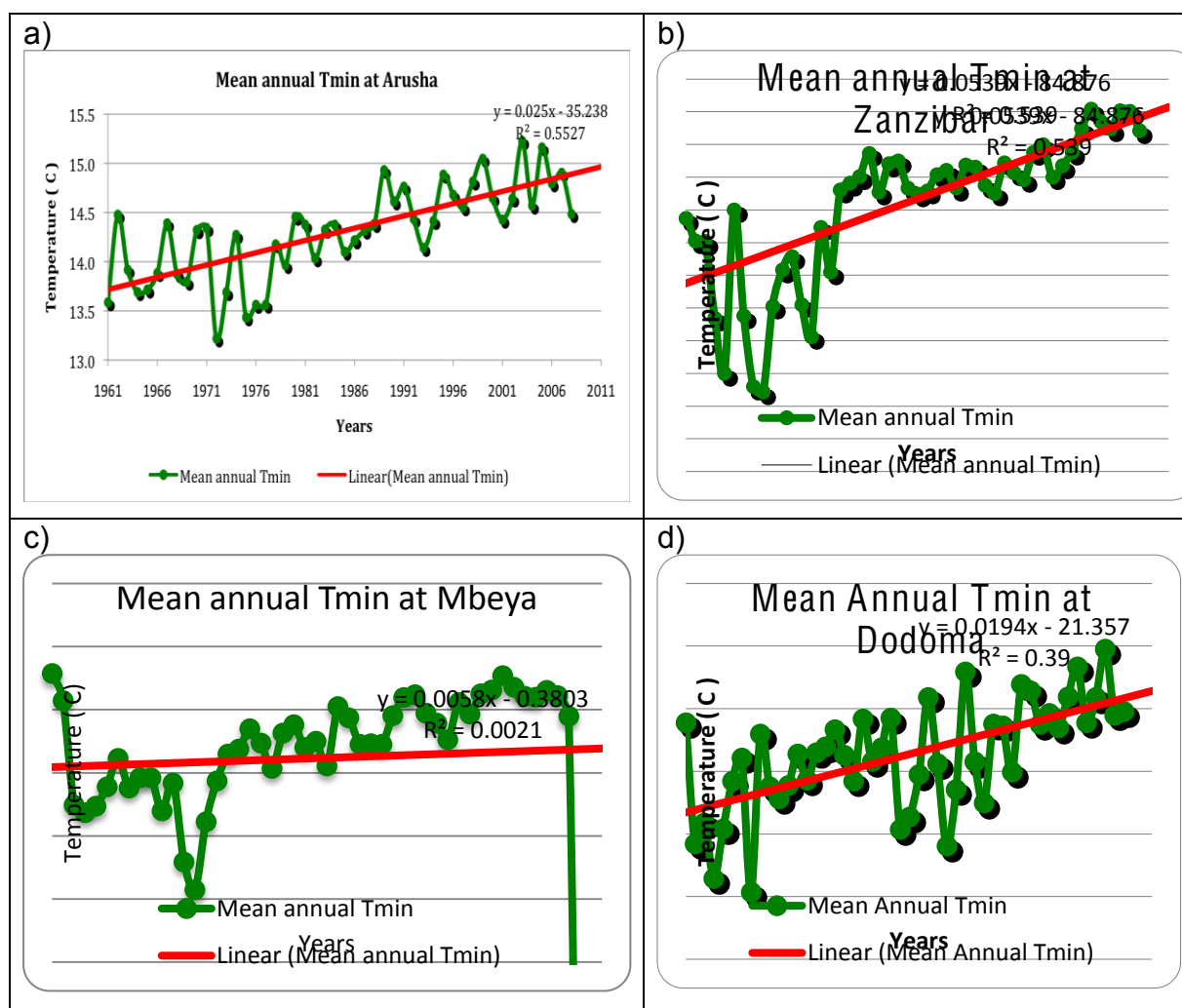


Figure 6: Mean annual minimum temperature trend at a) Arusha, b) Zanzibar, c) Mbeya and d) Dodoma stations

Source: Matari et al. (2008)

2.2.2 Rainfall

A slightly weak decreasing trend can be discerned from the mean annual rainfall time-series over most of the meteorological stations (Figure 7). The observed rainfall trends are not statistically significant, underlining the nature of uncertainty associated with rainfall patterns. However, intra-seasonal and inter-annual variability manifested through late onset and early cessation, increase in dry spells and shift in rainfall patterns are becoming more common. Projections from Global Circulation Models (GCMs) are indicating that due to doubling concentration of CO₂ in the atmosphere by 2100; there will be an increase in rainfall in some parts while other parts will experience decreased rainfall (Matari et al., 2008). The areas with two rainfall seasons that is, the north-eastern highland and Zanzibar, the Lake Victoria basin and the northern coast would experience an increase in March to May (long-rains) rainfall by up to 15 percent, While, southern, south-western, western and central areas will experience a decrease in March to May rainfall by up to 6%.

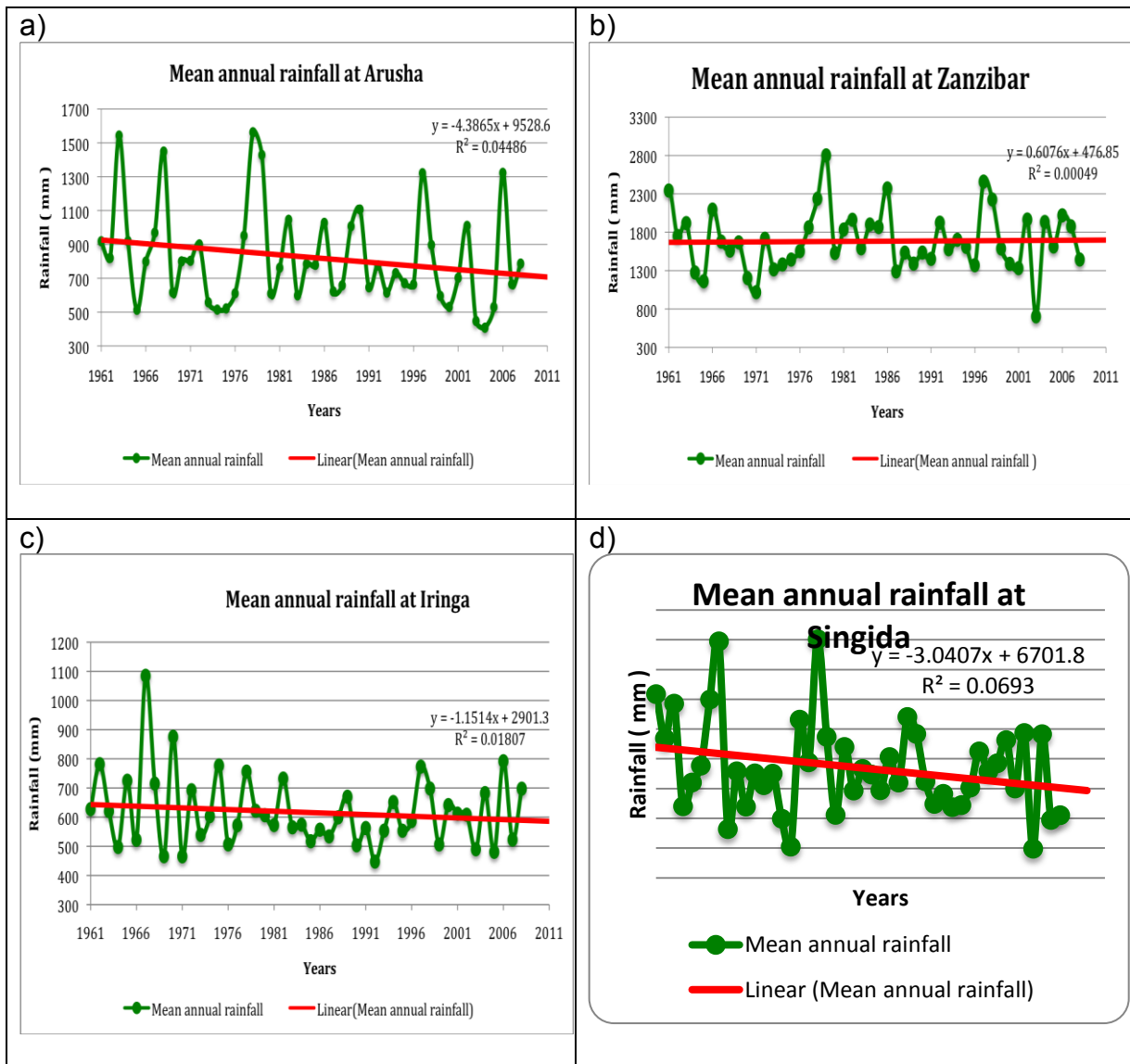


Figure 7: Mean annual rainfall trend at a) Arusha, b) Zanzibar, c) Iringa and d) Singida stations

Source: Matari et al. (2008)

2.3 . Impacts, Risks and Vulnerabilities of Climate Change

2.3.1 Impacts of Climate Change

Climate change projection indicates that the frequency and severity of extreme climatic events will increase. In the last 40 years Tanzania has experienced severe and recurring droughts with devastating effects to agricultural, water and energy sectors. Currently more than 70% of all natural disasters in Tanzania are hydro-meteorological, and are linked to droughts and floods. For instance, the droughts of 2003, 2005 and 2009 severely affected agriculture, energy and business sectors in Tanzania. The environmental and ecological impacts of these droughts were alarming. Agriculture in the affected areas was crippled, a lot of livestock and wildlife perished due to starvation and lack of water. Following these droughts, Tanzania suffered serious energy crisis which had severe social and economic implications.

The floods of 2009, for instance, were particularly devastating on humans, property and infrastructure. Some of these impacts are further elaborated in the following sections.

Agriculture and Food Security

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, 2008b²⁰, URT, 2009a²¹).

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 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 (URT, 2008). 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, 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 (for example, *striga spp*), a noxious weed

²⁰ United Republic of Tanzania - URT (2008b). Study on strategies for addressing negative effects of climate change in food insecure areas of Tanzania. Ministry of Agriculture, Food and Cooperatives. Ministry of Agriculture, Food and Cooperatives, Dar es Salaam.

²¹ URT, 2009a

particularly for cereal crops; insect pests (for example, *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 severely 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, 2010²²).

The assessment of food security undertaken by the Ministry of Agriculture, Food and Cooperatives (URT, 2008) revealed that semi-arid 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 (AEZ) as results of climate change (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

²² East African Community (EAC)(2010). Declaration of the 12th summit of EAC heads of state on food security and climate change. East African Community, Arusha.

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.

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. 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. Furthermore, some of the perennial rivers have changed to seasonal rivers and some wetlands have dried up.

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, and 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 to 1.2m (Figure 8). 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 to 4.1% minimum discharge, 0.4 to 7.5% maximum discharge, and 0 to- 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 rivers (except Great Ruaha). Predicted rainfall increases expected from some GCMs indicate future discharge increases of 8 to 41% (average discharge), 6 - 30% (minimum discharge), 0.4 to 45% (maximum discharge) and decrease of 6 - 16% (Zero Flow Duration).



Figure 8: Bismark rocks showing the drop in water level of Lake Victoria

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.

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. 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 USD (\$) 20 to 100 million per year by 2030, rising to USD (\$) 25 to 160 million per year by 2050 – the range reflecting different climate and development assumptions (Global Climate Adaptation Partnership and Partners, 2011²³).

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 9) show that prevalence of cholera, has over the past few decades coincided with El Nino events. The first cholera outbreak were reported in 1974 and since 1977, cases were reported each year with a case fatality rate averaging 10.5% between 1977 and 1992 (WHO, 2008). Prevalence elevates in rainy seasons and becomes even higher during floods (URT, 2006²⁴).

²³ Global Climate Adaptation Partnership and Partners, 2011). The Economics of Climate Change in the United Republic of Tanzania.

²⁴ United Republic of Tanzania - URT (2006). Annual Health Statistical Abstract. Ministry of Health, Dar es Salaam

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.

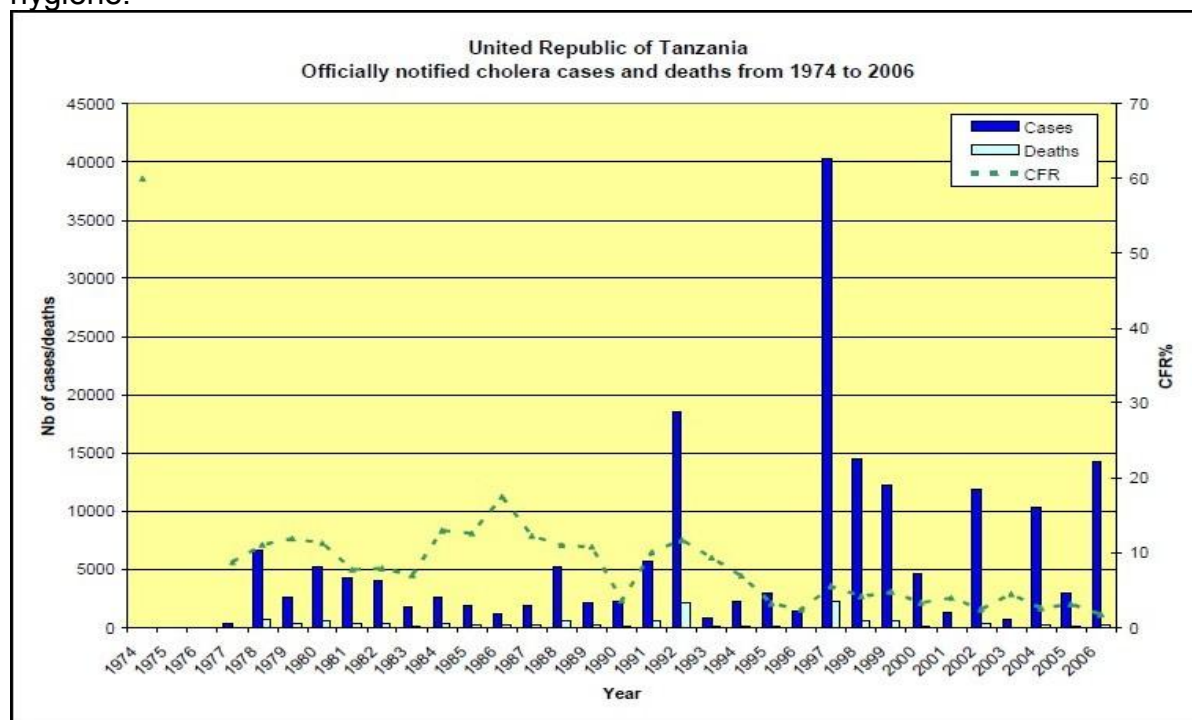


Figure 9: Officially notified cholera cases and deaths in the United Republic of Tanzania from 1974 to 2006

Source: WHO (2008²⁵)

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 or 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.

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

²⁵ World Health Organization – WHO (2008). Cholera Country Profile: United Republic Of Tanzania. World Health Organization - Global Task Force on Cholera Control. 7 April 2008

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 impacting marine ecosystem 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 (for example, 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 livelihoods.

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.

Energy

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 acerbated 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% hydroelectricity 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 phenomena 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 MDGs and place poverty reduction efforts at jeopardy.

Forestry

Climate change impacts on forest ecosystems and biodiversity are expected to vary depending on vegetation species. 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 (for example, forest to woodlands, or woodlands to grasslands).

The NAPA, 2007 forecasts change to drier forests and ecosystems as a result of climate change. 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.

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 or 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, 2008²⁶). Increased temperature and changes in rainfall regime will seriously affect the variability of such goods and services from the forestry sector.

Biodiversity

According to the IPCC (2007²⁷a), 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, 2004²⁸). 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., 2007²⁹).

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 10), 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 et al., 2011).

²⁶ United Republic of Tanzania - URT (2008). State of the environment report 2008. Vice President's Office, Division of Environment, Dar es salaam.

²⁷ IPCC, 2007a

²⁸ Berger, 2004

²⁹ Fischlin et al., 2007



Figure 10: 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 conditions.

Tourism

Tourism has close connections to the environment and is considered to be a highly climate sensitive sector. Climate variability determines the length and quality of tourism seasons thus plays a major role in the destination choice and tourist spending. Climate affects a wide range of the environmental resources that are key attractions for tourism, such as snow conditions over Mount Kilimanjaro, wildlife productivity and biodiversity, water levels and quality. Climate also has an important influence on environmental conditions that can deter tourists, including infectious disease, wildfires, insect or waterborne pests, and extreme events such as tropical cyclones.

Like elsewhere in the world, the sector is already being impacted by climate change. The manifestations of climate change are highly relevant for tourism destinations and

tourists alike. For instance, Mountain Kilimanjaro has lost 80% of its ice cover between 1912 and 2005. It is envisaged that such melting of ice on Mountain Kilimanjaro; sea level rise; submerging small islands and destruction of coastal investments and infrastructures (for example, hotels and recreation facilities), beaches, as well as coral reef bleaching will continue to impact negatively the tourism sector by changing the scenic view of the natural environment (Mushi, 2009³⁰).

Apart from the impacts of sea level rise, which have destroyed cultural, historical, archaeological and heritage sites along coastal areas in the country, heat stress and drought have also caused massive wildlife deaths in the northern tourist zone. Destruction of infrastructure such as roads and bridges is devastating. Road maintenance becomes particularly difficult and expensive during prolonged heavy rains in many parts of the country. For example the 2006 El Niño rains, left many park roads impassable for a long period of time, and resulted in reduced tourist visits and loss of revenue. In places like Ruaha National Park ecosystem, droughts have had significant impacts on wildlife and hence tourism (URT, 2002³¹; Kangalawe 2010³²). Tourism in the Ruaha National Park, for instance, depends on the presence of water in the Great Ruaha River and its catchments. However, the Great Ruaha River where the park is located is threatened by the persistent dryness of the basic natural resource that supports livelihoods in the area.

Industries

Most industrial development in Tanzania is either light manufacturing industries or agro-processing plants and mills located mainly in urban centres. In 2000 there were 36 registered industries and other businesses and by 2007 the number had increased to about 262.

Most of the industries concentrate in manufacturing of simple consumer goods including food, beverages, tobacco, textiles and furniture, as well as wood and allied products of which they depend much on agro-products. The large dependence on agricultural raw materials means that the industrial sector, like agriculture, is vulnerable to the impacts of climate change. Despite the agro-based nature of most of these industries, power supply is mainly from hydro sources which are again vulnerable to climate change impacts, particularly drought. Therefore climate change adversely affects the sector and peoples wellbeing at large. The effects include:

- a) Decrease in industrial production due to unstable power supply, water supply, low or inadequate supply of agricultural raw materials, damage of infrastructure, which mean limited inflow of foreign currency;
- b) Increase of costs for imported materials and technology, which would mean more capital flight;
- c) Increased occupational health risk due to high temperatures and inadequate water for sanitary activities;

³⁰ Mushi, R. S (2009): Climate Change and its Impact on Coastal Tourism, A case of Bagamoro District. Msc Dissertation, University of Dar es Salaam

³¹ United Republic of Tanzania - URT (2002). National Water Policy. Ministry of Water and Livestock Development, Dar es Salaam.

³² Kangalawe, R.Y.M. (2010). Mainstreaming climate change adaptation in the management of freshwater resources in the Rufiji Basin. A consultancy report submitted to the Ruaha Water Programme. WWF-Tanzania Country Office, Dar es Salaam.

- d) Failure to expand industrial investments due to increased uncertainty;
- e) Decrease in GDP, hence, low revenue collection by government; and
- f) Increase in unemployment rate due to decreased industrial investment and production.

Livestock

Most of the livestock are concentrated in the semi-arid areas (including, 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. There has been 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, and Rift Valley Fever. 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., 2009³³).

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, for example, by destroying breeding and feeding sites. This problem is aggravated by drought and frequent floods resulting from climate change.

Infrastructure

Increased rainfall due to climate change may cause flood damage to transport, communications and buildings infrastructures. For instance, in December 2009 and January 2010, unusual 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, 2003³⁴) reported that for the Dar es Salaam coastline the 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

³³ Kangalawe, R.Y.M., Mung'ong'o, C.G., Yanda, P.Z., Mwakaje, A.G., Kalumanga, E. (2009). Climate change and variability impacts, vulnerability and adaptive capacity in Kasulu District, Tanzania. Chapter 2. In: Kangalawe, R.Y.M., Mung'ong'o, C.G. and Yanda, P.Z. (Eds.). People's Perceptions and Community Response to Climate Change and Variability: Selected Cases from Tanzania. Institute of Resource Assessment, University of Dar es Salaam.

³⁴ United Republic of Tanzania - [URT \(2003\). Initial National Communication under the United Nations Framework Convention on Climate Change \(UNFCCC\). Vice president's Office, Dar es Salaam.](#)

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.

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 to 75% of the city's population while the planned settlements occupy an area of 25 to 30% (URT, 2002³⁵; UN-HABITAT, 2009³⁶:11; URT, 2011³⁷). 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 such were abandoned. In the northern part of Ras Mkumbuu peninsular near Chake Chake there are several submerged ruins believed to represent an

³⁵ United Republic of Tanzania - URT (2002). Population and Housing Census 2002. United Republic of Tanzania. National Bureau of Statistics, Dar es Salaam

³⁶ United Nations Human Settlements Programme - UN-HABITAT (2009). Tanzania: Dar es Salaam City Profile. United Nations Human Settlements Programme, Regional and Technical Cooperation Division, Nairobi.

³⁷ United Republic of Tanzania – URT (2011). The Dar es Salaam City Environment Outlook 2011. Vice President's Office, Division of Environment, Dar es Salaam. Draft.

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 (Figure 11).



Figure 11: Road destruction by floods at Tandale Mtogole, 2011

The Kilosa, Mpwapwa and Kongwa, and Kilombero floods 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, 2010³⁸). The cost of restoring the infrastructure and services ravaged by floods in Kilosa and Mpwapwa amounted to Tshs 329 billion³⁹. 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

³⁸International Federation of Red Cross and Red Crescent Societies – IFRC (2010). Tanzania: Floods. Available at: <http://www.ifrc.org/docs/appeals/10/MDRTZ0101.pdf>.

³⁹ See: http://www.bongofree.net/news_articles/english_news/ctl/readdefault/mid/700/articleid/41355.aspx

were destroyed and approximately 2,256 hectares of crops including paddy and maize were destroyed⁴⁰.

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.



Figure 12: Floods in Dar es Salaam, December 2011

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.

Land use

⁴⁰ See: [Daily News \(12th May 2011\). Floods displace 9,000 in Kilombero. Available at: http://dailynews.co.tz/home/?n=19764](http://dailynews.co.tz/home/?n=19764); see also <http://reliefweb.int/node/404112>

There are different types of land use including areas under human settlements, forest, game reserves, and livestock grazing. Land use change is a major threat to Tanzania ecosystems. Increasing human populations, coupled with changing land tenure systems, are fragmenting once open and dynamic ecological systems. The interaction of climate change and land-use change presents new challenges to policy makers, managers and local communities pursuing sustainable natural resource management strategies for human welfare and conservation of biodiversity. Agricultural expansion into key resource areas, such as swamps and the riverside strips eliminates important dry season grazing reserves. Wildlife and livestock vulnerability to drought due to the loss of these forage reserves is exacerbated by the loss of landscape scale connectivity associated with agricultural expansion creating land use conflicts.

On the other hand, man alters the planet surfaces in diverse ways through urbanization, deforestation, foresting former grasslands, irrigating drylands for crops, damming rivers to create man-made lakes and reservoirs, and reclaiming swamps and marshlands, among others. These factors affect the climate on scales ranging from the macro to micro scales. The opportunities rising from reforestation, afforestation and forest conservation in the context of climate change have not yet been tapped by Tanzanians. Therefore, the increased awareness and capacity to ensure that land use need to be enhanced.

Education

Drought, floods and other natural disasters reduce opportunities for employment due to disruption of livelihood systems. Those who are expected to provide for their family have to migrate elsewhere to look for work or sometimes the whole family has to migrate away from areas where education is provided. This increases the possibility of children not to access education and be provided with necessities which can help them to obtain school needs such as uniforms, stationery as well as psychosocial support. Hence deny their right to access education. Furthermore, for the pastoralists and peasantry societies, drought often force them to migrate into areas with better weather conditions which support pastoral and agricultural activities. This means that the family will migrate with all their children, which disrupts the continuity of children education and in some cases they miss it completely.

In 2009 the northern part of the country, where most of rural dwellers are pastoralists, particularly Manyara and Arusha experienced severe drought. Households could not depend on income from selling their livestock as buyers demanded very low price. They became increasingly reliant on food aid and sometimes had to sell their animals at that very low price in order to have money for family use and send their children to school. The drought exposed country to poverty and food insecure as most of the livestock died due to lack of pastures and water. Children were taken out of school to work in order to increase household income and enhance food security, thereby affecting school attendance.

Increased instances of flooding and other natural phenomena also results in their houses, school buildings and other infrastructure such as roads and bridges, etc. being damaged, impacting on children's right to receive education. Floods lead to waterborne diseases which normally affect children incapacitating them from

attending school. For example, when Kilosa district was hit by floods in December 2009 and January 2010), three primary schools were destroyed and permanently closed. Eight schools were closed for several weeks in order to provide temporary accommodation for flood victims, thus not allowing children access to education in such premises. Similar experiences were reported for the floods in Kongwa and Mpwapwa between December 2009 and January 2010, and in Kilombero valley in January to February 2011 (Daily News, 12th May 2011). In March 2006, a cyclone hit Liwale district where five classrooms and two offices were damaged affecting 225 pupils. Such incidences of extreme weather conditions due to climate change are expected to continue.

2.3.2 Vulnerability

Tanzania is experiencing the impacts of extreme weather events, such as drought and flood events that have had significant impact to both the people and the economy. Severe droughts are increasingly being felt in many parts of the country with negative consequences on, among others, food production and water scarcity. Droughts have seriously affected most vulnerable sectors including agriculture, forestry, fisheries, energy, health, water, industry, business/trade, tourism and services.

The livelihoods of about 80% of Tanzanians depend on the agriculture, forestry and fisheries resources. Small-scale farmers are more vulnerable as they are highly dependent upon rain fed production. In addition to the effects of prolonged dry spells or droughts on crops and livestock, periods of increased rainfall (with associated increase in pests and diseases) will negatively affect agricultural output. High rainfall intensity also influences soil degradation.

The major portion of Tanzania's electricity supply comes from hydro-generation. Rainfall variability has affected power generation and supply, changing the energy mix from over 60% hydro ten years ago to less than 50% hydro to date.

Tanzania's industries are mainly agro-based, dealing mainly with processing of agricultural and wood products, and manufacturing of agrochemicals. These products are vulnerable to climate change. Some manufacturing industries aligned to the agricultural sector will be affected by the climate change-impacted agricultural economy.

Infrastructure is highly vulnerable to climate change impacts, e.g. through damage caused by flooding. Such disruptions may act as disincentives to investment, and sustainable economic growth and poverty reduction. Similarly, various service sectors are vulnerable to the impacts of climate change and may require rapid response to be able to avert the needed resiliencies.

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, as noted earlier, agriculture is vulnerable to the effects of climate change associated with global warming. The increased vulnerability of this sector is the biggest challenge for sustained economic development and improved livelihood in the rural communities.

2.4 Climate Change Initiatives and Governance

2.4.1 Climate Change Initiatives

In addressing climate change at national level, various initiatives and programmes have been undertaken in Tanzania in the context of UNFCCC and its Kyoto Protocol. As the first step, Tanzania ratified UNFCCC and its Kyoto Protocol in 1996 and 2002, respectively to ensure that climate change issues are addressed at the national level supported by national policies and legislation. Therefore, implementation of the UNFCCC and the Kyoto Protocol is further supported by the enabling environment including the National Environment Policy (1997) and the EMA.

Various adaptation and mitigation initiatives and programmes, strategies and plans as shown in Table 3 demonstrates the national commitment in addressing climate change issues and its contribution to global efforts to adapt and mitigate climate change. Formulation of NAPA in 2007 formed a clear basis for identifying and implementing adaptation actions at both sectoral and local levels. Furthermore, several mitigation initiatives have been implemented in the context of CDM and other emerging mitigation opportunities such as REDD+. Ongoing national REDD+ initiatives are expected to enhance the contribution of Tanzania as the net sink through its forests in various forms.

Generally, all initiatives at both national and local levels are geared towards enhancing Tanzania's participation in addressing climate change in order to build resilience and achieve sustainable development. Tanzania will continue to explore all emerging opportunities under the Convention and its Kyoto Protocol in the subsequent commitment periods to be agreed upon by the Parties. It is envisaged that the NAMAs as well as NAPs, supported technologically, financially and with appropriate capacity building will enhance the contribution of Tanzania in addressing climate change.

The climate change initiatives undertaken in Tanzania are implemented in line with several other initiatives. For instance, this Strategy is part of the broader implementation of the national policies and efforts to reduce poverty and support sustainable development at national, local and individual level. It is part of implementation of the National Environmental Policy 1997, EMA, the Tanzania Vision 2025; the Millennium Development Goals (MDGs); MKUKUTA II; Tanzania Five Years Plan (2011-2015). It is also congruent with various sector policies.

Tanzania's Vision 2025, aims at attaining high quality livelihood for its people and develops a strong and competitive economy, among other things. Some of the strategies toward attaining these objectives are: ensuring food self-sufficiency and security; universal access to safe water; absence of abject poverty; reduction in infant and maternal mortality rates; economic growth rate of 8% per annum or more; attainment of macroeconomic stability; and an adequate level of physical infrastructure. These aims may not be attained if climate change adaptation concerns are not factored in the development process and mitigation opportunities in

the context of sustainable development to be exploited, as well as the MDGs which were declared in year 2000 have many strategies similar to those in the Tanzania Vision 2025, including the eradication of poverty and attainment of environmental sustainability. Thus in order to realise the objectives of the Vision 2025 and MDGs, the government has translated them into the National Strategy for Growth and Reduction of Poverty popularly known as MKUKUTA, covering the periods 2005 - 2010 and 2011 - 2015, and associated national five years plan 2011 - 2015.

Climate change impacts are therefore considered as major threats towards attaining Tanzania's Vision 2025 and the MDGs. Such impacts like drought, frequent floods; and increasing vector-borne diseases such as malaria, dengue fever and diarrhoeal diseases are becoming common in the country threatening efforts to achieve the objectives of the development policies and strategies. It is in this context that climate change is one of the priority area in the second National Strategy for Growth and Reduction of Poverty. Preparation of this National Climate Change Strategy is therefore also an effort to translate the broad climate change strategies in MKUKUTA II into specific strategic actions to be budgeted and implemented on the ground. These efforts are intended to shield both the Vision 2025 and MDGs from failure due to the climate change impacts.

Table 3: Initiatives undertaken at national level

No.	National initiative/ study	Year	Financing Agency	Remarks
1	Inventory of GHG emissions	1993 - 1994	UNEP	The main GHG studied were CO ₂ , CH ₄ and N ₂ O
2	Technological and other options for GHG Mitigation	1994 - 1995	The German Technical Cooperation (GTZ) Agency	The study involved the macro-economic analysis, energy pricing and mitigation cost analysis and a multiple criteria assessment.
3	Assessment of Vulnerability and Adaptation to Climate Change	1994 - 1996	United States Country Studies Programme	The main sectors studied were: agriculture (crop production and livestock), water, coastal resources and forestry.
4	Development of Climate Change National Action Plan	1996 - 1998	United State Country Studies Programme	Identification of the complimentary actions between climate change and sectoral policies.
5	Adoption of National Environment Policy	1997	Government of Tanzania	Provides a policy framework for environmental issues relating those sectors to climate change
6	Enabling Activities Towards preparation of the Initial National Communication to the UNFCCC	1997 - 1999	GEF/UNEP	The project updated the previous works of climate change studies, through capacity building
7	Revised National Energy Policy	2003	Government of Tanzania	Policy promotes environmentally sound technologies
8	National Adaptation Program of Action (NAPA)	2004 - 2006	GEF/UNEP	The project identified Urgent and Immediate Adaptation options to combat climate change impacts

9	Enactment of the Environment Management Act – CAP 193	2004	Government of Tanzania	Section 75 of EMA describes how climate change issues can be addressed in Tanzania.
10	Assessment of Technology Needs Assessment (TNA)	2004 - 2005	GEF/UNEP /GOT	The project identified environmentally friendly technology to adapt and mitigate climate change impacts in Tanzania
11	Preparation of the national Clean Development Mechanism – CDM investor's Guide	2004	Government of Tanzania	enabled the approval process for CDM projects in Tanzania
12	Preparation of National Capacity Needs Self Assessment and Action Plan	2007	Government of Tanzania/UNDP -GEF	Enabled the preparation of capacity building needs for MEAs implementation in Tanzania
13	National CDM Handbook	2009	Government of Tanzania	Further elaborated the approval procedure for CDM in Tanzania
14	Preparation of National REDD Framework for Reducing Emissions from Deforestation and Forest degradation	2009	NORAD	The main goal of the National REDD+ Strategy is: to facilitate effective and coordinated implementation of REDD+ related policies, processes and activities so as to contribute to climate change agenda and overall sustainable development. And enable establish mechanisms required for Tanzania to benefit from a post-2012 internationally-approved system for forest carbon trading, based on demonstrated emission reductions from deforestation and forest degradation.
15	Climate Change, Impacts, Adaptation and Mitigation in Tanzania (CCIAM)	2009	NORAD	Research programme initiated to support the REDD+ implementation capacity in the country. By the end of the programme, a comprehensive research and methodology tool kit for climate change adaptation and mitigation will have been put in place to enable Tanzania implement the post-2012 climate mitigation and adaptation regimes successfully.
16	Climate change Impacts Assessment- Tanzania	2009	Government of Tanzania/Danida	The overall objective was to reveal and document both the key locally based impacts of climate change and their cultural, socio-economic and environmental implications to the local communities and to the country as a whole, and collect and

				consolidate pictorial and textural materials that could facilitate comparability of the past and present physical environment so as to reveal the magnitude of change where possible.
17	Tanzania economics of climate change	2010	DFID/SEI	The objective was to evaluate the costs and implications of climate change to Tanzania and explore carbon opportunities in mitigation activities
18	Other climate related studies	Various	Research and institutions of higher learning	Several studies undertaken and sponsored by various organisations.

2.4.2 Legal and Institutional Framework

Implementation of climate change issues in Tanzania is undertaken within the context of the National Environmental Policy, 1997 and the EMA and other related policies and legislations. At national level, the VPO, Division of Environment (DoE) is responsible for all climate related activities. DoE is both the NCCFP and Designated National Authority (DNA) for clean development mechanism under the Kyoto Protocol.

Furthermore, EMA provides for establishment of various committees at both national and local levels. At national level, there is an established NCCSC chaired by Permanent Secretary of the VPO. This committee provides policy guidance to the NCCFP ensure coordinated actions and participation within various sectors and institutions. There is also NCCTC chaired by the Director of Environment which is geared to provide technical advice to the NCCFP, stimulate more coordinated actions of actors and broaden the participation of various actors in addressing climate change. A detailed diagrammatic representation of institutional arrangement for environmental management is illustrated in Figure 13. Climate change issues are addressed using the same institution framework.

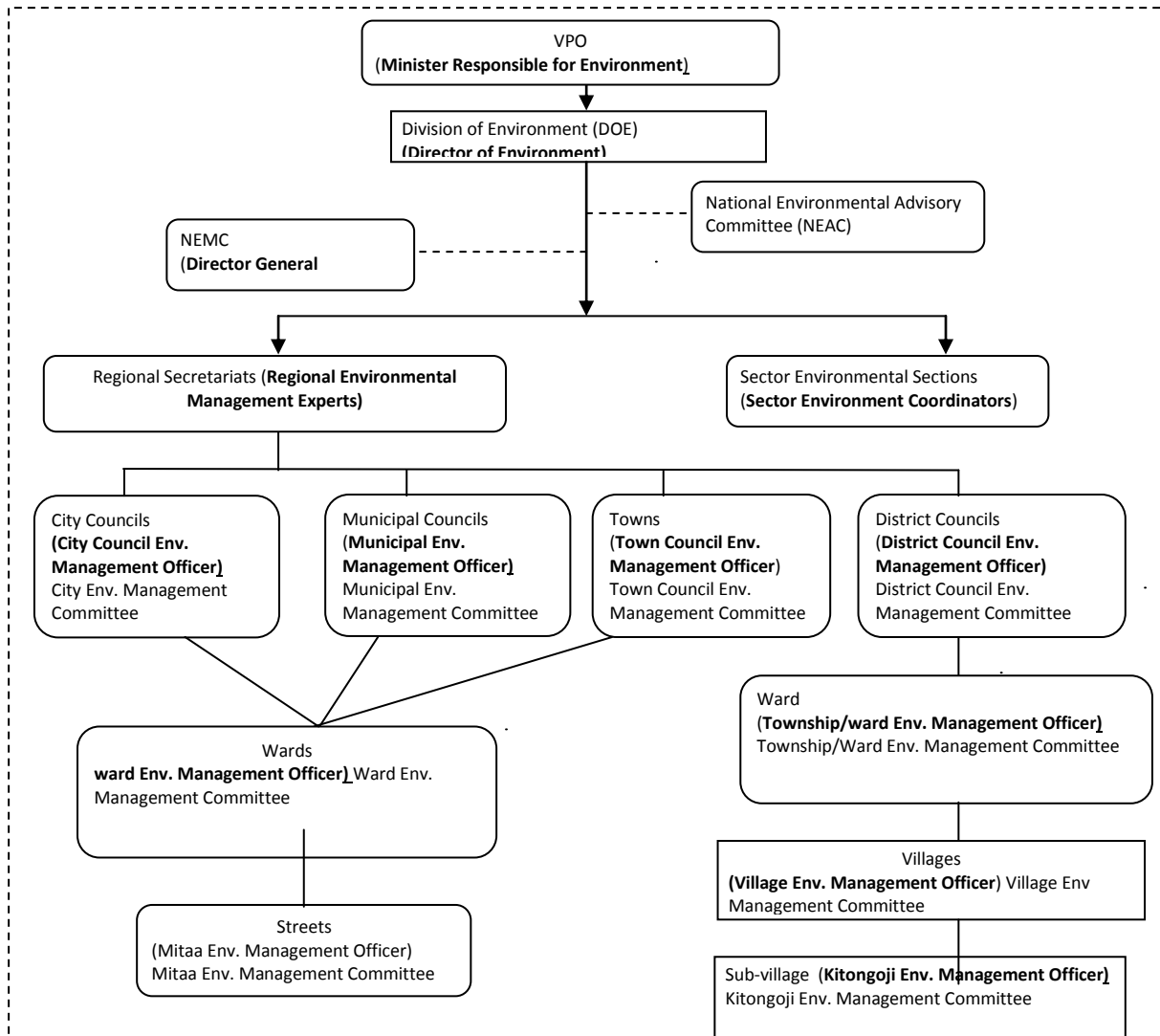


Figure 13: Diagrammatic representation of existing institutional arrangement for environmental management

3. THE CLIMATE CHANGE STRATEGY

This Strategy has been developed with a **Vision** to enhance climate resilience in Tanzania and reduce the vulnerability of natural and social systems to climate change. The **Mission** is to establish efficient and effective mechanisms to address climate change adaptation and achieve sustainable national development through mitigation actions with enhanced international cooperation.

3.1 Goal

The **goal** of this Strategy is to enable Tanzania to effectively adapt to and participate in global efforts to mitigate to climate change with a view to achieving sustainable economic growth in the context of the Tanzania's national development blueprint, Vision 2025; Five Years National Development plan; and national cross sectoral policies in line with established international policy frameworks.

3.2 Objectives

To achieve the stated goal, the following specific **objectives** have been set.

- a) To build the capacity of Tanzania to adapt to climate change impacts.
- b) To enhance resilience of ecosystems to the challenges posed by climate change.
- c) To enable accessibility and utilization of the available climate change opportunities.
- d) To enhance participation in climate change mitigation activities that lead to sustainable development.
- e) To enhance public awareness on climate change.
- f) To strengthen information management on climate change.
- g) To enhance institutional arrangements to adequately address climate change.
- h) To enhance mobilization of resources in particular finance to address climate change.

3.3 Scope

This Strategy covers broader areas strategic interventions which indicate strategic actionable objectives that need to be implemented. The broader strategic areas are related to adaptation, mitigation and cross-cutting issues. For implementation purposes, this Strategy includes coordination, resource mobilization and implementation plan. In addition, there is provision of an implementation arrangement that indicates the roles of various actors in the implementation of this strategy). The presentation of the scope is shown in Figure 14.

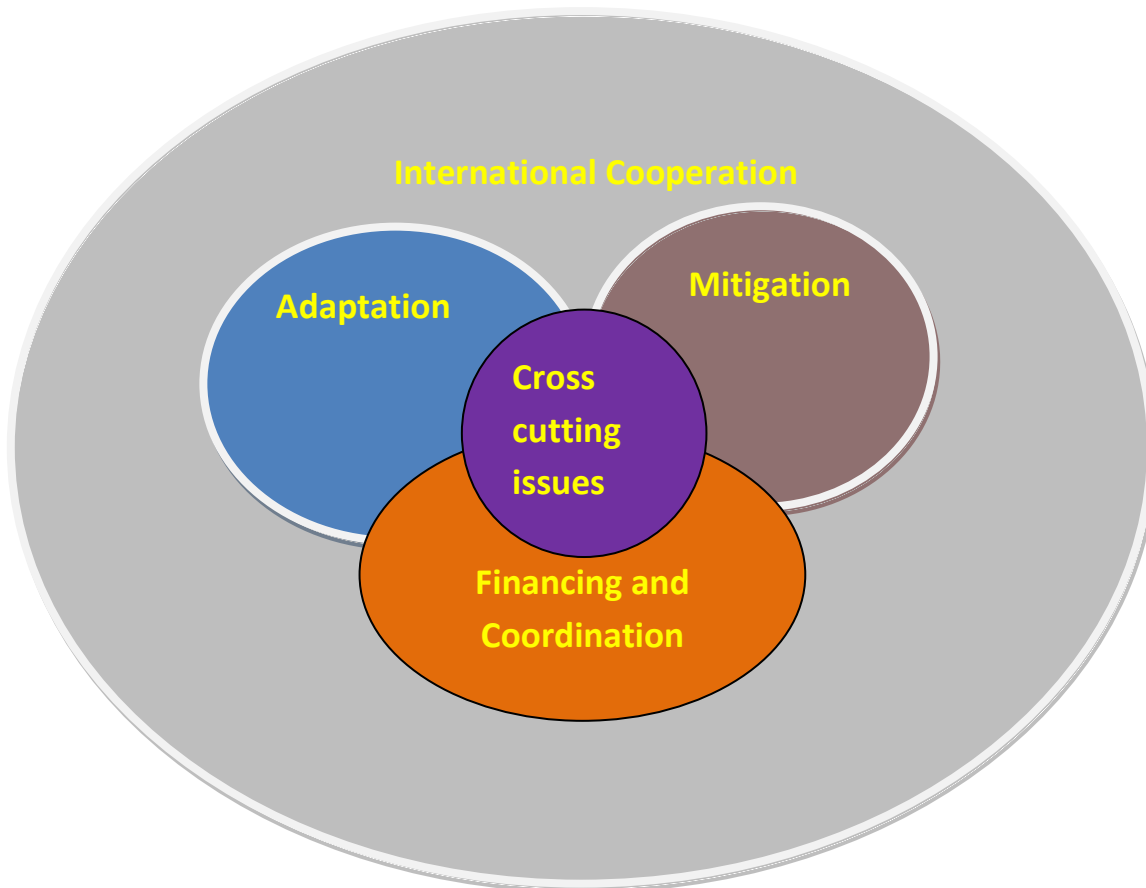


Figure 14: Scope of the strategy

3.4 Strategic Interventions

3.4.1 Adaptation strategies

Adaptation is the highest priority for Tanzania. The adaptation strategies identified in this section are built on and extend beyond the NAPA of the country as they have been prepared in a deliberate approach that covers key socio- economic growth sectors. It also responds to Cancun Agreement which require the countries to develop their National Adaptation Plans (NAPs) for the purpose of identifying medium and long term adaptation actions. Furthermore this Strategy provides basis for identifying short, medium and long term adaptation activities designed to address existing and emerging climate change threats.

This Strategy focuses on critical natural resource based sectors and outlines potential measures for adaptation to the adverse effects of climate change impacts. Various adaptation strategies in each sector are identified as shown in Table 4.

Table 4: Strategies on Climate Change Adaptation by Sectors/themes

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
<p>1. Water Resource</p>	<p>Water is the main source of life and is harnessed for domestic, agriculture, industrial use and hydro power generation. Climate change is impacting water sources. Addressing climate change impacts to water resources will allow continuous availability of water for these elements which are important for sustaining livelihood, economic growth and social development.</p>	<p>To ensure water quality, availability and accessibility in a changing climate</p>	<p>a) To enhance protection and conservation of water catchments b) To invest and promote appropriate water management technologies c) To invest in exploration and extraction of underground water. d) To improve water quality</p>	<p>a) Protecting and conserving water catchments b) Enhancing exploration and extraction of underground and other water sources c) Facilitating and promoting water recycling and reuse d) Promoting rain water harvesting e) Enhancing coordination of water abstraction and use f) Promoting efficiency in water supply and use to ensure adequate and sustainable water supplies to all sectors. g) Facilitate access to water resources h) Enhance management of</p>	<p>MoW, MNRT, MAFC, VPO – DOE, PMO-RALG, UWSA's, NEMC, Private Sector, CSOs</p>

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
				<p>water sources to improve sanitation and hygiene</p> <p>i) Promoting water treatment and storage.</p> <p>j) Enhancing decentralization of water sources management.</p> <p>k) Conducting vulnerability assessment in water resources</p>	
<p>2. Coastal and Marine environment</p>	<p>Coastal and marine environment, harbours enormous ecosystem goods and services that are vital for life. Protecting the coastal and marine environment from the impacts of climate change will ensure sustainability of these services.</p>	<p>To sustain availability of coastal and marine ecosystem goods and services.</p>	<p>a) To promote sustainable management of coastal and marine environment</p> <p>b) To strengthen coastal and beach erosion control systems</p> <p>c) To promote livelihood diversification for coastal communities</p>	<p>a) Establishing mechanisms for coastal erosion control</p> <p>b) Promoting alternative sources and technologies to enhance water availability</p> <p>c) Promoting sustainable coastal land use planning</p> <p>d) Enhancing protection and conservation of coastal and marine ecosystems.</p> <p>e) Enhancing</p>	<p>MLHSD, VPO, MNRT, MNRT, MLFD, PMO-RALG, NEMC, TPDF, Private Sector, CSOs</p>

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
				<p>decentralization of coastal systems management.</p> <p>f) Supporting alternative livelihood initiatives for coastal communities</p>	
<p>3. Forestry</p>	<p>Climate change impacts affect many forest and ecosystem processes. Protecting and conserving biodiversity through application of best practices in soil and water conservation; expanding forest cover and use of adaptive species as well as linking conservation areas is vital in adapting to climate change and ensuring continuity in the availability of ecosystem goods and services hence improving the livelihoods of Tanzanian.</p>	<p>To enhance climate change resilience of forests for continued supply of the ecosystems goods and services.</p>	<p>a) To mainstream climate change aspect into forest management practices</p> <p>b) To promote use of lesser known tree species.</p> <p>c) To promote alternative livelihood to forest dependent communities.</p> <p>d) To promote use of non-timber materials.</p> <p>e) To Promote deliberate greening activities</p>	<p>a) Enhancing control of forest fire, disease and pest breakout.</p> <p>b) Enhancing conservation of forests biodiversity and control of invasive species.</p> <p>c) Supporting alternative livelihood initiatives for forest dependent communities.</p> <p>d) Promoting establishment of woodlots.</p> <p>e) Establishing comprehensive monitoring system for forest resources and ecosystem conditions</p>	<p>MNRT, PMO-RALG, VPO-DOE, SUA, Private Sector, CSOs</p>

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
				<ul style="list-style-type: none"> f) Strengthening and up scaling of community based forest management best practices g) Promoting use of non wood construction materials. h) Promoting energy efficient technologies. i) Enhancing decentralization of forest management 	
4. Wildlife	Reducing vulnerability of the wildlife and habitats to climate change will significantly contribute to ecosystem integrity and ensure sustainable management of wildlife resources.	To enhance resilience of wildlife ecosystems to impacts of climate change.	<ul style="list-style-type: none"> a) To promote wildlife management practices that increase resilience to climate change. b) To establish wildlife climate change related monitoring and information management systems 	<ul style="list-style-type: none"> a) Enhancing protection and conservation of wildlife habitats b) Strengthening wildlife information database and management systems c) Enhancing management of emerging human-wildlife conflicts d) Promoting appropriate methods for conservation of climate change 	MNRT , LGAs, TANAPA, Private Sector, CSOs

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
				<p>threatened species.</p> <p>e) Enhancing involvement of local communities in wildlife conservation through Wildlife Management Areas (WMA)</p> <p>f) Conducting vulnerability assessment of wildlife</p> <p>g) Enhance controlled fire management system in wildlife habitats</p>	
<p>5. Agriculture and food security</p>	<p>More than 80% of population in Tanzania depends on climate sensitive rain fed agriculture as source of livelihood. Reducing vulnerability of the sector to climate change will significantly contribute to socio-economic development and ensure food security.</p>	<p>To enhance resilience of agriculture sector to climate change for sustainable livelihood.</p>	<p>a) To identify suitable crops for new agro-ecological zones.</p> <p>b) To promote appropriate agricultural practices that increase resilience to climate change.</p> <p>c) To promote use of appropriate technologies for production, processing, storage and distribution</p>	<p>a) Assessing crop vulnerability and suitability (cropping pattern) for different Agro-ecological zones</p> <p>b) Assess trade comparative advantage on traditional export crops with changing climate</p> <p>c) Promoting appropriate irrigation systems</p> <p>d) Promoting early maturing and</p>	<p>MAFC, PMO, MoT, Ministry of Works, MLHSD, MSCT National Food Reserve Agency, TFDA, TBS, TMA</p>

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
				drought tolerant crops e) Enhancing agro- infrastructural (input, output, marketing, storage) systems f) Promoting appropriate indigenous knowledge practices g) Development of crop insurance strategy. h) Strengthening weather forecast information sharing for farmers i) Strengthening post harvest processes and promote value addition j) Addressing soil and land degradation by promoting improved soil and land management practices/technique s. k) Strengthen integrated pest	

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
				management techniques l) Promote use of pest/disease tolerant varieties m) Strengthen early warning systems for pest surveillance.	
6. Human Health	<p>Climate change is a significant and emerging threat to human health. Enhancing resilience and climate change adaptation will reduce proliferation of infectious diseases and occupational health risks thereby ensure a healthier nation, which is particularly important for sustainable development.</p>	<p>To increase resilience and adaptive capacity of people and health systems, to address the impacts of climate change.</p>	<p>a) To enhance public health care systems capacity to respond to climate change-related health risks. b) To improve disease surveillances and design of diseases control programmes (e.g. preventive and curative procedures). c) To improve knowledge on climate change related occupational health risks</p>	<p>a) Strengthening control systems related to health risks and diseases. b) Ensuring availability of specialized trained staff and medical facilities for addressing climate-related diseases and other health risks. c) Enhancing information sharing systems and cooperation with international community in addressing climate change – health related issues. d) Enhancing health</p>	<p>MOHSW, NIMR, Government and Private Hospitals</p>

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
				insurance system	
7. Tourism	Tourism is among economic sectors with greatest growth potential in Tanzania. Many of Tanzania's vulnerable areas to climate change are also major tourism destinations such as the beaches, national parks and forest biodiversities. The present tourism circuits (Parks and Reserves) are based on animal distribution and climate condition. Adaptation interventions are required to make the sector resilient to climate change.	To build resilience and adaptive capacity of the tourism industry to climate change.	<ul style="list-style-type: none"> a) To promote alternative tourist attractions. b) To restore the degraded tourist sites. c) To sensitize and enhance adaptive tourism infrastructural development. 	<ul style="list-style-type: none"> a) Diversification of income sources and tourist attractions. b) Promoting integrated and participatory conservation of tourist sites. c) Promoting eco-tourism. d) Enhancing decentralization of management of tourism attraction centres. 	MNRT, LGAs, TANAPA, Private Sector, CSOs
8. Energy	Climate change impacts has led to frequent and persistent droughts that dry up of major hydropower dams threatens socio-economic development and livelihood at both local and national levels. Diversifying and	To enhance resilience of energy sector to climate change.	<ul style="list-style-type: none"> a) To promote and improve use of alternative energy sources. b) To promote use and acquire efficient energy technologies in household, public and industrial sectors. 	<ul style="list-style-type: none"> a) Promoting diversification of energy sources including non – traditional. b) Supporting development and utilization of community based off-grids/ mini-grids 	MEM, TANESCO, MoW, MIT, MNRT, MCST, Private Sector, CSOs

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	exploiting other enormous potential sources of energy will not only enhance energy resilience and reduce vulnerability of the sector to climate change impacts, but also will enhance energy security at national and regional levels.			<ul style="list-style-type: none"> c) Promoting clean coal for energy generation. d) Promoting development and use of energy efficient technologies. e) Promoting application of cogeneration in industrial sector. f) Promoting energy plantations to reduce pressure on catchment natural forests. 	
9. Industry	Industry is one of the key economic sectors in the country. Unreliable rainfall and prolonged drought will affect availability of energy sources and raw materials for industries .In addition, sea level rise and frequent flooding, is threatening industrial infrastructures	To build a diversified and resilient industrial sector.	<ul style="list-style-type: none"> a) To promote alternative energy sources b) To promote adoption of efficient technologies. c) Enhance occupational health in industries d) Enhance resilience of industrial sector to changing climate 	<ul style="list-style-type: none"> a) Promoting diversification and integrated energy sources. b) Promoting establishment of energy management systems. c) Promoting development and adoption of firm⁴¹ 	MIT, MEM, MSCT, NEMC, TBS

⁴¹ Firm means organisational enterprise

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	<p>which are mostly located in coastal areas. Moreover, increased temperature due to climate change will reduce industrial productivity due to inconvenient working environment and machinery efficiency. Therefore, adaptation strategies in the sector are important for sustainable growth of the economy.</p>			<p>environmental policy d) Assess vulnerability of industrial sector e) Promoting appropriate planning for industrial locations and zoning in the context of climate change f) Promoting insurance schemes in industrial establishments</p>	
<p>10. Livestock</p>	<p>About 60 million hectares out of 94 million hectares of land resources, which are rangelands utilized for livestock grazing are vulnerable to climate change impacts. Increasing temperature and frequent droughts are likely to reduce rangeland. Livestock vector borne diseases and spread of tsetse fly may narrow the area under rangeland. As a consequence, the</p>	<p>To enhance resilience of livestock industry development to climate change impacts</p>	<p>a) To promote climate change – resiliency livestock farming practices b) To acquire appropriate technologies for livestock production systems</p>	<p>a) Promoting climate change resilient traditional and modern knowledge on sustainable pasture and range management systems. b) Promoting development and implementation of land use plans countrywide. c) Enhancing development of livestock infrastructure and</p>	<p>MLFD, MAFC, PMO, MoW, MLHSD, MSCT, Private Sector, CSOs</p>

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	<p>already low productivity of grazing livestock could be further diminished. Hence, need to strengthen resilience of livestock producers so as to be able to adapt with climate change impacts and ensure food security.</p>			<p>services. d) Promoting development of livestock insurance strategy. e) Strengthening weather forecast information sharing for pastoralist f) Promoting livelihood diversification of livestock keepers. g) Promoting improved traditional livestock keeping system.</p>	
<p>11. Fisheries</p>	<p>It is the interest of Tanzania to have better and more effective management approaches that ensure mainstreaming of climate change issues into the fisheries sector in order to improve quality of life of the people, sustain national economy and enhance the productivity and diversity of the aquatic ecosystems and fisheries sector in</p>	<p>To have fisheries resources able to resist and/or adapt to climate change risks and continue supporting community livelihoods and the economy in general.</p>	<p>a) To promote protection and conservation of aquatic ecosystems. b) To explore and promote alternative/diversified means of livelihoods for fisheries communities c) To promote environmentally friendly and adaptation technologies in fish catch, processing and storage</p>	<p>a) Enhancing monitoring of fisheries habitat and species. b) Facilitating enhancement and/or development of integrated data management system in the fisheries sector in line with the CEIS. c) Promoting aquaculture. d) Enhancing</p>	<p>MLFD, MNRT, MCST, MOVET, IMS, Private Sector, CSOs</p>

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	general.			protection and conservation of aquatic ecosystems. e) Supporting alternative livelihood initiatives for fisheries community.	
12. Infrastructure	The projected effects of climate change could have significant implications for the nation's infrastructure system. As infrastructure assets have long operational lifetimes they are sensitive not only to the existing climate at the time of their construction, but also to climate variations over the decades of their use. To increase the resilience of both new and existing infrastructure, preparedness in planning ahead and	To have an infrastructure ⁴² system that is resilient to Climate Change.	a) To mainstream climate change aspect into infrastructure initiating designing and development. b) To promote deployment and use of appropriate technology in infrastructure designing and development.	a) Promoting and enhancing use of building codes and standards adaptive to climate change. b) Promoting integrated planning in infrastructure designing, development and use of appropriate technologies c) Promoting construction and rehabilitation of relevant infrastructure. d) Promoting insurance system for infrastructures	MOW, MoT, MoF, TANROADS, TPA, TAA, RAHCO,TRL, SUMATRA, TEMESA, Private Sector, CSOs

⁴² For the purpose of this strategy the focus is on buildings, roads, bridges, railways, maritime and aviation.

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	manage the impacts of climate change is not avoided.				
13. Human settlements	It is estimated that about 60% of housing in urban areas are in unplanned, unserviced and/or hazardous areas such as river valleys. Reducing the vulnerability of human settlements to climate change will improve socio-economic development and community wellbeing.	To have human settlement systems that are resilient to climate change.	<ul style="list-style-type: none"> a) To mainstream climate change issues into urban and rural planning. b) To promote use of appropriate building materials adaptive to climate change. c) To promote acquisition and use of efficient technologies in households and public facilities. d) To promote sustainable availability of livelihoods and social services in both urban and rural areas. 	<ul style="list-style-type: none"> a) Promoting building standards to accommodate impacts of climate change. b) Enhancing land use planning. c) Improving settlements of communities in climate change risk prone areas. d) Relocation of settlements from high risk areas. e) Promoting sustainable housing schemes. f) Promoting insurance schemes for human settlements 	MLHSD, MoT, Ministry of Works, PMO-RALG, NHC, LGAs, Private Sector, CSOs
14. Land use	Tanzania is committed at continued livelihoods support by promoting sustainable land use and land management systems.	To have resilient land use plans (land management systems) for sustainable development.	<ul style="list-style-type: none"> a) To promote and enhance sustainable land use planning at all levels b) To mainstream climate change into land use planning. 	<ul style="list-style-type: none"> a) Reviewing and enforcing land use master plans. b) Exploring and promoting sustainable land management 	MLHSD, PMO-RALG, LGAs, Private Sector, CSOs

Sector/ Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
				technologies. c) Promoting and supporting effective land use planning at all levels	

3.4.2 Mitigation strategies

Despite its negligible GHG emissions, Tanzania can participate in mitigation activities to contribute to its sustainable national development. Notably, potential sources of emissions include: traditional energy sources, transportation systems, agricultural production and waste disposal management activities. In light of the opportunities presented by mitigation initiatives, Tanzania stands to gain financially from the mechanisms, such as CDM, NAMAs, REDD+ and other carbon markets/trading. The mitigation strategies earmarked for this Strategy are presented in Table 5.

Table 5: Strategies on Climate Change Mitigation by Sectors/Themes

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
1. Energy	Even though Tanzania has negligible contribution to the generation of greenhouse gases from energy sources the country wishes to play a role in reducing global emissions while achieving sustainable development.	To achieve sustainable development through promotion of low carbon technologies.	<ul style="list-style-type: none"> a) To promote use of efficient energy technologies. b) To enhance supply and use of renewable energy. c) To promote use of other clean energies. 	<ul style="list-style-type: none"> a) Enhancing use of renewable energy share in the national grid and off-grid. b) Enhancing off – grid power supply to rural areas. c) Promoting diversification of energy sources. d) Supporting exploitation of geothermal, clean coal and safe nuclear energy. e) Promoting energy efficient technologies and practices. f) Developing NAMAs focusing on energy generation and conservation. g) Promoting green energy related technologies 	MEM , MIT, VPO, TANESCO, REA, NDC, COSTECH, PMO-RALG, Private Sector, CSOs
2. Industry	Emission reduction of greenhouse gases can be taken up with adequate technological mitigation measures	To mitigate greenhouse gas emissions through strengthening policy guidance concerning energy	<ul style="list-style-type: none"> a) To promote diversification of clean energy sources. b) To promote adoption of 	<ul style="list-style-type: none"> a) Enhancing cleaner production practices and technologies. b) Promoting diversification of energy sources and 	MIT , MEM, VPO, TANESCO, REA, NEMC, TIRDO, COSTECH, Private Sector, CSOs

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	in industry. It is important to develop policies that actively encourage private sector involvement in the development of mitigation activities.	conservation and efficient utilization, demonstration and application of energy conservation technologies.	efficient technologies. c) To promote establishment and adoption of <i>firm</i> environmental and energy policies related to emissions reduction.	fuel switching technologies. c) Promoting establishment of environmental and energy management systems. d) Enhancing adoption of clean and energy efficient technologies. e) Developing NAMAs focusing on energy efficiency and conservation. f) Promoting efficient production technologies	
3. Livestock	Livestock production is affected by climate change. Consideration of the livestock sector is crucial for mitigation of, climate change as the sector is a producer of greenhouse gases (GHG).	To enhance reduction of GHG emissions from livestock sector.	a) To promote appropriate livestock management practices that reduce emissions b) To promote use of improved animal feed stuffs.	a) Promoting manure management practices that reduce emission b) Promoting appropriate technology for animal feed stuff production c) Promoting waste management in abattoir d) Improving carbon capture by rangelands and complementary activities.	MLFD , PMO-RALG, VPO, NEMC, Private Sector, CSOs
4. Transport	Transportation is one of the main sources of CO ₂ emissions.	To have an efficient transport system with	a) To promote low emission transport systems.	a) Promoting fuel switch in transport facilities. b) Improving systems for	MOT , PMO-RALG, MOW, DART,

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	This means that transport planning has to deal with aspects of climate change.	minimum GHG emissions.	b) To promote non-motorized transport systems.	<ul style="list-style-type: none"> rapid transportation. c) Promoting use of mass transport facilities d) Establishing infrastructures for and promoting use of non-motorized transport. e) Proper urban transport planning to facilitate efficient and low GHG modes of transportation f) Developing NAMAs on transport systems. 	TANROADS, TRL, TAZARA
5. Mining	Tanzania possesses a considerable resource of coal. This resource is currently exploited only on a small scale, but is potentially suitable as a source of energy or coal-based materials for domestic industries. Such development provides opportunity for reducing emissions through capturing methane and provision of energy.	<p>To ensure sustainable supply of clean energy.</p> <p>To ensure that mining is conducted in a safe, sustainable and environmentally-sound manner.</p>	<ul style="list-style-type: none"> a) To promote diversification and integrated clean energy sources. b) To explore carbon capture and storage technologies. c) To promote adoption of energy efficient technologies. d) To promote establishment and adoption of firm environmental and energy policies. 	<ul style="list-style-type: none"> a) Enhancing cleaner production practices and technologies. b) Promoting diversification and integration of energy sources and fuel switching technologies. c) Promoting establishment of environmental and energy management systems. d) Exploring capturing and storage of GHG. e) Enhancing adoption of energy efficient technologies. 	MEM , PMO-RALG, VPO, NEMC, VETA, TANESCO, REA, TIRDO, COSTECH

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
				f) Promoting best practices for methane recovery and drainage	
6. Wetlands	Wetlands deliver a wide range of ecosystem services including carbon sequestration. However, they are also important source for GHG particularly methane. Thus sustainable wetland management is necessary to enhance climate change mitigation.	To improve management of wetlands for enhanced absorption and storage of GHG.	a) To promote conservation of wetlands. b) To promote alternative livelihoods to wetland dependent communities.	a) Promoting cross-sectoral and ecosystem-based approaches to wetland management. b) Supporting alternative livelihood initiatives for wetland communities. c) Enhancing infrastructures for appropriate management of wetlands. d) Promoting management of natural and manmade wetlands.	MoW , VPO, MNRT, MAFC, RALG, NEMC, Private Sector, CSOs
7. Waste management	Waste management presents both challenges and opportunities in mitigation of climate change. Sustainable management of waste including tapping emission from waste as source of energy can contribute to reducing GHG	To explore and enhance contribution of waste management sector in mitigation climate change and contribution to sustainable development.	a) To promote application of sanitary landfills. b) To promote wastewater management. c) To promote energy generation from municipal wastes.	a) Promoting generation and utilization of energy from wastes. b) Promoting onsite sorting of wastes. c) Enhancing methane recovery in wastewater treatment. d) Promoting landfill methane recovery e) Enhancing recovery, recycling and reuse of materials from solid	MoW , VPO, MNRT, MAFC, PMO-RALG, NEMC, Private Sector, CSOs

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	emission			wastes. f) Development of NAMAs on waste disposal facilities	
8. Forestry	Tanzania has high sequestration potential for GHG due to existing extensive forest cover. Addressing the drivers of deforestation and forest degradation will enhance the contribution of the forest sector to global GHG mitigation efforts and enhance sustainable development.	Enhance the contribution of forest sector to national sustainable development through exploitation of global GHG mitigation potentials.	a) To promote and enhance afforestation and reforestation b) To enhance implementation of National REDD Strategy.	a) Promoting afforestation and reforestation b) Supporting household energy plantations to reduce pressure on natural forests c) Supporting capacity building for community based forest carbon assessment d) Promoting reduction of emission from deforestation e) Promoting reduction of emission from forest degradation f) Promoting sustainable management of forest Enhancing and conservation of carbon stocks g) Developing NAMAs in forest management	MNRT , PMO-RALG, VPO, NEMC, SUA, Private Sector, CSOs
9. Agriculture	Climate Change and its associated impacts on agriculture sector is a major concern in	To enhance contribution of agriculture sector to national sustainable	a) To enhance carbon sequestration in agriculture sector.	a) Promoting adoption of high yielding technologies. b) Promoting agro-forestry systems.	MAFC, PMO, VPO, SUA, Private Sector, CSOs

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	Tanzania. Agriculture sector can contribute to mitigation as a consequence of improving productivity and sustainability.	development through appropriate agriculture production systems		<ul style="list-style-type: none"> c) Enhancing management of agricultural wastes. d) Promoting minimum tillage and efficient fertilizer utilization. e) Promoting best agronomic practices such as conservation agriculture technologies. f) Promoting integrated nutrients management. g) Explore NAMAs opportunities in agriculture 	

3.4.3 Strategies on Cross-Cutting Issues

The socio-economic development of the country depends on sectoral and cross-sectoral activities. In the national efforts towards climate change adaptation and mitigation issues of cross-cutting nature have to be addressed in all sectors. Among the activities or programmes that need to be supported and implemented would include establishment and implementation of awareness programmes to sensitize the public on climate change impacts, adaptation and mitigation options; establishment of adequate research capacity for various R&D and training institutions to address issues related to climate change; building sufficient capacities of marginalised groups, including women, to address climate change related disaster risks; supporting acquisition of appropriate technologies, for example, for enhancing early warning systems and weather forecasting; and documentation and promotion of indigenous knowledge on climate change adaptation in various socio-economic sectors. These initiatives should be complemented by rigorous support to integration of climate change adaptation in all sectors; development and implementation of a national climate change communication strategy. To achieve all the above, the strategy identify a need to build the capacity of all sectors and relevant institutions to address climate change adaptation.

Reducing emissions that are causing global warming will need international cooperation in almost all interventions. It is also factual that developing countries in particular LDCs that are particularly dependent on climate sensitive sectors will not be able to address the impacts of climate change or participate in mitigation opportunities without international support. Therefore, international cooperation in adaptation, mitigation and cross cutting issues such as financing and technology will be critical in implementing this strategy.

The key concern is that international cooperation and commitments will be based on equity within the objectives and principles of the UNFCCC. Participating in international discourse on climate change shall remain important to ensure that Tanzania benefits from such international cooperation frameworks. The strategies to achieve the above are presented in Table 6.

Table 6: Strategies on Cross-cutting issues

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
1. Research and development	Effective adaptation and mitigation need reliable data. Thus, more research is needed to establish climate change patterns, vulnerability, adaptive capacity, mitigation option and develop technologies that will ensure sustainable response systems and minimize impacts and risks associated with climate change.	To undertake detailed and coordinated research on climate change impacts, vulnerability and adaptation, mitigation options and develop technologies that will ensure sustainable response systems for minimising impacts and risks associated with climate change.	<ul style="list-style-type: none"> a) To enhance coordinated research on climate change patterns; impacts; vulnerability; adaptation and mitigation options. b) To promote researches and development on technologies that will ensure sustainable response systems. c) To promote the implementation of research findings d) Development of new models for predicting the impacts of CC 	<ul style="list-style-type: none"> a. Researching and promoting indigenous knowledge on adaptation and mitigation options b. Promoting research on sustainable and integrated natural resources management systems. c. Enhancing research and development on coastal and marine environment d. Enhancing Research and Development of drought-tolerant, early-maturing and pest-resistant crop varieties and livestock; e. Promoting research on climate change related diseases, vectors and other health risks. f. Identifying and developing appropriate technologies for adaptation and mitigation. g. Developing new and making use of available models for predicting impacts of climate change and estimating adaptation and mitigation cost. h. Enhancing research innovations and technologies on eco-friendly energy resources 	MCST, MNRT, MAFC, MLFD, MOHSW, COSTECH, NIMR, UDSM, VPO, NEMC, TMA, SUA, Private Sector, CSOs, MATC, MEM, TANESCO, TIRDO, TEMDO, CAMATEC, R&D Institutions
2. Information, Communication , education and	Effective and successful implementation of	To establish a national climate change education,	a) To enhance information	a) Establishing a National Climate Change Awareness programme at	Higher learning Institutions, MOEVT,

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
public awareness	climate change activities will depend on how best all stakeholders: are aware of and share information on climate change, its impacts and available opportunities and climate change is mainstreamed into education system.	information communication and public awareness raising system.	<ul style="list-style-type: none"> sharing and communication systems b) To mainstream climate change issues into education system at all levels. c) Promote public awareness programs on Climate Change issues 	<ul style="list-style-type: none"> all levels. b) Promoting communication and networking on climate change information. c) Enhancing climate change data availability and dissemination. d) Mainstreaming climate change issues in curricula at all levels. e) Promoting Indigenous Knowledge on climate change adaptation. f) Capitalizing on media to disseminate climate change information g) Promoting the use of specific groups, e.g., art works traditional dances, religious gathering, films and songs on climate change information generation and dissemination. h) Promoting advocacy on climate change for politicians and decision makers. i) Enhancing availability of national climate change data base. 	MCST, VPO, SUA, UDSM, NEMC, PRIVATE SECTOR, CSOs, Religious groups, All Media, R&D Institutions
3. Technology transfer and development	Tanzania is aspiring towards acquiring and using technologies that are	To enhance technology development and transfer which play a major role in	a) To promote investment on technology development	a) Establishing a network which allows sharing knowledge and adapting technology to meet local conditions.	MCST, COSTECH, MOEVT, VPO, PMO-RALG, MAFC, MLFD, MNRT, MIT,

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	sustainable and affordable in addressing the adverse impact of climate change and that will enhance her contribution towards climate change mitigation.	national strategies to combat climate change and benefits from globally available mitigation options for the pursuit of sustainable development.	<ul style="list-style-type: none"> and transfer. b) To establish mechanisms and centres of excellence on technology development and transfer. c) To enhance technology partnerships and networks. 	<ul style="list-style-type: none"> b) Analysing and implementing technological needs assessment c) Establishing government incentive system for appropriate technologies. d) Enhancing deployment of appropriate technologies. e) Promoting establishment centres of excellence for appropriate technology development and transfer f) Enhancing innovations and technology development on eco-friendly energy resources. 	R&D Institutions
4. Capacity building and Institutional strengthening	The impacts of climate change are crosscutting and will affect all the development sectors and overall community livelihoods. The government is committed to build capacity of her people's understanding on climate change science and its linkage to livelihoods and socio-economic development; as well as the	To build the capacity of Tanzanians to manage climate change issues and utilize available and emerging opportunities for sustainable socio-economic development.	<ul style="list-style-type: none"> a) To build institutional capacity to effectively address climate change issues b) To strengthen institutional coordination and inter-linkages. 	<ul style="list-style-type: none"> a) Undertaking climate change institutional capacity needs assessment b) Developing and implementing a national capacity building programme on climate change c) Mobilising resources to support capacity building d) Strengthening national coordination, monitoring and evaluation systems e) Building the capacity of the government to undertake international and regional negotiations. f) Building the capacity of the 	PO (Cabinet Secretariat), VPO, PMO-RALG, MDAs, Private Sector, CSOs, R&D Institutions

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	capacity to adapt and mitigate to the adverse impacts.			government, civil society and the private sector on carbon credit and climate change financing. g) Establishing centres for coordinating climate change R&D activities	
5. Systematic observation	The provision of good meteorological services starts with the availability of sufficient and quality observation data. There is therefore an urgent need to enhance capacity in systematic observation for effective climate change adaptation.	To enhance capacity in systematic observation and enable efficient provision of meteorological services.	a) To enhance surface and upper air observing networks b) To enhance capacity in remote sensing c) To enhance capacity in data base management d) To promote indigenous knowledge in weather forecast and climate prediction	a) Strengthening of weather radar network b) Improving existing and establishing new synoptic, agro-meteorological and climatologically stations to meet optimum observation c) Establishing marine stations d) Promoting documentation of indigenous knowledge. e) Enhancing data availability and modelling on climate change at all levels f) Enhancing international cooperation in systematic observation	TMA, MoT, VPO, PMO-RALG, Private Sector, CSOs
6. Early warning systems	Tanzania is affected by frequent and extreme weather and climate events that include droughts, floods, strong winds, and tropical cyclones.	To enhance protection or reduction of loss of life as well as socio-economic and ecological loss and damage associated with climate change.	a) To enhance early warning systems that respond to the challenges of climate variability and change	a) Enhancing capacity in monitoring and prediction of extreme weather events and associated impacts b) Improving telecommunications for rapid and effective data and information exchange; c) Enhancing capacity to	TMA, MOW, PMO, MOEVT, MAFC, MCST, TCAA, Private Sector, CSOs, R&D Institutions

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	Due to increased frequency and severity of extreme weather events, there is therefore a need to establish effective early warning systems that will provide information which allows individuals and communities to protect their lives and properties.		<ul style="list-style-type: none"> b) To establish efficient mechanisms for packaging and dissemination of weather and climate information c) To promote advanced weather forecasting technologies. 	<ul style="list-style-type: none"> efficiently analyze and disseminate early warning information d) Enhancing documentation of relevant historical data e) Strengthening capacity in Numerical Weather Prediction and modeling f) Enhancing cooperation among relevant stakeholders and media, to ensure timely dissemination of products and information related to early warning g) Promoting regular review of appropriate technologies for effective functioning of early warning systems. 	
7. Disaster and Risk management	Natural disasters in Tanzania are increasing in frequency and impact. On average, almost two climate related disasters of significant proportions have been recorded every month. Reducing vulnerability on the increasing in frequency and intensity of climate	To reduce the risk to life and livelihood and strengthen resilience of the community and infrastructure on climate change impacts for sustainable development.	<ul style="list-style-type: none"> a) To strengthen national capacity for disaster risks reduction and management b) To strengthen coordination and collaboration between diverse stakeholders in disaster management. 	<ul style="list-style-type: none"> a) Enhancing mechanisms for climate change related risks and vulnerability assessments b) Strengthening institutional arrangement for disaster and risk management c) Enhancing disaster preparedness and management at all levels d) Promoting technologies for management of climate change related disasters and risks. e) Establishing comprehensive community based early warning and 	PMO, TMA, PMO-RALG, VPO, MDAs, Academic and R&D Institutions, Private Sector, CSOs

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	change related disaster for sustainable development.		c) To mainstream climate change into disaster risk management programmes.	disaster management systems f) Enforcing land use plans	
8. Impacts of response measures	Measures should be put in place to ensure that response measures to climate change do not affect Tanzania negatively in the area of acquisition of new technologies for climate change and sustainable development.	To ensure measures implemented to address climate change do not compromise sustainable development endeavours and should benefit the nation and its people.	a) To establish the impacts of response measures in all development and social sectors b) To establish opportunities and costs related to the response measures to climate change c) To ensure land/forestry based activities to address climate change do benefit the country.	a) Identifying and assess the impact of climate change interventions by international and national authorities on socio-economic development in Tanzania. b) Promoting locally available sustainable and affordable source of technology c) Ensuring that land laws are enforced. d) Enhancing local capacity for land management e) Enhancing capacity for technology transfer to ensure relevant technologies are locally manufactures/ and or available. f) Elaborate and implement a work programme on loss and damage related to the response measure to climate change.	VPO, PMO, , PMO-RALG, MDAs, Higher Learning Institutions ESRF, COSTECH TIC, REPOA, Private Sector, CSOs
9. Gender and vulnerable groups	Impacts of climate change are differently affecting gender	To mainstream gender and vulnerable groups concerns in	a) To integrate gender and vulnerable groups related	a) Integrating gender and vulnerable groups related issues into climate change initiatives	VPO, MCDGC , PMO, MoF, MIT, MFAIC, ESRF, TIC,

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	<p>and vulnerable groups due to their different roles in the society. Therefore, gender perspective in development and implementation of adaptation and mitigation strategies is crucial to narrow the gender gap and reducing impact.</p>	<p>addressing climate change adaptation and mitigation with the aim of enhancing equity on measures to address climate change.</p>	<p>issues into climate change initiatives</p> <p>b) To promote research that generates gender and vulnerable groups disaggregated data</p> <p>c) To enhance participation of women and vulnerable groups in planning, decision making and implementation of climate change adaptation and mitigation initiatives</p> <p>d) To promote gender and vulnerable groups equity in benefit sharing of opportunities arising from climate change adaptation and mitigation</p>	<p>b) Ensuring that climate change researches generate gender disaggregated data on impacts and response.</p> <p>c) Enhancing equitable representation of women and vulnerable groups at all levels in planning, decision making and implementation of adaptation and mitigation initiatives</p> <p>d) Promoting safeguards that will ensure gender and vulnerable groups equity in benefit sharing related to climate change initiatives</p>	<p>COSTECH, REPOA, Private Sector, CSOs.</p>

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
<p>10. Planning and financing</p>	<p>The need for financial resources for adaptation to and mitigation of climate change is continuously increasing with changing climate. Enhanced planning and financial systems are important for effective adaptation and mitigation.</p>	<p>To have adequate financial resources for climate change adaptation and mitigation initiatives.</p>	<p>a) To build effective and efficient system for planning, mobilization and management of climate change funds b) To mainstream climate change issues into development planning at all levels c) To enhance coordination and management of climate change funds d) To ensure equitable flow of climate change opportunities to the public.</p>	<p>a) Facilitating links between national and international private sectors for mobilization of climate change funds b) Incorporating climate change issues into MTEF; c) Introducing special tax for investments on climate change mitigation initiatives; d) Establishing a window for climate change financing mechanism in existing government basket fund. e) Establishing mechanisms for ensuring that all funds mobilized for climate change related activities are kept in the climate change window. f) Establishing mechanisms for ensuring flow of climate change funds and opportunities to implementing institutions and communities.</p>	<p>MoF, VPO, PO – PC, PMO-RALG, MDAs, Academic institutions and R&D institutions, CSOs, Private Sector.</p>
<p>11. International cooperation</p>	<p>Tanzania alone cannot address climate change without international support. Therefore it is crucial to enhance international</p>	<p>To ensure international cooperation plays a critical role in addressing climate change in the country.</p>	<p>a) To strengthen Tanzania participation in international climate change negotiations. b) To ensure</p>	<p>a) Strengthening Tanzania's participation in the international climate change negotiations. b) Increasing bilateral collaboration with various partners and international organizations/institutions in areas related to climate</p>	<p>VPO, MFAIC, MDAs and Academic and R&D Institutions.</p>

Sector/Theme	Strategic statement	Goal	Strategic objectives	Strategic interventions	Key actors
	cooperation for effective climate change interventions.		<p>collaboration with various stakeholders in areas related to climate change.</p> <p>c) To enhance international cooperation in the management of transboundary resources.</p>	<p>change.</p> <p>c) Promoting South-South and South-North collaboration in areas of research and development, systematic observations, early warning systems, technologies, capacity building, etc</p> <p>d) Participating in the implementation of trans-boundary climate related actions as and when appropriate.</p> <p>e) Increasing international support in the context of means of implementation.</p>	
12. Climate change and security	Security issues and concerns need to be identified and understood	To undertake activities amongst the security organs with the view to identify and understanding security issues as it is security of climate change	To understanding security concerns and take appropriate means and solution needed	<p>a) Evaluation and understanding within the security organs and systems of the importance of climate change.</p> <p>b) Enhancing cooperation between National and International organs on climate change related issues.</p>	National Security organs, VPO, Training and Research Institutions

4. IMPLEMENTATION ARRANGEMENTS

4.1 Implementation Plan

The institutional arrangement provided by the Environmental Management Act and also described in Chapter Three underpins the implementation of this Strategy. The overall coordination of the implementation of the strategy will be under the responsibility of the NCCFP. The NCCFP will also be responsible for preparing national climate change frameworks such as NAPs, NAMAs, guidelines and other relevant national documents. NCCFP will be responsible for Monitoring and Evaluation (M&E) of the overall implementation of the strategy where an M&E framework will be developed.

The general implementation of the strategies at sectoral level will be the responsibility of the relevant Government Departments and Agencies. 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 strategic interventions at local level. The established cross-sectoral committees, which are the NCCSC and the NCCTC will be important fora to facilitate implementation of cross-sectoral climate change interventions. To keep and update track records on climate change, National Bureau of Statistics will be the custodian.

The MDAs will prepare projects, programmes, action plans and cost the strategic interventions relevant to their respective sectors based on the strategic interventions identified in the strategy. Each MDA will prepare sector specific action plans indicating targets to be achieved; time frame for implementing the interventions in short, medium and long term; and outcome indicators. The plans will subsequently be integrated in the Government budgets through the Medium Term Expenditure Frameworks for implementation. Broad and complex interventions may be addressed by preparing and implementing stand alone projects or programmes. Sectoral ministries and LGAs will be reporting the implementation status to NCCFP on annual basis whereby the NCCFP will ensure the availability of such information to the public.

Civil Society Organisations are encouraged to cooperate with the Government in implementing the strategy through various projects and/or programmes. The private sectors either individually or in collaboration with the Government under public-private partnership (PPP) arrangement are encouraged to implement innovative projects to address climate change. These may include CDM project activities; REDD+ initiatives, NAMAs and other carbon markets.

Development partners either bilaterally or through their multilateral arrangements are encouraged to support the government in implementing this Strategy by providing technical and financial support, as well as facilitate resource mobilization. They are also encouraged to provide capacity building and facilitate technology development and transfer to various stakeholders in implementing this Strategy.

4.1.1 Coordination

Implementation of this Strategy will follow the institutional arrangement as provided by the EMA. In that context, the Strategy will be coordinated by the Vice President's Office which is responsible for coordination of environment management.

To coordinate climate change issues in the country the NCCTC and NCCSC will guide the implementation of this Strategy. The NCCTC shall provide technical advice to the NCCFP, while the NCCSC shall provide policy guidance, as well as ensure coordinated action and participation within various sectors. The implementation of specific strategic interventions and activities will be done in the respective MDAs; and LGAs according to their roles and responsibilities under EMA and mandates. NGOs, civil society organisations, religious organisations, educational institutions etc are encouraged to participate by facilitating the implementation of specific adaptation and mitigation projects at a community level. Resource mobilization, financial management and reporting shall be undertaken pursuant to the government's financial management guidelines and systems established under the Ministry of Finance. However, special arrangements will be made in cooperation with the Ministry of Finance to enhance existing resource mobilization and financial management systems to cope with increasing demand in financial support for addressing climate change (if necessary).

4.1.2 Information and Communication Arrangement

The information management and communication in the implementation of this Strategy will follow institutional arrangements established in the EMA. The VPO is the centre for environmental information management and communication in the country. Climate change information will be collected from various sources, managed and communicated to the public by the VPO. Communications of that information will periodically be done through publication of relevant reports. However other information communications mechanisms may be used in order to easily reach the public and cater for increasing demand of climate change information. Such mechanisms include: VPO official website, National Climate Change Website, newsletters, television and radio programmes, newspapers and cultural performances. To facilitate information communication, where necessary, the VPO will collaborate with key stakeholders dealing with climate change in the country to communicate climate change information. Such stakeholders include MDAs; LGAs, research and academic institutions, civil society organisations, private sector, politicians, religious organisations, media, and educational institutions among others.

4.1.3 Reporting Arrangements

The reporting arrangement in the implementation of this Strategy will follow the established government reporting system, as well as reporting system provided in EMA. Under the government reporting system, MDAs and LGAs are supposed to report implementation of the strategy annually. In addition, EMA requires Sector Environmental Coordinators and District/Council/Town Environmental Management Officers to report on implementation of their Environmental Action Plans that include climate change issues. Since the MDAs and LGAs are expected to integrate relevant strategic interventions in their respective plans, their quarterly and annual reports will capture information on the implementation of the Strategy. This will include financial reporting that will be subjected to audit as per government regulation. In this case,

MDAs and LGAs will report on any financial resources that were allocated for the implementation of specific climate change issues in relation to this Strategy.

4.2 Financing Climate Change

4.2.1 Financing Plan

Addressing climate change in Tanzania will largely depend on financial support from international community. Domestic funding from government budget, private sector, as well as individual contributions will complement this effort. However, an integrated approach and coordinated working system is highly required to ensure that funds to address climate change are used to achieve the objectives presented in this strategy. To ensure resources availability, the strategy proposes establishment of a National Climate Change Fund (NCF) and a special climate change window under Basket Fund to finance its implementation. However, a balance of financing is required in both adaptation and mitigation to climate change. Such balance is also important in financing other areas such as capacity building, technology development and transfer as well as awareness rising. Funding sources for implementation of this strategy are categorised into National Funds, International Funds and Commitments related to UNFCCC and Kyoto Protocol.,

4.2.2 Estimating the Cost of Climate Interventions

Although the actual cost of implementing this Strategy has not been established, the key determinant in estimating the cost of climate change impacts can be indirectly derived from the climate change interventions outlined, that is, adaptation, mitigation, capacity building and cross-cutting interventions. This is because without an accurate and static future scenario it is difficult to cost the necessary actions needed to contend with the changes. This challenge is demonstrated by a UNFCCC report that provides a range as opposed to specific numbers that estimate the additional funding needed for adaptation by 2030. The report projects a need equivalent to between USD (\$) 49 to 171 billion per annum globally (UNFCCC, 2007)⁴³.

Moreover a recent study undertaken by the Stockholm Environment Institute⁴⁴ estimates that the cost of building adaptive capacity and enhancing resilience against future climate change in Tanzania is USD (\$)100 to 150 million per year. But, an additional USD (\$) 500 million per year (but probably more) is needed to address current climate risks, in reducing future impacts and building resilience to future climate change.” The SEI report further states that while uncertain, aggregate models indicate that net economic costs could be equivalent to a further 1 to 2 % of GDP per year by 2030. With such uncertainty, it is difficult to arrive at a definitive cost of executing the Strategy.

A less inaccurate formula for arriving at the cost of implementing this Strategy is for the sectors, while developing the action plan, to estimate the cost of climate change interventions outlined herein, together with on-going programmes. This will involve (i) rating line activities based on sensitivity to climate change impacts on a four point scale (that is, no impact; low impact; medium impact and high impact); (ii) estimating

⁴³ UNFCCC (2007), Investment and Financial Flows to Address Climate Change, Climate Change Secretariat, Bonn

⁴⁴ SEI 2010: The Economics of Climate Change in the United Republic of Tanzania

a climate mark-up factor for each rating; (iii) applying the climate mark-up factor to each line budget item and; (iv) escalating annual cost to account for inflation.

The climate mark-up indices are comparable to those used in the UNFCCC report on investment and financial flows to address climate change. No impact, low-impact, medium-impact and high-impact correspond to a 0%, 5%, 10% and 15% mark-up respectively. Additionally, the United States average inflation rate of 2%⁴⁵ can be used to escalate the subsequent annual estimates after the base year since the indicative budget estimates are in US dollars terms or if the cost are in Tanzania shillings the prevailing inflation rate in the country will be used.

4.2.3 International Funds

International Funds that are financing climate change include the Global Environment Facility (GEF), banks and bilateral funds.

a) The World Bank Funds

The World Bank is an important source of fund for environmental and natural resources management. The support has been either in form of grants where the bank acts as an implementing agency of GEF or in form of lending of its own funds. The funding is both directly to environmental projects and capacity building. Lending for environment in the World Bank falls under the theme of Environment and Natural Resources (ENRM) accounting for about 9% of all the bank's lending (ibid 2009). The ENRM theme consists of seven sub-themes: (i) biodiversity, : (ii) climate change, : (iii) environmental policies and institutions, : (iv) land administration and Management, : (v) pollution management and environmental health, : (vi) water resources management, and : (vii) other environment and natural resources management. For International Bank for Reconstruction and Development (IBRD) funds alone there has been a notable increase in Climate Change related commitments for IBRD countries, which surged from an average of 8% to 40% in Financial Year 2008 (ibid 2009). In terms of share by region, for IDA countries on average about half of the commitments go to Sub-Saharan Africa (SSA) and a fifth to South Asia (SAR) and EAP. Middle East and North Africa (MNA) has a small share.

b) Africa Development Bank (AfDB) Funds

The Africa Development Bank (AfDB) is also becoming an important source of finance for environmental management and protection in particular climate change. The Bank is a GEF Executing Agency enabling it to appraise and implement projects on behalf of GEF and obtain direct access to GEF resources. Moreover, as part of AfDB commitment to supporting Africa's move toward climate resilience and low carbon development, the bank is expanding access to international climate change financing. To that end, the bank is implementing the Climate Investments Funds (CIF), a pair of financing instrument worth USD (\$) 6.4 billion designed to channel scaled up financing in form of grants, concessional loans and risk mitigation instruments to developing countries through multilateral development banks (MDB) including the AfDB. The aim is to blend funding for climate solutions with other MDB,

⁴⁵ US Federal Reserve System (2012), Historical data, US Annual Inflation available at <http://www.federalreserve.gov/econresdata/statisticsdata.htm>

national and private sector development resources, thereby leveraging substantial additional funds. By expanding CIF implementation in Africa, the AfDB hopes to inspire investor confidence in the continent and generate even more financing for clean energy and climate compatible development. The AfDB has also established the Climate for Development in Africa (Climate Development Africa); Special Fund (CDSF); the Africa Water Facility and the Congo Basin Forest Fund. It is also in the process of setting up an African Green Fund (AGF).

c) Global Environment Facility (GEF)

GEF is an independent financial organisation that provides grants to Developing Countries and Countries with Economies in Transition for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer and persistent organic pollutants. These projects benefit the global environment, linking local, national and global environmental challenges and promoting sustainable livelihoods. The GEF also works on several cross-cutting issues and programs such as Result and Learning; Earth Fund and Public private Partnerships; Capacity Development; Small Grants Programme; and Country Support Programme. In addition the GEF serves as financial mechanism for the following conventions: Convention on Biological Diversity (CBD); UNFCCC; Stockholm Convention on Persistent Organic Pollutants (POPs); United Nations Convention to Combat Desertification (UNCCD); and the GEF although not linked formally to the Montreal Protocol on substances that Deplete the Ozone Layer (MP), supports implementation of the protocol in Countries with Economies in Transition.

In undertaking its activities, GEF operates with its agencies that include: the United Nations Development Programme (UNDP); United Nations Environment Programme (UNEP); Food and Agricultural Organisation of United Nations (FAO), United Nations Industrial Development Organisations (UNIDO), International Fund for Agricultural Development (IFAD), the AfDB; the European Bank for Reconstruction and Development and the Inter-American Development Bank.

d) Bilateral Funds

Bilateral Funds are funds which are provided in the arrangement between one donor country and a developing country, institution, or NGO. Bilateral funds are mainly channelled through special assistance agencies in donor countries. Additional official assistance is channelled from donor to recipient countries through multilateral organisations and through international NGOs. Some bilateral donors have a regional focus whilst others prefer regional networks for example SADC, EAC, AU etc. Interest of some donors is also confined to specific aspects of climate change.

Over the past years, a whole range of traditional donor countries have created new funds to support climate change programmes in developing countries. These include Governments of Australia, Germany, Japan, Spain, Norway, the UK together with the European Union and USA. These include:

- i). The Environmental Transformation Fund (International Window) of the UK.
- ii). The International Climate Protection Initiative of Germany.
- iii). Norwegian International Climate and Forest Initiative.
- iv). The Global Initiative on Forests and Climate of Australia.
- v). The Global Climate Change Alliance of the European Union.

- vi). The UNDP-Spain MDG Achievement Fund-Environment and Climate Change Thematic Window.
- vii). The Cool Earth Partnership of Japan.

e) General Budget Support

A key tool in this collaboration is Performance Assessment Framework, agreed between the government and development partners. The initiative is financed by 11 bilateral development partners: Norway, UK, Japan, Sweden, Denmark, Ireland, Canada, Germany, Finland, Netherlands, and Switzerland; together with the European Commission, the World Bank, and the AfDB. In this case, GBS also is encouraged to support implementation of the Strategy through establishment of a special climate change window.

f) East Africa Climate Change Funds

The East African Community has developed a Climate Change Policy, Climate Change Master Plan and Climate Change Strategy. The community has also established a Climate Change Fund which is in the process of being capitalised. The objective of the fund is to help the Party States to adapt and mitigate climate change. The fund if well capitalised will be one of the important sources of finance for adaptation and mitigation to climate change in the region.

g) Individuals and Foundation Funds

Wealthy individuals and foundations have emerged to finance climate change adaptation and mitigation initiatives. Examples of individuals and foundations funding climate change in Tanzania include: Clinton Foundation; The Bill and Mellinda Gates Foundation; Open Society Institute; START International; Rockefeller Foundation; WWF; WaterAid and Ford Foundation. These foundations and individuals can provide important source of funds for small communities/individual climate change adaptation and mitigation projects.

4.2.4 Multilateral Agreement Funds

These include funds which were established under UNFCCC and Kyoto Protocol to facilitate implementation of climate change activities. These include Least Developed Countries Fund (LDCF), Special Climate Change Fund (SCCF), Green Climate Fund (GCF) and Adaptation Fund.

Least Developed Countries Fund (LDCF)

The LDCF addresses special needs of the LDCs under the climate change convention. Specifically, the LDCF was tasked with financing the preparation and implementation of NAPAs. The LDCF is the major existing fund mandated to finance the implementation of NAPAs. Consistent with the findings of the NAPAs, the LDCF focuses on reducing the vulnerability of those sectors and resources that are central to development and livelihoods, such as water; agriculture and food security; health; disaster risk management and prevention; infrastructure and fragile ecosystem.

Special Climate Change Fund (SCCF)

The SCCF supports adaptation and technology transfer in all developing country parties to the UNFCCC. The SCCF supports both long-term and short-term adaptation activities in water resources management; land management; agriculture; health; infrastructure development; fragile ecosystems including mountainous ecosystems; and integrated coastal zone management.

Green Climate Fund (GCF)

This fund was established with an objective of supporting projects, programmes, policies and other activities in developing countries using thematic funding windows. The fund is the window through which a balanced share of multilateral funding for adaptation and mitigation will be channelled.

Adaptation Fund (AF)

The Adaptation Fund was established by the Parties to the Kyoto Protocol of the UN Framework Convention on Climate Change to finance concrete adaptation projects and programmes in developing countries that are parties to the Kyoto Protocol. The Fund is financed with 2% of the Certified Emission Reduction (CER) issued for projects of the CDM and other sources of funding.

4.2.5 National Funds

The main national funds are revenue collected by the Government through taxes and charges from various investments associated to climate change mitigation. These funds are allocated to various MDAs and Local Government Authorities through their Medium Term Expenditure Framework that will be reflected in their both recurrent and development budgets. Climate change interventions in such MDAs and LGAs can be supported under this arrangement. Other sources of domestic funds include established funds such as National Environmental Trust Fund, National Climate Change Fund and REDD Funds; Payments for Environmental Services (for example, Payment for Ecosystem Services-PES); funds obtained through Public Private Partnership and funds from local NGOs⁴⁶. These funds can be drawn for implementation of various planned activities by following arrangements established under such funds.

4.3 Monitoring and Evaluation FrameworkError! Bookmark not defined.

The Strategy will follow Government standard monitoring and evaluation processes and procedures. Monitoring and evaluation is important for measuring performance in various areas of the strategy in order to meet targets and indicators. This will be done following the institutional arrangement provided by EMA. In that context, the VPO will monitor the implementation of the strategy through Sector Environmental Sections, the Regional Environmental Experts, and the Town/City/Municipal/District Environmental Management Officers. Furthermore, Environmental Management Officers from the LGAs will send their implementation reports to VPO-DoE. In this case, VPO will develop indicators and general monitoring and evaluation framework. These indicators along with the key deliverables and benchmarks will be the main tools for assessing implementation progress of the Strategy. The obtained

(i) ⁴⁶ The National Environmental Trust Fund and National REDD Trust Fund are still not yet operational.

information will be compiled in various periodical monitoring reports and made available to various stakeholders through quarterly and annual reports, budget speeches and relevant reports.

4.3.1 Monitoring plan

This monitoring plan has been designed to ensure that the VPO in conjunction with responsible sectors are empowered to make informed decisions regarding the effectiveness of the existing, planned and future programmes and projects in the country, as well as ensure the effective use and mobilisation of resources. This monitoring plan has been designed to ensure collection of information for use by coordinating agencies and key stakeholders. In principle it will focus on the coordination process and review of reports to measure progress toward achieving the strategic interventions in this Strategy. Monitoring will be done at three levels: (i) **input**; (ii) **process**; and (iii) **output**. At the input level the VPO will focus on determination of the cost-effectiveness of the activities, projects and programmes to be undertaken. This is will be undertaken through a review reports submitted to the VPO periodically by the coordinators and managers responsible for climate change projects and programmes at the sector level. To augment the information acquired, VPO could utilise relevant information derived from monitoring tools, including stakeholder analysis; documentation review; biophysical measurements; direct observation; cost-benefit analysis; structured interviews; questionnaires; and surveys, among others. At the process level the Division of Environment shall review and analyse the success of climate change mainstreaming in existing and planned sectoral activities which have been or are about to be implemented within the given time frame in the country.

4.3.2 Evaluation plan

Evaluation activities will be organised on an ad hoc and on-going basis. This includes all the evaluation activities to be carried out during the whole intervention period, comprising at strategy level ex-ante, mid-term, and ex-post evaluation as well as any other evaluation activity VPO may find useful for improving intervention programmes management. The evaluation of this Strategy by the VPO will also measure the extent in which the strategic interventions and actions undertaken such evaluation activities will be organised on an on-going basis. The evaluation of this Strategy by VPO will also measure the extent in which the strategic interventions and actions undertaken have realised their desired changes in the sectors. It is recommended that the VPO undertake outcome and impact evaluations at three key stages in the implementation plan. **Ex-ante evaluation** will set the basis for setting up a system of evaluation by identifying objectives, target levels, and baselines for each response strategy. On this basis a system of on-going evaluation has to be developed which ensures continuous activities for strategy evaluation during the whole response strategy period. A **mid-term evaluation** will be conducted to provide an overview of the achievements of the objectives, technical approach and implementation framework towards the desired results. The information obtained will provide an avenue to make adjustments or amendments to the implementation plan (if necessary). The **final evaluation** will be conducted at the end of the five year period of the Climate Change Strategy to measure the achieved results against

planned ones. The final results and findings shall guide VPO in revising this Strategy.

REFERENCES

- Berger, J. (2004). The last mile: How to sustain long-distance migration in mammals. *Conservation Biology*, 18: 320-331.
- [Daily News \(12th May 2011\). Floods displace 9,000 in Kilombero. Available at: http://dailynews.co.tz/home/?n=19764](http://dailynews.co.tz/home/?n=19764); see also <http://reliefweb.int/node/404112>
- Desanker, P.V. (2004). The NAPA Primer. United Nations Framework Convention on Climate Change (UNFCCC) - Least Developed Countries Expert Group (LEG), Bonn, Germany, 192p. Available at: <http://www.unfccc.int/ldc>; <http://www.NapaPrimer.org>
- East African Community – EAC (2010). Declaration of the 12th summit of EAC heads of state on food security and climate change. East African Community, Arusha
- Elisa, M., Gara, J.I., and Wolanski, E. (2011). A Review of Water Crisis in Tanzania's protected areas with emphasis on Katuma River-Lake Rukwa Ecosystem. *Journal of Ecohydrology & Hydrobiology* [DOI: 10.2478/v10104-011-0001-z]
- Fischlin, A., Midgley, G.F., Price, J. T., Leemans, R., Gopal, B., Turley, C., Rounsevell, M. D.A., Dube, O. P., Tarazona, J., and Velichko, A.A. (2007). Ecosystems, their properties, goods, and services. In Parry, M.L., Canziani, O.F., Palutikof, J. P., van der Linden P. J., and Hanson, C.E. (Eds.), *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, 211-272.
- Global Climate Adaptation Partnership and Partners, (2011). The Economics of Climate Change in the United Republic of Tanzania.
- Hannah, L., Lovejoy, T.E., and Schneider, S.H. (2005). Biodiversity and Climate Change in Context. In, Lovejoy, T. E., Hannah, L. (Eds.). *Climate Change and Biodiversity*, Yale University Press, New Haven, CT, USA and London, UK.
- International Federation of Red Cross and Red Crescent Societies – IFRC (2010). Tanzania: Floods. Available at: <http://www.ifrc.org/docs/appeals/10/MDRTZ0101.pdf>.
- IPCC (2007a). Summary for Policymakers. In Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden P.J., and Hanson, C.E. (Eds.). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK and New York, NY, USA.
- Kangalawe, R.Y.M. (2010). Mainstreaming climate change adaptation in the management of freshwater resources in the Rufiji Basin. A consultancy report submitted to the Ruaha Water Programme. WWF-Tanzania Country Office, Dar es Salaam.
- Kangalawe, R.Y.M., Mung'ong'o, C.G., Yanda, P.Z., Mwakaje, A.G., Kalumanga, E. (2009). Climate change and variability impacts, vulnerability and adaptive capacity in Kasulu District, Tanzania. Chapter 2. In: Kangalawe, R.Y.M., Mung'ong'o, C.G. and Yanda, P.Z. (Eds.). *People's Perceptions and Community Response to Climate Change and Variability: Selected Cases from Tanzania*. Institute of Resource Assessment, University of Dar es Salaam.
- Matari et al. (2008)
- Meyer, B., Balozzi, J.J., Shanyang, M.W., Mwangulango, N.A, and Qolli, A. (2006). *Katavi Rukwa Ecosystem*. Report KRCD project, GTZ/ECO-AGEG
- NFP (2001). National Forest Programme.

- Stern, N. (2006). What is the economics of climate change? *World Economics* 7(2): April-June 2006.
- Tonnang, H.E.Z., Kangalawe, R.Y.M. and Yanda, P.Z. (2010). Predicting and mapping malaria under climate change scenarios: The potential redistribution of malaria vectors in Africa. *Malaria Journal* 2010, 9:111 [DOI: 10.1186/1475-2875-9-111].
- UNDP (2007). Human Development Report 2007/2008: Fighting climate change: human solidarity in a divided world. Palgrave Macmillan, New York.
- United Nations Human Settlements Programme - UN-HABITAT (2009). Tanzania: Dar es Salaam City Profile. United Nations Human Settlements Programme, Regional and Technical Cooperation Division, Nairobi.
- United Republic of Tanzania - URT (2002). National Water Policy. Ministry of Water and Livestock Development, Dar es Salaam.
- United Republic of Tanzania - URT (2002). Population and Housing Census 2002. United Republic of Tanzania. National Bureau of Statistics, Dar es Salaam
- United Republic of Tanzania - [URT \(2003\). Initial National Communication under the United Nations Framework Convention on Climate Change \(UNFCCC\). Vice president's Office, Dar es Salaam.](#)
- United Republic of Tanzania - URT (2006). Annual Health Statistical Abstract. Ministry of Health, Dar es Salaam
- United Republic Of Tanzania - URT (2007). Tanzania National Adaptation Programme of Action, 2007. Vice President's Office, Dar es Salaam
- United Republic of Tanzania - URT (2008). State of the environment report 2008. Vice President's Office, Division of Environment, Dar es salaam.
- United Republic of Tanzania - URT (2008a). Economic Survey, 2007. The Ministry of Finance and Economic Affairs, Dar es Salaam
- United Republic of Tanzania - URT (2008b). Study on strategies for addressing negative effects of climate change in food insecure areas of Tanzania. Ministry of Agriculture, Food and Cooperatives. Ministry of Agriculture, Food and Cooperatives, Dar es Salaam.
- United Republic of Tanzania – URT (2009). Climate Change Impacts Assessment Report - 2009. Vice President's Office - Division of Environment, Dar es Salaam
- United Republic of Tanzania – URT (2009). Climate Change Impacts Assessment Report - 2009. Vice President's Office - Division of Environment, Dar es Salaam
- United Republic of Tanzania - URT (2009a). Climate change and agriculture policy brief. Vice President's Office, Division of Environment, Dar es Salaam
- United Republic of Tanzania – URT (2010). National Strategy for Reduced Emissions from Deforestation and Forest Degradation (REDD+). Draft. Vice President's Office, Dar es Salaam.
- United Republic Of Tanzania - URT (2010a). The Economic Survey 2009. The Ministry of Finance and Economic Affairs, Dar es Salaam
- United Republic of Tanzania - URT (2010b). Energy consumption by sources in Tanzania. Ministry of Energy and Minerals – MEM, Dar es Salaam.
- United Republic of Tanzania – URT (2011). The Dar es Salaam City Environment Outlook 2011. Vice President's Office, Division of Environment, Dar es Salaam. Draft.
- United Republic of Tanzania – URT (2007). National Adaptation Programme of Action (NAPA)

- United Republic of Tanzania – URT (2008). State of the Environment Report 2008. Vice President's Office, Division of Environment, Dar es salaam.
- United Republic of Tanzania – URT (2009b). Climate change and livestock policy brief. Vice President's Office, Division of Environment, Dar es Salaam; and URT (2010a). The Economic Survey 2009. The Ministry of Finance and Economic Affairs, Dar es Salaam
- United Republic of Tanzania – URT (2010). The Economic Survey 2009. Ministry of Finance and Economic Affairs, Kiuta, Dar es Salaam
- United Republic of Tanzania – URT, 2009a
- Wandiga, S.O., Opondo, M, Olago, D., Githeko, A., Downs, T., Yanda, P.Z, Kangalawe, R.Y.M., Kabumbuli,R., Opere,A., Githui, F., Kathuri, J., Olaka, L., Apindi, E., Marshall, M., Ogallo, L., Mugambi,P., Kirumira, E., Nanyunja, R., Baguma, T. Sigalla, R., and Achola, P. (2010). Vulnerability to epidemic malaria in the highlands of Lake Victoria basin: the role of climate change/variability, hydrology, health and socio-economic factors. *Climate Change* 99: 473–497 [DOI: 10.1007/s10584-009-9670-7]
- World Health Organization – WHO (2008). Cholera Country Profile: United Republic Of Tanzania. World Health Organization - Global Task Force on Cholera Control. 7 April 2008
- Yanda, P.Z., Kangalawe, R.Y.M. and Sigalla, R.J. (2006). Climatic and socio-economic influences on malaria and cholera risks in the Lake Victoria Region of Tanzania. *ICIFAI Journal of Environmental Economics* (IJEE) 4 (3): 44-70
- <http://www.tanzania.go.tz/naturalresources.html>
- http://www.bongofree.net/news_articles/english_news/ctl/readdefault/mid/700/articleid/41355.aspx

ANNEXES

Annex 1

Agro-ecological zones of Tanzania

Zone	Sub-Zone and areas	Soils and Topography	Altitude	Rainfall (mm/yr)	Growing season
COAST	North: Tanga (except Lushoto), Coast and Dares Salaam	Infertile sands on gently rolling uplands, Alluvial soils in Rufiji, Sand and infertile soils	Under 3000m	North: Bimodal, 750-1200mm	North: October-December and March-June
	South: Eastern Lindi and Mtwara (except Makonde Plateau)	Fertile clays on uplands and river flood plains		South: Unimodal, 800-1200mm	South: December-April
ARID LANDS	North: Serengeti, Ngorongoro Parks, Part of Masai land	North: Volcanic ash and sediments. Soils variable in texture and very susceptible to water erosion	North: 1300-1800m	North: Unimodal, unreliable, 500-600mm	March- May
	Masai Steppe, Tarangire Park, Mkomazi Reserve, Pangani and Eastern Dodoma	South: Rolling plains of low fertility. Susceptible to water erosion. Pangani river flood plain with saline, alkaline soil	South 500-1500m	South: Unimodal and Unreliable, 400-600mm	
SEMI-ARID LANDS	Central Dodoma, Singida, Northern Iringa, some of Arusha, Shinyanga	Central: Undulating plains with rocky hills and low scarps. Well drained soils with low fertility. Alluvial hardpan and saline soils in Eastern Rift Valley and lake Eyasi. Black cracking soils in Shinyanga.	Central: 1000-1500m	Central: unimodal and unreliable: 500-800mm	December - March

Zone	Sub-Zone and areas	Soils and Topography	Altitude	Rainfall (mm/yr)	Growing season
	Southern: Morogoro (except Kilombero and Wami Basins and Uluguru Mts). Also Lindi and Southwest Mtwara	Southern: Flat or undulating plains with rocky hills, moderate fertile loams and clays in South (Morogoro), infertile sand soils in centre	South-eastern 200-600m	South-eastern: Unimodal 600-800mm	
PLATEAUX	Western: Tabora, Rukwa (North and Centre), Mbeya	Western: Wide sandy plains and Rift Valley scarps	800-1500m	Western: unimodal, 800-1000mm	November-April
	North: Kigoma, Part of Mara	Flooded swamps of Malagarasi and Ugalla rivers have clay soil with high fertility			
	Southern: Ruvuma and Southern Morogoro	Southern: upland plains with rock hills. Clay soils of low to moderate fertility in south, infertile sands in North.		Southern: unimodal, very reliable, 900-1300mm	
SOUTHERN AND WESTERN HIGHLANDS	Southern: A broad ridge of from N. Morogoro to N. Lake Nyasa, covering part of Iringa, Mbeya	Southern: Undulating plains to dissected hills and mountains. Moderately fertile clay soils with volcanic soils in Mbeya	Southern: 1200-1500m	Southern: unimodal, reliable, local rain shadows, 800-1400mm	Northern: December – April
	South-western: Ufipa plateau in Sumbawanga	South-western: Undulating plateau above Rift Valleys and sand soils of low fertility	South-western: 1400-2300m	Southern: unimodal, reliable, 800-1000mm	South-western: November-April
	Western: Along the shore of Lake Tanganyika in Kigoma and Kagera	Western: North-south ridges separated by swampy valleys, loam and clay soils of low fertility in hills, with alluvium and ponded clays in the valleys	Western: 100-1800m	Western: bimodal, 1000-2000mm	Western: October-December and February- May

Zone	Sub-Zone and areas	Soils and Topography	Altitude	Rainfall (mm/yr)	Growing season
NORTHERN HIGHLANDS	Northern: foot of Mt. Kilimanjaro and Mt. Meru. Eastern Rift Valley to Eyasi	Northern: Volcanic uplands, volcanic soils from lavas and ash. Deep fertile loams. Soils in dry areas prone to water erosion.	Northern: 1000-2500m Granitic Mts: 1000-2000m	Northern: Bimodal, varies widely 1000-2000mm	Northern: November-January and March-June
	Granite Mts Uluguru in Morogoro, Pare Mts in Kilimanjaro and Usambara Mts in Tanga, Tarime highlands in Mara	Granite steep Mountain side to highland plateaux. Soils are deep, arable and moderately fertile on upper slopes, shallow and stony on steep slopes		Granitic Mts. Bimodal and very reliable 1000-2000m	Granitic Mts. October-December and March-June
ALLUVIAL PLAINS	K-kilomberao (Morogoro)	K-Cental clay plain with alluvial fans east and west		K—Unimodal, very reliable, 900-1300mm	K-November-April
	R- Rufuji (Coast)	R- Wide mangrove swamp delta, alluvial soils, sandy upstream, loamy down steam in floodplain		R-Unimodal, often inadequate 800-1200mm	R- December-April
	U- Usangu (Mbeya)	U-Seasonally Flooded clay soils in North, alluvial fans in South		U-Unimodal, 500-800mm	U-December-March
	W- Wami (Morogoro)	W- Moderately alkaline black soils in East, alluvial fans with well drained black loam in West		W-Unimodal, 600-1800mm	W-December-March

