

**UNITED REPUBLIC OF TANZANIA**



**NATIONAL ADAPTATION PROGRAMME OF ACTION  
(NAPA) FOR TANZANIA.**



**Division of Environment, APRIL 2006**

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## LIST OF ABBREVIATIONS

CBD	Convention on Biological Diversity
INC	Initial National Communication
LDCs	Least Developed Countries
MDGs	Millennium Development Goals
NAP	National Action Plan to Combat Desertification
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action
NEAP	National Environmental Action Plan
NEP	National Environmental Policy
NFP	National Forestry Policy
NSGRP	National Strategy for Growth and Reduction of Poverty
PMO	Prime Minister's Office
TMA	Tanzania Meteorological Agency
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
VAR	Vulnerability Assessment Report

## **ACKNOWLEDGEMENT**

The United Republic of Tanzania is one of the countries that regularly suffer from various climate-related hazards such as floods and droughts which have substantial effects on economic performance and poverty reduction. The recent drought and subsequent poor crop yield in many parts of the country has negatively impacted Tanzania leading to severe hunger and power shortage. In order to reduce such impacts, appropriate plans and programme that constitute to local community adaptation strategies are required at both local and national levels. However, few of the existing development plans and programmes take strategies and risks into account. In the few cases where climate change does receive attention, the focus is on mitigation, rather than adaptation.

Preparation of the National Adaptation Programme of Action is regarded a timely and essential opportunity for Tanzania enhancing the adaptive capacity of vulnerable communities in Tanzania. In view of this, the Government of the United Republic of Tanzania wishes to thank the NAPA Team who worked tirelessly in the during consultation and preparation of this document. Indeed, the team had invaluable contributions and inputs in developing specific sectors.

Furthermore, the Government of Tanzania would like to take this opportunity to convey special thanks to the Global Environment Facility(GEF) for providing the financial support through the United Nations Environment Programme (UNEP). In particular special thanks should go to Ravi Sharma and Liza Lerclec for their technical guidance during the preparation of the project proposal and finalization of the report.

**A. R.M.S. Rajabu**  
**Permanent Secretary, Vice President's Office**

## EXECUTIVE SUMMARY

Tanzania National Adaptation Programme of Action (NAPA) preparation has been a timely opportunity to look at the country's climate change related vulnerabilities in various sectors which are important for the economy. Tanzania NAPA document is informed by the aspirations of National Development Vision 2025 for high and shared growth, quality livelihood, peace, stability and unity, good governance, high quality education and global competitiveness. Since Tanzania's economy is largely dependent on agriculture, it is deemed that sustainable development can be achieved when strategic actions, both short term and long term are put in place to address climate change impacts on agriculture and other key economic sectors. The process of NAPA preparation involved looking at the effects of climate change as a threat mainly to the agrarian population that still depends on subsistence agriculture for their daily livelihood. The past trend on droughts and floods; and recent poor harvest in 2005 which caused hunger in most parts of the country and disappearance of the ice cap at Mount Kilimanjaro is now more than ever imminent evidence of climate change due to evident temperature increases caused by global warming. The frequency of extreme weather events such as El Nino floods in 1997/98 and the recent drought are few but important reminders of the deadly effects of climate change to Tanzania. In this context, the Tanzania NAPA identifies priority areas in various sectors, and further prioritizes project activities in those sectors. These activities need immediate and urgent actions for the country to adapt to such climate change effects on a short term basis as well as putting in place mechanisms for addressing long-term adaptation initiatives.

Tanzania NAPA has been prepared as part of the overall integrated plans, policies, and programs for sustainable development at national level. The process not only adhered very closely to the Annotated Guidelines agreed at the conference of the Parties in 2001 and elaborated by the LDC Expert Group, but also was conducted in a transparent and participatory manner. The process started with the formation of a team of experts which composed the NAPA Team. Then the team undertook climate change vulnerabilities assessment across key sectors clustered in seven working groups (Agriculture, Energy, Forestry and Wetlands, Health, Human Settlements, Coastal and marine and fresh water resources). A total of 20 team members were involved in undertaking the consultations at various stages. After identification of vulnerabilities in each sector, key adaptation options and strategies that would best address those vulnerabilities were developed. The consultations were undertaken at national, regional as well as district levels. The consultations allowed for exchange of information on climate change hazards and created an opportunity for the NAPA Team to learn and gain insight on the sector specific hazards and adaptation techniques that were translated into proposed project activities. Furthermore, the invaluable stakeholder consultations at grassroots level helped to prioritize the fourteen top most possible adaptation activities that would address the country's most urgent needs from all sectors.

Initially, 72 project activities were proposed with a breakdown of 11 in agriculture sector; while water, energy, forestry, health and wildlife sectors had 7 project activities each. Industry and coastal and marine resources sectors had 6 project activities each; human settlements had 9 and finally, tourism had 5. Using a list of agreed criteria that best suits Tanzania conditions and local environment, these were later narrowed down into 14 priority project activities. The project activities were further ranked in accordance with

their importance regarding impacts on poverty reduction and health, reliability, replicability of the technique and sustainability. In the final analysis, the 14 selected projects activities are:

- 1) Water efficiency in crop production irrigation to boost production and conserve water in all areas
- 2) Alternative farming systems and water harvesting
- 3) Develop alternative water storage programs and technology for communities
- 4) Community based catchments conservation and management programs
- 5) Explore and invest in alternative clean energy sources e.g. Wind, Solar, bio-diesel, etc. to compensate for lost hydro potential
- 6) promotion of application of cogeneration in the industry sector for lost hydro potential
- 7) Afforestation programmes in degraded lands using more adaptive and fast growing tree species
- 8) Develop community forest fire prevention plans and programmes
- 9) Establishing and Strengthening community awareness programmes on preventable major health hazards
- 10) Implement sustainable tourism activities in the coastal areas and relocation of vulnerable communities from low-lying areas.
- 11) Enhance wildlife extension services and assistance to rural communities in managing wildlife resources
- 12) Water harvesting and recycling
- 13) Construction of artificial structures, e.g., sea walls, artificially placing sand on the beaches and coastal drain beach management system
- 14) Establish good land tenure system and facilitate sustainable human settlements

The proposed project activities form the basis of required financial and technical assistance from national level as well as the international community. Given the current subsistence farming and status of natural resources which the large community depend on for their daily livelihoods, delaying the implementation of these projects will further negatively affect development in health care and nutrition, life expectancy, primary education, improvement in agriculture and livestock development, roads and communication infrastructure, which are top agenda of the fourth phase of the Tanzanian government.

In order to implement those projects, the relevant key sectors in collaboration with the Vice President's Office will be the main custodian of the NAPA while project activities will be implemented by relevant sectors local communities. However, this NAPA program is not perceived as an end product but a living document that will need to be updated from time to time in order to adapt to the changing environmental conditions of the country.

## **1. 0 INTRODUCTION & SETTING**

### **1.1 General Overview of NAPA development in Tanzania**

Tanzania National Adaptation Programme of Action (NAPA) document is informed by the aspirations National Development Vision 2025 for high and shared growth, quality livelihood, peace, stability and unity, good governance, high quality education and international competitiveness. Since Tanzania's economy is largely dependent on agriculture, it is deemed that sustainable development can only be achieved when strategic actions, both short term and long term are put in place to address climate change impacts on agriculture and other key economic sectors.

NAPA identifies climate change related vulnerabilities of key economic sectors, which form basis of the livelihood of the rural community and backbone of the national development and prosperity. Thus information in NAPA is a concise disc, action oriented towards priority on the ground activities.

### **1.2 The NAPA Vision**

The overall vision of Tanzania's NAPA is to identify immediate and urgent Climate Change Adaptation Actions that are robust enough to lead to long-term sustainable development in a changing climate.

### **1.3 Objectives of NAPA**

The main objectives of NAPA are:

- i. To identify and develop immediate and urgent NAPA activities to adapt to climate change and climate variability;
- ii. To protect life and livelihoods of the people, infrastructure, biodiversity and environment;
- iii. To mainstream adaptation activities into national and sectoral development policies and strategies, development goals, visions and objectives;
- iv. Increase public awareness to climate change impacts and adaptation activities in communities, civil society and government officials;
- v. To assist communities to improve and sustain human and technological capacity for environmentally friendly exploitation of natural resources in a more sustainable way in a changing climate;
- vi. To complement national and community development activities which are hampered by adverse effects of climate change; and
- vii. To create a long-term sustainable livelihood and development activities at both community and national level in a changing climatic conditions.

### **1.4 The NAPA Process**

The NAPA process was based on consultation sectors and literature review.

#### **1.4.1 Guiding Principles**

In line with annotated guidelines for the preparation of NAPA (LEG, 2002), Tanzania NAPA preparation process was guided by the following principles:-



a) A Participatory process

Tanzania being a large country, a sectoral participatory approach was employed during consultation exercise.

b) Multidisciplinary approach

This was taken into account in the formation of a NAPA team. The NAPA team comprised of experts from various government institutions (Ministries, Universities, Agencies, etc) and private institutions and NGOs.

c) Complementary Approach at all levels

The NAPA complements other existing national programmes including National Strategy for Growth and Reduction of Poverty, Agricultural Sector Development Strategy (ASDS), Rural Development Strategy, National Action Plan to Combat Desertification (NAP) and National Biological Diversity Strategy and Action Plan (NBSAP).

d) Sustainable development

The project activities that will enhance sustainable development were given a great consideration during preparation of Tanzania NAPA Framework.

e) Country-Driven Approach

Since Tanzania is party to a number of Multilateral Environmental Agreements (MEAs), the NAPA Framework has been designed to suit the needs of Tanzanians to combat local and global impacts of climate change. Sound Environmental management

The NAPA Framework has been formulated strategically to be inline with the Environmental Management Act, 2004, which came into force on July 1, 2005.

f) Cost-effectiveness

NAPA has taken into consideration the feasibility and implementation costs, based on past and ongoing projects, strategies and plans, e.g. tree planting projects, impregnated mosquito nets programmes, etc.

g) Simplicity

NAPA process is intended to create simple and sustainable activities that are appealing to communities which will be recipients of the project-based activities.

i) Flexibility

NAPA framework allows for the implementation of the activities by private sector as well as NGOs, CBOs, individuals and government institutions.

#### **1.4.2 The process of developing NAPA**

The process of developing the National Adaptation Programme of Action started with the formation of NAPA team by a National Climate Change Focal point, which is the Vice President's Office - Division of Environment. The NAPA team composed of 20 experts from different sectors which was divided into four groups. The four groups of NAPA team were assigned a task of consulting stakeholders of different sectors namely energy and industry; agriculture, livestock, forest, land use, tourism, health, wildlife and wetland; and coastal, marine, and freshwater resources. The sectoral vulnerability and adaptation tools were the main approach used in the country-wide consultation to obtain vulnerability and adaptation information from relevant sector. This approach was adopted because of the size of the country, making it difficult for community approach, except in some sectors like agriculture and water. Thus, the four groups analyzed impact of climate change in the country and came up with a NAPA synthesis report based on past and present studies. The synthesis report was followed by a public consultation (using interviews and questionnaires) with stakeholders including government officials in different ministries, private sectors such as industries, and some communities. Among other areas, consultation with stakeholders was undertaken in 13 districts and 52 villages at local communities including Bagamoyo, Pangani, Rufiji, Mtera, Mbeya, Shinyanga and Dar es Salaam.

The NAPA Team synthesized and reviewed the gathered information on adverse effects of climate change and coping strategies. This information included the past climate change studies, sectoral policies and plans, and national strategies for sustainable development. Also the team conducted a participatory rapid assessment to assess the current vulnerability and potential increase in climate hazards and associated risks of the critical sectors. This was based on clear consensus that there was good information and scientific research at national level that was used to evaluate past, current and future efforts on climate change aspect.

In addition, the information on assessment of vulnerability and adaptation response options for Tanzania due to climate change impact was updated during the NAPA assignment. Based on those information, further analysis was done on the proposed adaptation measures with due regard to the National Action Plan (NAP). Some measures have double benefits, i.e. achieving the objectives of the sector as well as adapting the effects of climate change impacts. Less costly measures were considered as important for implementation in the short-term and medium term programme while those demanding higher investment for further research can form part of the long-term programme in

NAPA. A total of 72 adaptation activities were proposed from all sectors which were finally reduced to 14 projects.

### **1.5 Criteria for Selecting Priority Project Activities**

The following criteria were and are expected to be the basis for the ranking:-

- Level or degree of adverse effects of climate change;
- Poverty reduction to enhance adaptive capacity;
- Cost effectiveness;
- Improvement of the livelihood of the rural communities;
- Vulnerable groups in the communities, e.g. the rural poor;
  
- Cost of the project;
- Complementarity to national goals and objectives; and
- Locally driven criteria (country driven).

The overriding principle was the immediate and urgent needs that was disclosed and/or argued by stakeholders.

### **1.6 Development Links of NAPA**

NAPA is linked with other national development policies, goals, objectives, plans, strategies and programme and supports/complements strategies and programmes of other multilateral environmental agreements that Tanzania is Party. These include: the United Nations Convention to Combat Desertification (UNCCD), United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Vienna Convention on the Protection of Ozone Layer and Montréal Protocol on Substances that Deplete the Ozone layer, among others. A number of strategies and action plans related to some of these conventions are in place. These encompass the National Biodiversity Strategy and Action Plan (NBSAP), the National Action Programme (NAP), and the National Biosafety Framework (NBF). Indeed, the NAP provides useful information for development of NAPA.

Other relevant strategies and action plans relevant to the NAPA development include the Rural Development Strategy, the Agriculture Sector Development Strategy, and Local Government Reform Strategy (to implement the 1999 Local Government Act – which re-created the concept of decentralisation by devolution). More important, the government has recently adopted the National Strategy for Growth and Reduction of Poverty- NSGRP (MKUKUTA in Kiswahili), which is a second national organizing framework for putting the focus on poverty reduction high on the country's development agenda. The NSGRP /MKUKUTA strives to widen the space for country economic ownership and effective participation of civil society, private sector development and fruitful local and external partnerships in development and commitment to regional and other international initiatives for social and economic development.

The NSGRP builds on the Poverty Reduction Strategy Paper (PRS(P)) (2000/01-02/03), the PRS Review, the Medium Term Plan for Growth and Poverty Reduction and the Tanzania Mini-Tiger Plan 2020 (TMTP2020) that emphasize the growth momentum to fast-track the targets of Vision 2025. The NSGRP is expected to last 5 years, i.e. from 2005/06 to 2009/10. The end point of the strategy coincides with the targets of the National Poverty Eradication Strategy (NPES - 2010); it is two thirds of the way towards the MDGs (2015) and 15 years towards the targets of Vision 2025.

Furthermore, the National Environmental Action Plan (NEAP) of 1994 led to formulation of National Environmental Policy (NEP) in 1997. The NEP provides a framework for mainstreaming environmental considerations into the decision making process in Tanzania. Though NEP does not pay explicit attention to climate change, the primary environmental issues brought forward include many of the concerns that would be addressed by non-regrets climate change adaptation measures. In particular, the NEP highlights the importance of integrating environmental management in several sectoral programmes and policies. In addition, National Forestry Policy (NFP), 1998 which is a review of the 1953 version, gives no direct reference to climate change despite the vulnerability of Tanzanian forests to changed climatic conditions. One of the main objectives of the NFP is to ensure ecosystems stability through conservation of forest biodiversity, water catchments, and soil fertility. The policy states that new forest reserve for conservation will be established in areas of high biodiversity value and that biodiversity conservation and management will be included in the management plans for all protected forests.

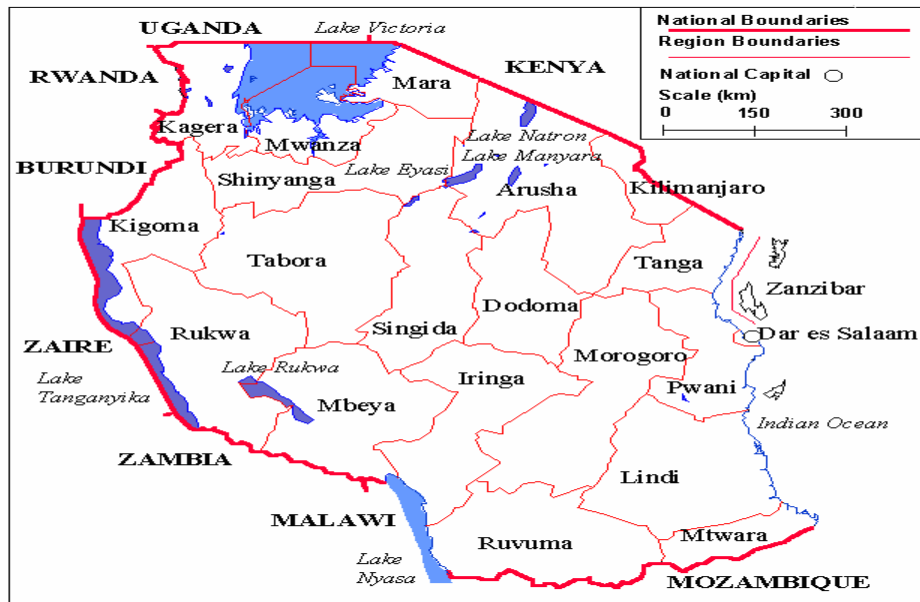
## **2.0 GENERAL INFORMATION AND VULNERABILITY**

### **2.1 Geographical location and characteristics**

The United Republic of Tanzania is located in the Eastern Part of Africa is one of the largest countries in Africa continent. Tanzania is located between 1<sup>0</sup>S to 12<sup>0</sup>S and 30<sup>0</sup>E to 40<sup>0</sup>E. The eastern boundary is an 800-km coastal liner fronting the Indian Ocean from Kenya in the North at 4<sup>0</sup>38'S to Mozambique in the South at 10<sup>0</sup>30'S. Some 40 km offshore are the islands of Zanzibar (i.e. Unguja and Pemba) and Mafia (to the South), plus numerous smaller islands. Except for the coastal belt, most of the country is part of the central African plateau at between 1,000-3,000 meters above sea level, characterized by gently sloping plains and plateaus broken by scattered hills and low-lying wetlands. The country can be roughly divided into four main climatic/topological zones namely: lowland Coastal Zone, The Highlands zone, the plateau Zone, and the Semi-desert Zone.

Mount Kilimanjaro, which is located in the Northern part of Tanzania, is the highest point in Africa at 5896 m above sea level. Tanzania also has the famous Great Lakes in Africa namely Lake Tanganyika, which is at 358 m below sea level, Lake Victoria, Lake Nyasa, Lake Manyara and Rukwa. Fig. 1 shows the map of administrative boundaries of the United Republic of Tanzania.

**Figure 1** Map of Tanzania showing administrative boundaries



## 2.2 Climate and its trend in Tanzania

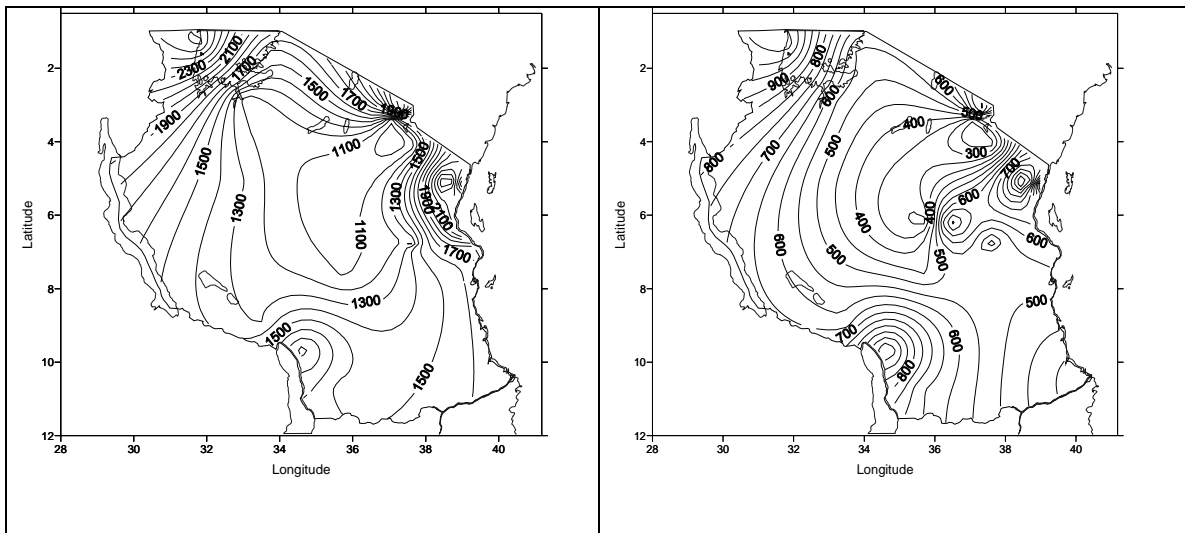
The climate of Tanzania varies from place to place in accordance with geographical location, altitude, relief and vegetation cover.

### 2.2.1 Rainfall Pattern

Rainfall patterns in the country are subdivided into: tropical on the coast, where it is hot and humid (rainy season March-May): semi-temperate in the mountains with the short rains (*Vuli*) in November-December and the long rains (*Masika*) in February –May: and drier (*Kiangazi*) in the plateau region with considerable seasonal variations in temperature. The mean annual rainfall varies from 500 millimeters to 2,500 millimeters and above. The average duration of the dry season is 5 to 6 months. However, recently, rainfall pattern has become much unpredictable with some areas/zones receiving extremely minimum and maximum rainfall per year. Figures 2 a-b show the map of Tanzania indicating areas experienced maximum and minimum rainfall for two selected stations and their associated time series (Figures c-d) from 1921 to 2005.

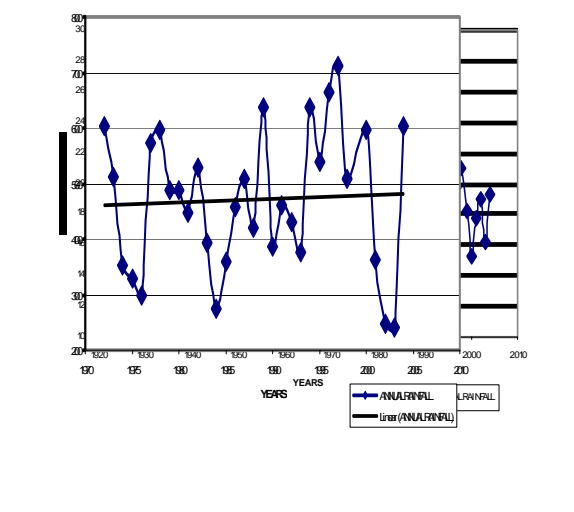
**Figure 2 a-b: Map of Tanzania showing areas of Maximum and Minimum rainfall**

2a: Extreme Maximum Rainfall	2b: Extreme Minimum Rainfall
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Source: TMA, 2005

2c: Bukoba annual maximum rainfall time series 1921-2005



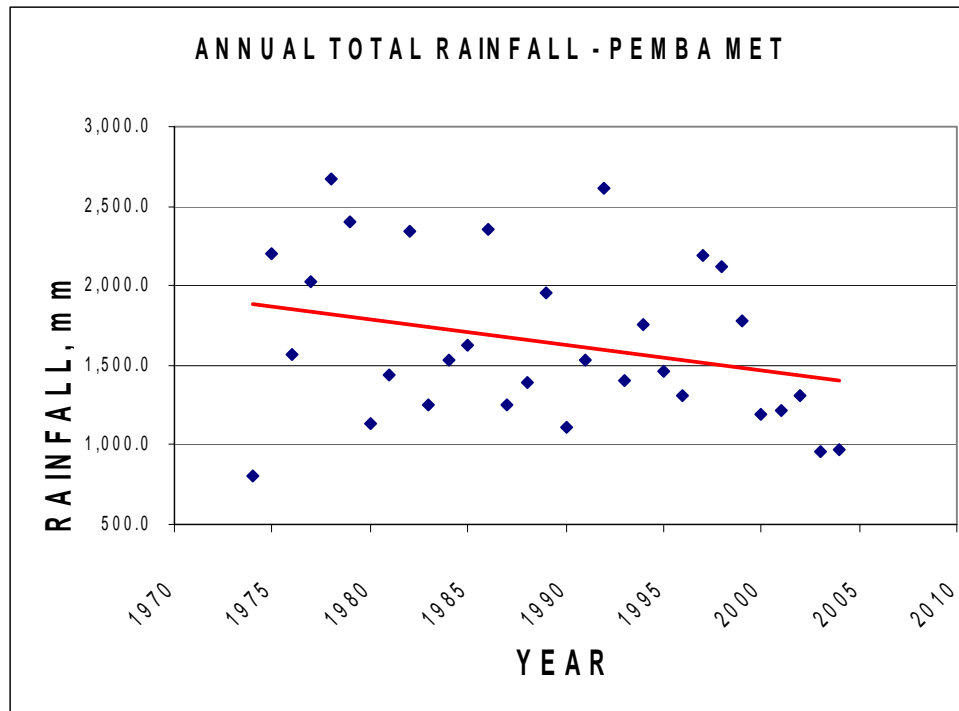
2d: Kongwa annual minimum rainfall time series 1921-2005



Source: TMA, 2005

Furthermore, analysis of total annual rainfall for 21 meteorological stations in selected regions of Tanzania indicated that there is a decreasing trend for over 13 stations (61.9%) whereas an increasing rainfall trend was observed over 7 stations (33.33%) and 1 station had almost a constant pattern. The most affected stations were Pemba, Zanzibar, Moshi and Arusha. However, one common feature of the rainfall pattern was a greater variability in cycles. Figure 3 shows the trend of rainfall observed from 1970 to 2005 at Pemba meteorological station, Zanzibar.

Figure 3 Rainfall Pattern at Pemba Meteorological station



In addition, the Disaster Vulnerability Assessment Report further shows that rainfall in some parts will increase (both short and long rain seasons) especially those areas getting bimodal rainfall particularly North Eastern, North West, Lake Victoria basin(e.g. Bukoba, Kagera) as shown in Figure 2c and Northern parts of coastal belt. On the other hand in areas experiencing unimodal pattern ,rainfall will decrease. Such areas include parts of South Western, Western, Central (e.g. Dodoma, Singida) and Eastern parts of the country. However, some anomalies are expected to happen in these areas as shown in Figures 4(a&b) for Bukoba and Kagera Annual rainfall anomalies.

**Figure 4a&b:** Graphs showing rainfall anomalies time series of some selected regions in Tanzania

Figure 4a: Bukoba annual rainfall anomalies

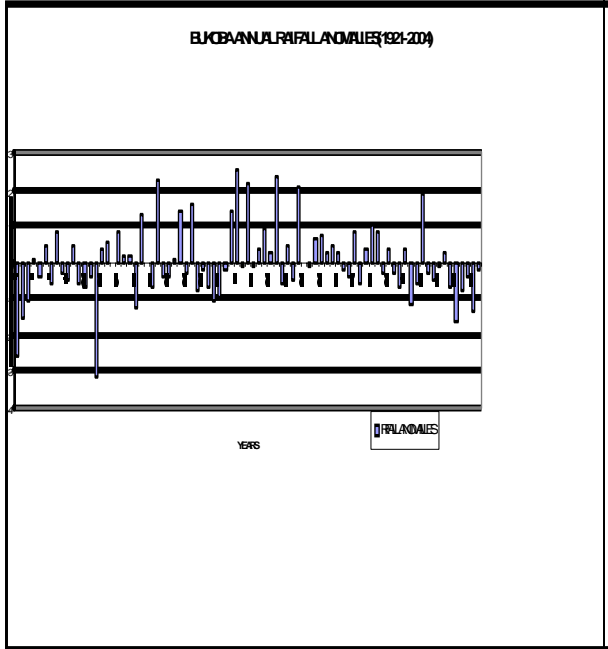
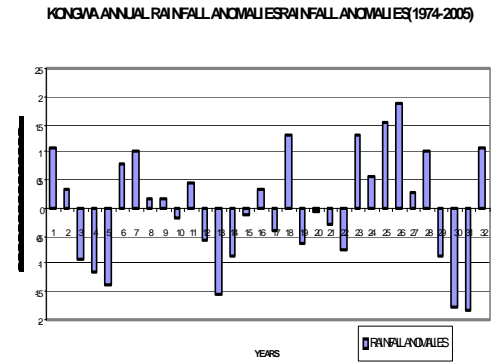


Figure: 4b:Kongwa annual rainfall anomalies series



Source: TMA 2005

### 2.2.2 Temperature Pattern

As explained in section 2.2, temperature in Tanzania also varies according to the geographical location, relief and altitude. In the Coastal Regions and the off-shore Islands the average temperatures ranges between 27 °C and 29 °C, while in the Central, Northern and Western parts temperatures range between 20 °C and 30 °C and higher between the months of December and March. In the Northeast and Southwest where there are mountainous areas and Makonde Plateau, the temperature occasionally drops below 15 °C at night during the months of June and July. In some parts (Southern Highlands) temperature can reach as low as 0 °C - 6 °C. This temperature variation has significant impact on the agro-ecological zones described in Table 1 section 2.4.1 and the adaptation strategies in the agriculture sector.

According to the INC, the mean temperatures will increase throughout the country particularly during the cool months by 3.5°C while annual temperatures will increase between 2.1°C in the North Eastern parts to 4 °C in the Central and Western parts of the country. Figures 5 (a&b) are maps of Tanzania showing areas experiencing extreme temperatures (Maximum and Minimum), while Figures 5c&d are graphs showing time series of these temperatures for Kilimanjaro and Mbeya regions, respectively. These changes in temperature can affect the coping strategies of the local communities for various sectors.

Figure 5a&b: Extreme Maximum and Minimum Temperatures in Tanzania

Figure 5a: Extreme Maximum temperature areas in Tanzania

Figure 5b: Extreme Minimum Temperatures areas in Tanzania



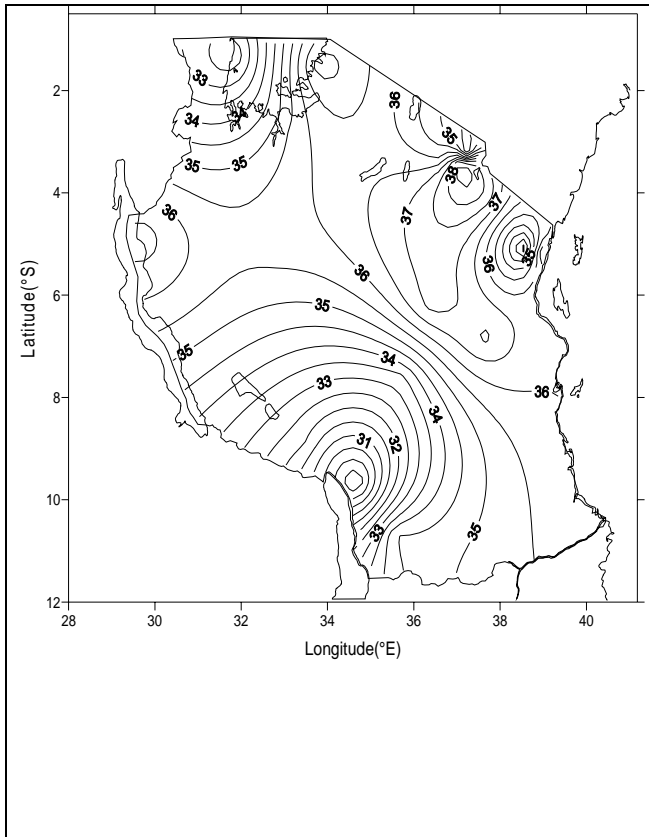


Figure 5c: Kilimanjaro airport time series for extreme maximum temperature

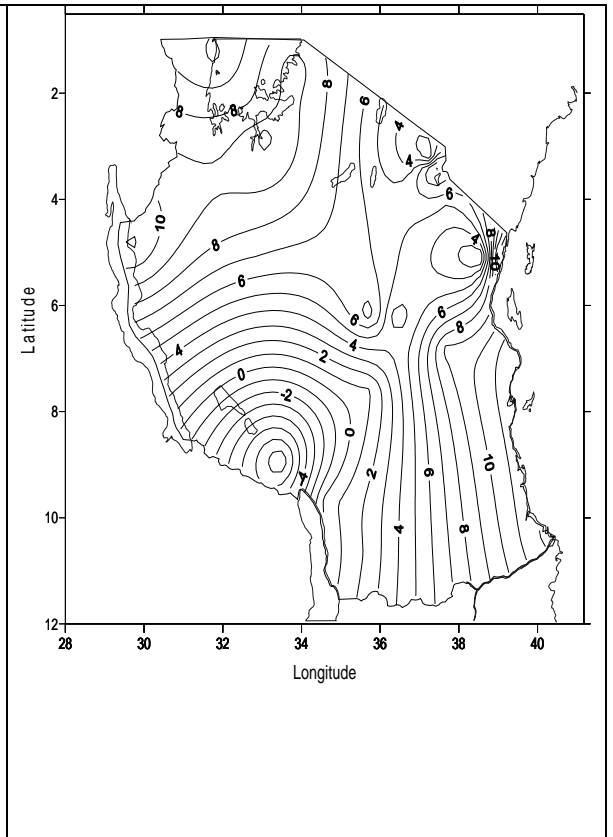
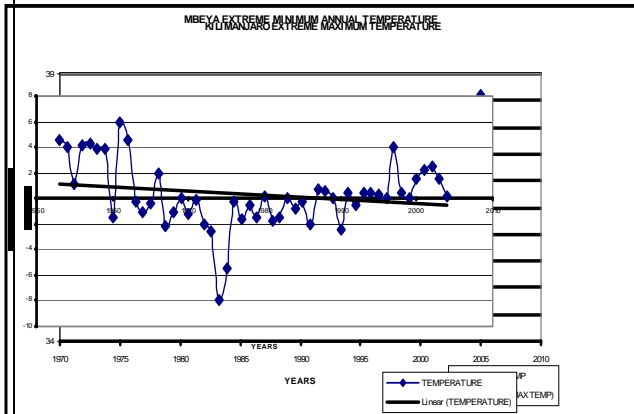


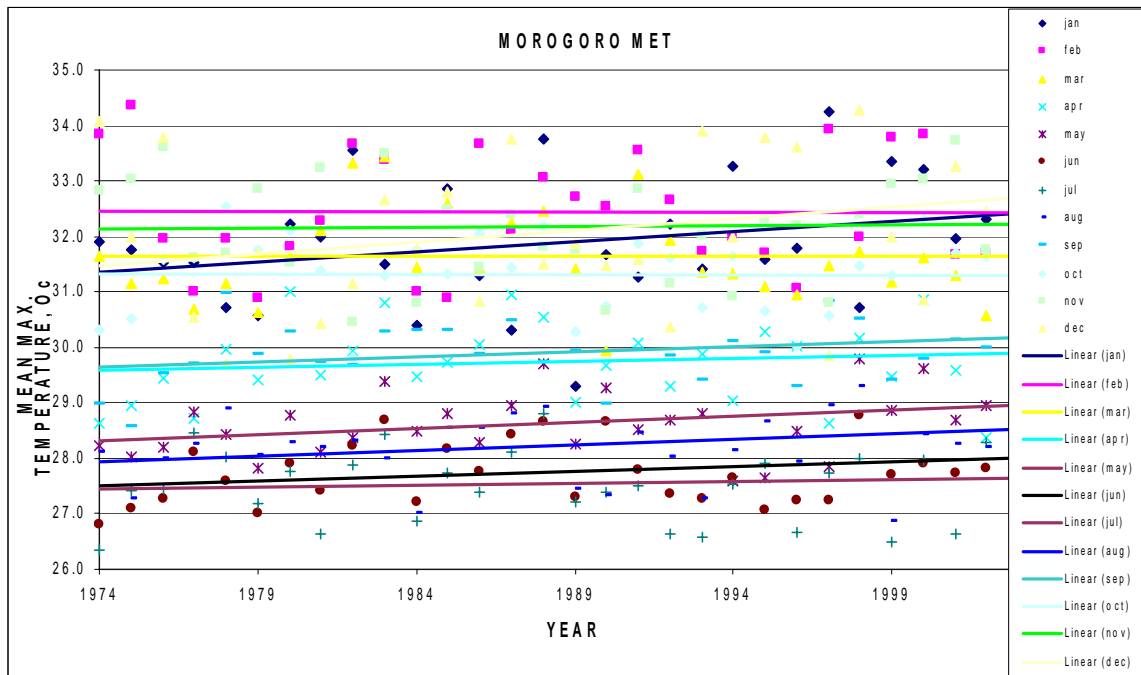
Figure 5d: Mbeya time series for extreme minimum temperature



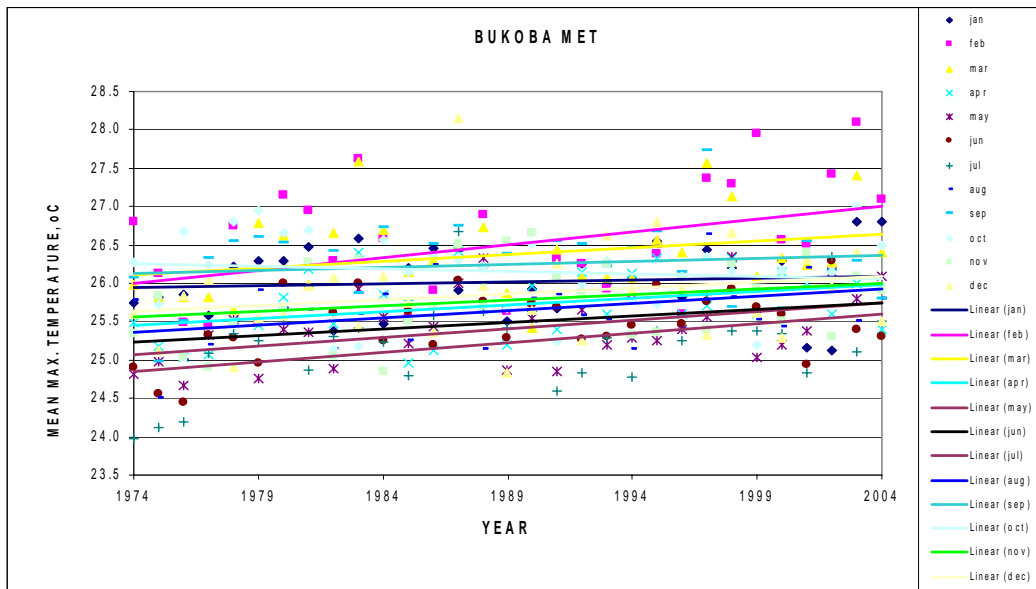
Source: TMA, 2005

Moreover, monthly minimum and maximum temperatures over the last 30 years (between 1974 and 2004) show upward trend at the analysed meteorological stations located in regions of Arusha, Bukoba, Dodoma, Iringa, Kilimanjaro, Mbeya, Morogoro, Mwanza, Songea, Tanga, Zanzibar and Shinyanga. The increasing trend was mostly associated with the months of January, July and December. Samples of increase in temperature are shown in Figure 6 for Morogoro meteorological station monthly minimum temperatures and Figure 7 for Bukoba meteorological station monthly maximum temperatures respectively. It is most probable that this is an indication of climate change. Although rainfall does not show significant changes for the past 30 years, there is no doubt that, increase in temperature increases evaporation rates of soil, water bodies as well as transpiration rate of plants.

Figure 6 Trend of monthly minimum temperatures at Morogoro Meteorological station



**Figure 7** Trend of monthly minimum temperatures at Bukoba Meteorological station

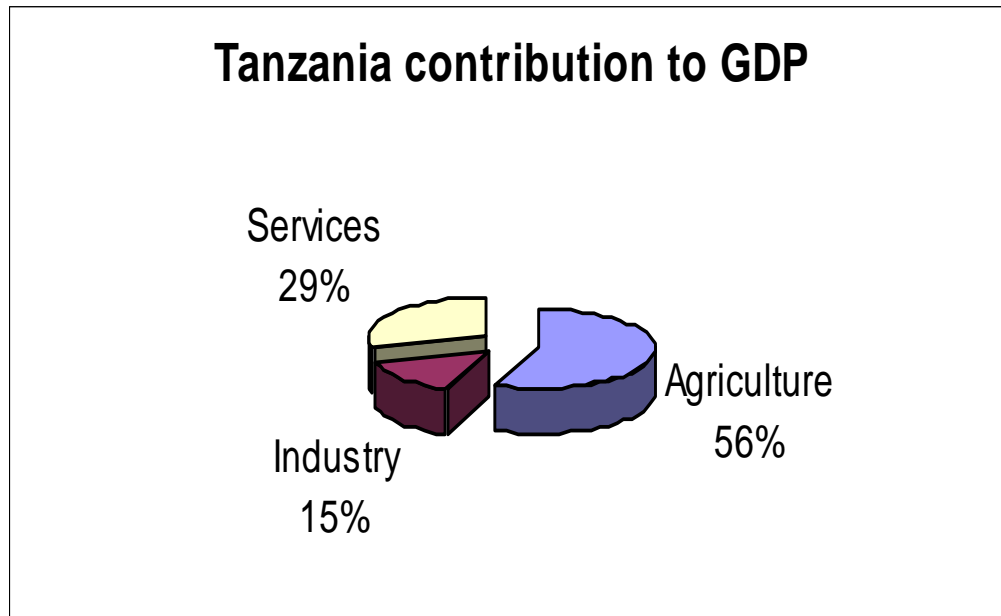


### 2.3 Economy and poverty

Tanzania is one of the 49 Least Developed Countries (LDCs) in the world, with about 35% of the population living below the poverty line. However, Tanzania recorded improved economic performance at macro-level in the past six years, whereby GDP grew at 6.2 percent in 2002. The National Accounts estimates show that the growth rate dropped to 5.6 percent in 2003 the inflation rate increased from 4.0 percent in July 2003 to 4.6 percent at the end of March 2004 due to drought that led to reduced food supplies and decreased power supply from hydropower plants. The target GDP growth rate for the NSGRP is estimated to be 6-8 percent per annum over the period of 2005-2010. The Challenge ahead is how to translate the recorded economic grow into normal livelihood of common Tanzanians.

Agriculture (including livestock) is the dominant sector in Tanzanian economy, providing livelihood, income and employment to over 80% of the population and it accounted for 56 percent of GDP and about 60 percent of export earnings in the past three years (Figure 8). Recently, the sector has registered an average annual growth rates of 4.8 percent compared to the average growth of 3.1 percent during 1998 to 2000. Other sectors that contribute to the economy are fisheries, mining, tourism and forestry, water, marine and coastal resources, energy, industry and wildlife. Figure 8 shows the contribution of selected sectors to the economy of the country.

Figure 8 Contribution of the Agriculture to the GDP



## 2.4 Vulnerability and sectoral analysis

Tanzania is considered one of the poorest countries due to its inherent vulnerability to disasters and external economic trade developments for which it has no control. The disasters include periods of drought and floods in some parts of the country (tropical hazards; vulnerable to flooding on the central plateau during the rainy season) and sudden outbreaks of diseases.

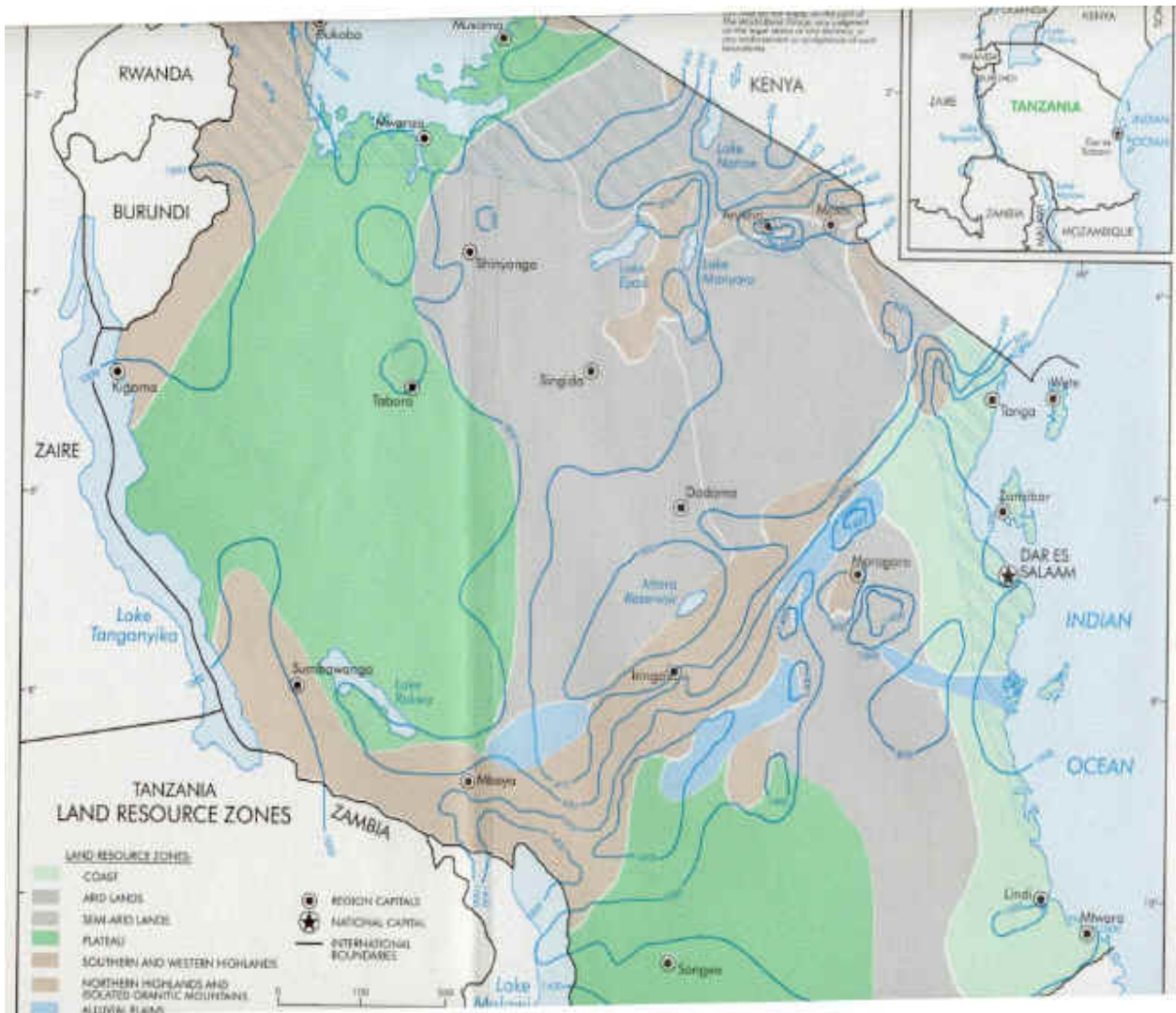
### 2.4.1. Agriculture

Tanzania has about 88.6 million hectares of land suitable for agricultural production, including 60 million hectares of rangelands suitable for livestock grazing. Based on altitude, precipitation pattern, dependable growing seasons and average water holding capacity of the soils and physiographic features, Tanzania has 7 agro-ecological zones. Table 1 and Figure 9 clearly indicate these zones:-

Table 1 Tanzania Agro ecological zones

Zone	Sub-Zone and areas	Soils and Topography	Altitude	Rainfall (mm/yr)	Growing season
<b>1. COAST</b>	North: Tanga (except Lushoto), Coast and Dares Salaam  South: Eastern Lindi and Mtwara (except Makonde Plateau)	Infertile sands on gently rolling uplands Alluvial soils in Rufuji Sand and infertile soils Fertile clays on uplands and river flood plains	Under 3000m	North: Bimodal, 750-1200mm  South: Unimodal, 800-1200mm	North: October-December and March-June  South: December- April
<b>2. ARID LANDS</b>	North: Serengeti, Ngorogoro Parks, Part of Masailand  Masai Steppe, Tarangire Park, Mkomazi Reserve, Pangani and Eastern Dodoma	North: Volcanic ash and sediments. Soils variable in texture and very susceptible to water erosion  South: Rolling plains of low fertility. Susceptible to water erosion. Pangani river flood plain with saline, alkaline soil	North: 1300-1800m  South 500-1500m	North: Unimodal, unreliable, 500-600mm  South: Unimodal and Unreliable, 400-600mm	March- May
<b>3. SEMI-ARID LANDS</b>	Central Dodoma, Singida, Northern Iringa, some of Arusha, Shinyanga  Southern: Morogoro (except Kiliombero and Wami Basins and Uluguru Mts). Also Lindi and Southwest Mtwara	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.  Southern: Flat or undulating plains with rocky hills, moderate fertile loams and clays in South (Morogoro), infertile sand soils in center	Central: 1000-1500m  Southeastern 200-600m	Central: unimodal and unreliable, 500-800mm  Southeastern: Unimodal 600-800mm	December - March
<b>4. PLATEAUX</b>	Western: Tabora, Rukwa (North and Center), Mbeya North: Kigoma, Part of Mara Southern: Ruvuma and Southern Morogoro	Western: Wide sandy plains and Rift Valley scarps Flooded swamps of Malagarasi and Ugalla rivers have clay soil with high fertility  Southern: upland plains with rock hills. Clay soils of low to moderate fertility in south, infertile sands in North.	800-1500m	Western: unimodal, 800-1000mm  Southern: unimodal, very reliable, 900-1300mm	November- April
<b>5. SOUTHERN AND WESTERN HIGHLANDS</b>	Southern: A broad ridge of from N. Morogoro to N. Lake Nyasa, covering part of Iringa, Mbeya Southwestern: Ufipa plateau in Sumbawanga  Western: Along the shore of Lake Tanganyika in Kigoma and Kagera	Southern: Undulating plains to dissected hills and mountains. Moderately fertile clay soils with volcanic soils in Mbeya Southwestern: Undulating plateau above Rift Valleys and sand soils of low fertility 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	Southern: 1200-1500m  Southwestern: 1400-2300m  Western: 100-1800m	Southern: unimodal, reliable, local rain shadows, 800-1400mm  Southern: unimodal, reliable, 800-1000mm  Western: bimodal, 1000-2000mm	Northern: December – April  Southwestern: November- April  Western: October-December and February-May
<b>6. NORTHERN HIGHLANDS</b>	Northern: foot of mt Kilimanjaro and Mt. Meru. Eastern Rift Valley to . Eyasi  Granite Mts Uluguru in Morogoro, Pare Mts in Kilimanjaro and Usambara Mts in Tanga, Tarime highlands in Mara	Northern: Volcanic uplands, volcanic soils from lavas and ash. Deep fertile loams. Soils in dry areas prone to water erosion. Granite steep Mountain side to highland plateaux. Soils are deep, arable and moderately fertile on upper slopes, shallow and stony on steep slopes	Northern: 1000-2500m Granitic Mts: 1000-2000m	Northern: Bimodal, varies widely 1000-2000mm  Granitic mts. Bimodal and very reliable 1000-2000m	Northern: November-January and March-June  Granitic Mts. October-December and March-June
<b>7. ALLUVIAL PLAINS</b>	K- kilimberao (Morogoro) R- Rufuji (Coast) U- Usangu (Mbeya) W- Wami (Morogoro)	K- Central clay plain with alluvial fans east and west R- Wide mangrove swamp delta, alluvial soils, sandy upstream, loamy down stream in floodplain U- Seasonally Flooded clay soils in North, alluvial fans in South W- Moderately alkaline black soils in East, alluvial fans with well drained black loam in West		K—Unimodal, very reliable, 900-1300mm R-Unimodal, often inadequate 800-1200mm U-Unimodal, 500-800mm W-Unimodal, 600-1800mm	K-November-April R- December-April U-December-March W-December-March

Figure 9 A map of Tanzania showing the agro ecological zones



Source: Ministry of Agricultural and Food Security, 2005

Studies undertaken during INC indicate that increase in temperature by 2°C -4°C would alter the distribution of the agro ecological zones. Consequently, areas that used to grow perennial crops would be suitable for annual crops. In addition, global warming would tend to accelerate plant growth and hence reduce the length of growing seasons.

Among the vulnerability in the agricultural sector include decreased crop production of different crops exacerbated by climatic variability and unpredictability of seasonality, erosion of natural resource base and environmental degradation. The following list shows the percentage of decrease of two selected crops; maize and coffee:-

- ❖ Maize: with increase in temperature and reduced rainfall as well as change in rainfall patterns, average yield will decrease by 33% country wide. Furthermore, yield of the same crop will decrease by up to 84% in the central regions, 22% in Northeastern highlands, 17% in the Lake Victoria region, and 10 – 15% in the Southern highland;
- ❖ Coffee and Cotton: As a result of temperature increase of 2-4 °C, coffee production is projected to increase by 18% in bimodal rainfall areas and 16% in unimodal rainfall areas.

Furthermore, climate change is expected to further shrink the rangelands which are important for livestock keeping communities in Tanzania. Currently, it is estimated that about 60% of the total rangeland is infested by tsetse fly making it unsuitable for livestock pastures and human settlements. Shrinkage of rangelands is likely to exacerbate conflicts between farmers and agriculturalists in many areas. Surveys show that existing number of cattle in Tanzania has already surpassed the normal carrying capacity in most of the areas as shown in Table 2. As a result, most livestock keepers are shifting their herd towards southern Tanzania in search for pastures.

Table 2 Livestock Carrying capacity for selected regions

Region	Carrying Capacity		Excess
	Existing	Recommended	
Mwanza	2, 180,275	63,360	2,116, 915
Shinyanga	3, 806,677	87,800	3, 718, 877
Dodoma	798,105	160,167	637, 938
Singida	727,930	117,983	609, 947

Source: Ministry of Livestock Development, 2005

#### 2.4.2. Water

Tanzania is endowed with many river basins which are economically important. Among these, the major ones are Rufiji, Pangani, Ruvu, Great Ruaha, Malagarasi, Kagera, Mara, Ruvuma, and Ugalla River Basins. Apart from being economically significant, these river basins also form an important part in sustaining the daily livelihood of the local communities through fishing and traditional farming irrigation systems.

The INC shows that rainfall pattern and soil moisture will vary due to changes in mean temperature hence affecting the runoff of these rivers. For instance the increase in temperature between 1.8 °C - to 3.6 °C in the catchments areas of River Pangani in the North and North East of the country, hence decrease in rainfall, will lead to a decrease of 6-9% of the annual flow of the river. Rufuji River, which houses Mtera and Kidatu hydropower stations, is expected to experience an increase in river flow by 5-11% due to low temperature fluctuation of between 3.3 °C to 4.6 °C and hence increase in rainfall. Floods on Rufiji and Pangani Rivers would cause damage to major hydropower stations and human settlements found along these river basins in the country.

Furthermore, the second Vulnerability Assessment Report (V.A.R II) on the other hand reveals that majority of households use more than one source of water supply, although (62%) depend on traditional sources of water supply. By ranking the values are wells (26%), rivers (24%) rain harvest (9%) and lakes (6%). Two thirds depend on wells, rain water and Lakes for water supply while only one third is served by piped water. Change in the precipitation will automatically affect each source and the consequences might be devastating depending on the magnitude. V.A.R I indicates that civil conflicts have been occurring between livestock keeper and farmers over grass and water for the animals in Morogoro, Mara and Kilimanjaro regions. Similarly due to mass exodus of cattle keepers in search of animal feeds school attendance has gone down. On more commercial basis,

crop and animal production has been affected negatively in areas with decreasing rainfall and vice versa.

### 2.4.3 Health

Malaria, prenatal mortality and AIDS are the three largest causes of loss of lives in the country. Under the current trend in both rainfall and temperature, the frequency of occurrences and impacts of the diseases will further rise. For example, malaria alone accounted for 16.67% of all reported deaths in Tanzania while prenatal deaths accounted for 13.34% of all deaths in 1997. Malaria is also one of the leading causes of morbidity in many regions of Tanzania ranging from 24% in Rukwa to 48.9% in Dar es Salaam. The V.A.R study further reveals among four major health hazards reported at village, district and national level, Malaria is one of them. Other major diseases in Tanzania are: Dysentery, Cholera, and Meningitis (Table 3).

Table 3 Shows the Human Health Hazards reported at Village, District and National Levels

S/N	Disease	Village %	District %	National estimate %
1	Dysentery	83	95	56
2	Malaria	98	93	85
3	Cholera	60	93	24
4	Meningitis	54	85	24

Source: Disaster Vulnerability Assessment Phase II by PMO and UCLAS 2003

An increase or prolonged rainfall and temperature will lead to increased epidemics of these diseases. Similarly there is increased outbreak of air borne diseases such as meningitis during hot seasons. Areas mostly affected are those getting high temperatures and less rainfall. Malaria transmission is said to be at its peak during high temperatures and humidity, after the rain season. Recently malaria has been observed to occur in non traditional areas found in high altitudes such as Kilimanjaro and Arusha as a pointer to climatic changes impacts. As more areas receive more rains, it will in turn attract more malaria vectors, leading to increased incidences of malaria diseases across the country.

Furthermore, the study conducted by Kangalawe and Yanda (2004) indicate that malaria is endemic in the lowlands but unstable in the highlands of the Lake Victoria region, there is creeping-up of the disease towards the highlands. The study further indicates that women and children are more vulnerable to malaria than men due the roles they play in the society, and that poverty influence adaptation to malaria/cholera in the area.

### 2.4.4 Forestry and Wetlands

Tanzania is well endowed with forest resources such that by 2002, 38.8 million hectares, (35% of the total land) were covered by forests and woodlands. However, all forest areas and types are under major threat of deforestation. The deforestation rate was estimated to be 91, 276 hectares per year in 2002. The main reasons for deforestation include clearing for agriculture and settlement, overgrazing, wildfires, charcoal burning and over-exploitation of wood resources for commercial purposes. All these activities contribute a great share to the increase of CO<sub>2</sub> in the atmosphere as the carbon sink is progressively reduced. Predictions show that the mean daily temperature will rise by 3<sup>0</sup>C – 5<sup>0</sup>C throughout the country and the mean annual temperature by 2<sup>0</sup>C – 4<sup>0</sup>C. There will also be



an increase in rainfall in some parts while other parts will experience decreased rainfall. Predictions further show that areas with bimodal rainfall pattern will experience increased rainfall of 5% – 45% and those with unimodal rainfall pattern will experience decreased rainfall of 5%– 15%.

The expected change of vegetation types in the forest zones due to increase in temperature are summarized in Table 4.

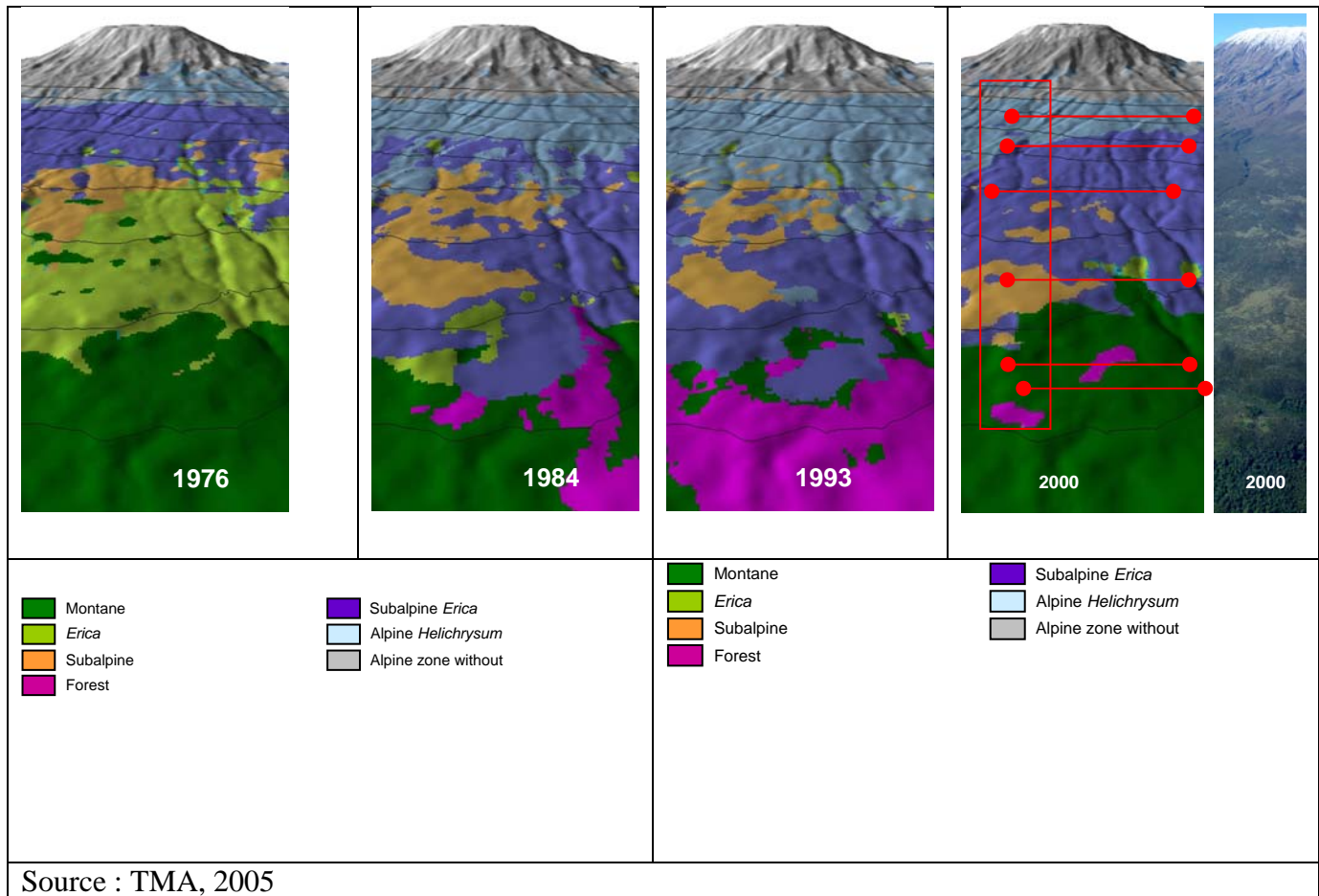
Table 4 Predicted changes in forests

<b>Type of vegetation</b>	<b>Expected change</b>
Sub tropical dry forest and subtropical moist forest life zone	Change to tropical; very dry forest, tropical dry forest and tropical moist forest
Subtropical thorn woodland	Completely be replaced/ disappear
Subtropical dry forest	Decline by 61.4%
Subtropical moist forest	Decline by 64.3%;

Species that will be more vulnerable are those with: limited geographical range and drought/heat intolerant; low germination rates; low survival rate of seedlings; and limited seed dispersal/migration capabilities.

Furthermore, recurrent forest fires have contributed to the diminishing of forests and forest resources in various parts of the country and ecosystems. More ecosystems and natural agro ecological zones are vulnerable as a result of bushfires emanating from impact of climate change. Among the chronic areas where bush fires have caused negative rampart effects include Mountains Uluguru and Kilimanjaro. At Mount Kilimanjaro vegetation cover has not only changed but has also been diminishing year after year due to frequent occurrence of fires, such that the Montane type of forest disappeared in year 2000 as is shown in Figure 10. As of result of these changes the ecological system and the catchment forests has been disturbed along the slopes of Mount Kilimanjaro.

**Figure 10: Changes in vegetation cover at Mt. Kilimanjaro**



### 2.4.5 Energy

Tanzania has a good number of energy sources including solar, wind, biogas, coal reserves, natural gas, hydropower, biofuel, wood fuel, and geothermal power. Of all these, the most exploited source is wood fuel because it is considered both cheap and accessible to the poor majority in rural and urban areas.

Petroleum, hydropower and coal are the major source of commercial energy in the country. The biomass energy resource, which comprises of fuel-wood and charcoal from both natural forest and plantations, accounts for 93 per cent of total energy consumption. Tanzania installed Hydro electricity generation capacity” of 561 MW. It is reported that Tanzania has an estimated 4800 MW of economic hydro potential capacity which accounts for 90 percent. However, not all these hydro-potential has been taped. In addition, due to drought, the highest water levels in most of the hydropower stations have progressively been declining in recent years. Data from the Ministry of Energy and Minerals show that the highest water level in Mtera Dam declined from 695.8m asl in 2003 to 690.5m asl in 2004 689.5m asl in 2005 and 688m asl in march 2006. Similar case was experienced in the Nyumba ya Mungu Dam where the level declined from

686.2m asl to 683.8m asl, 683m asl and 680m asl in 2003, 2004 and 2005 respectively. This has affected hydro power production such that the share of hydropower has fallen to about 40% versus thermal generated electricity.

Blackouts and power rationing as a result of low water levels in the hydro power dams have forced Tanzania Electric Supply Company (TANESCO) to rely on gas-powered generators and to look increasingly at thermal projects for future capacity increases. Power rationing for both domestic and industrial use makes Tanzania's economy more vulnerable to climate change related disasters; and leads to inefficiency in service provision to the public.

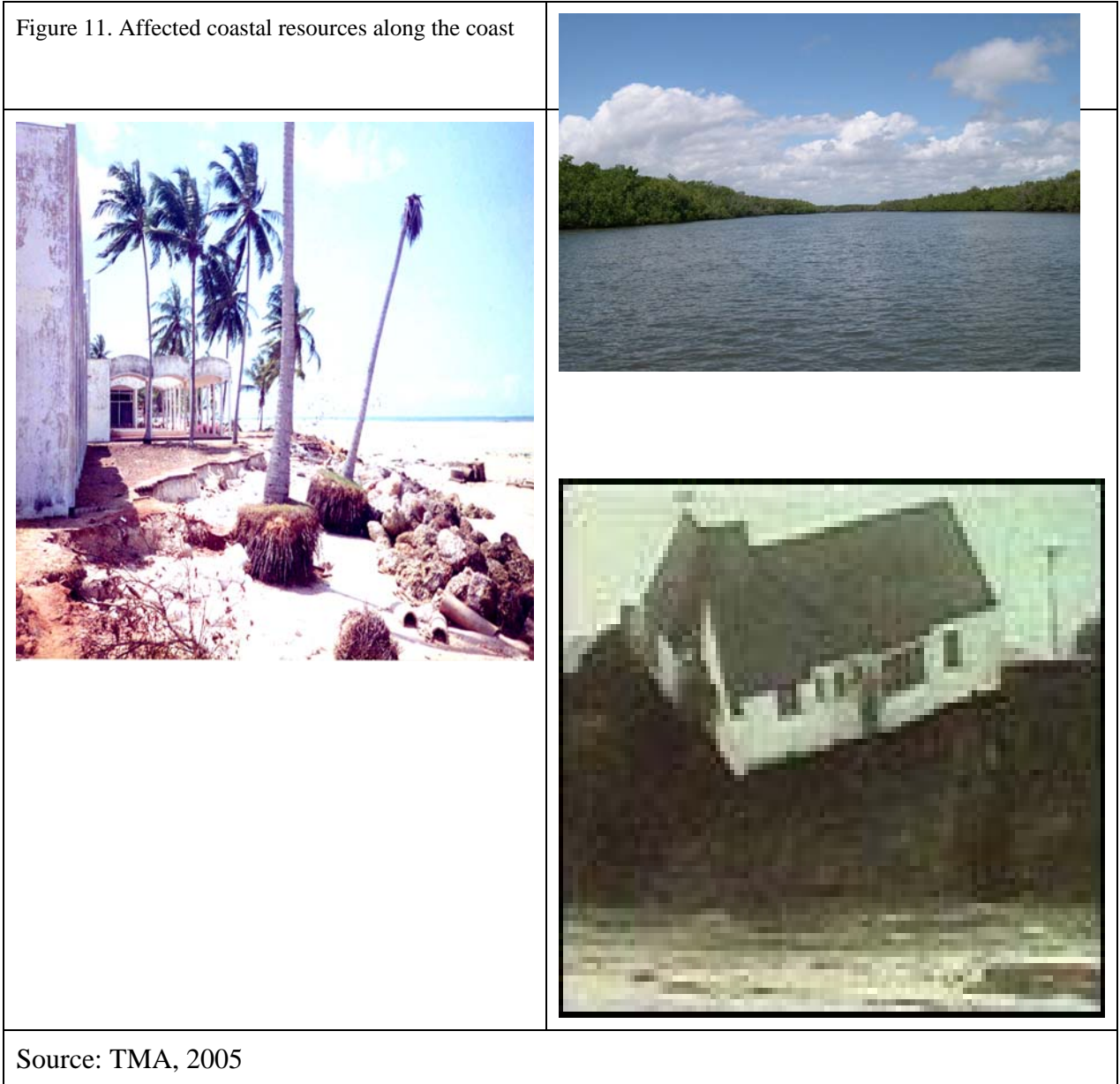
Tanzania has 1,200 million metric tons of coal, which could provide energy for paper mills, cement factories, agriculture and household consumption as well as generation of power. The current coal generated electricity capacity is 6MW. As an adaptive strategy, Tanzania plans to increase this capacity to 200MW in the short term and up to 600MW in the long term as adaptation to the drought situation of HEP dams. Wind and solar energy is another sources of energy. However, very little attempt has been made to utilize this source of energy which could be a viable alternative sources to reduce the dependency on wood and oil for heating purposes, hence reduction of CO<sub>2</sub> emissions. Solar Photovoltaic Market Transformation pilot project for off-grid areas in Mwanza region is an attempt to utilize the widely available solar potential for the production of energy. Moreover, other indigenous alternative sources of energy, which can be exploited to enhance Tanzania's energy sector so as to boost economic growth are being promoted at various levels.

#### **2.4.6 Coastal and Marine resources**

The coast of Tanzania is characterized by a wide diversity of biotopes and species, typical of the tropical Indowest Pacific oceans and the peoples living there utilize a variety of its natural resources. These coastal and marine resources of Tanzania have for generations had profound influences on the socio-economic well being and health status of not only the immediate communities but also those far removed from them. They constitute a significant component of the country's rich heritage, and the highly productive ecosystems play a substantial role in the economic and social development of the country. Coral reefs are an important coastal resource. In addition to being complex ecosystems and habitat to a wide diversity of marine flora and fauna, they are also important for the tourism and fisheries industries with the former industry serving as one of the main markets for fish products.

Rise in temperature as a result of climate change is expected to cause various impacts including rise in sea level which in the final analysis will lead to coastal resources and infrastructure destruction such as houses. This will in turn further impoverish the local communities which depend on these resources. Figure 11 shows the building and mangroves which are under threat of degradation.

**Figure 11 Photos of coastal resources and infrastructure along the coast**



Wetland habitats are important integral parts of the coastal fisheries industry and provide critical spawning and nursery grounds for many marine and freshwater organisms. Estuarine and lagoon fisheries are therefore major resources of a livelihood for many communities. The mangroves, in addition to providing physical protection for the coast against erosion, are used as firewood, building poles, boat building, fish smoking, and in making several domestic appliances (beds, drums, carts, etc.).

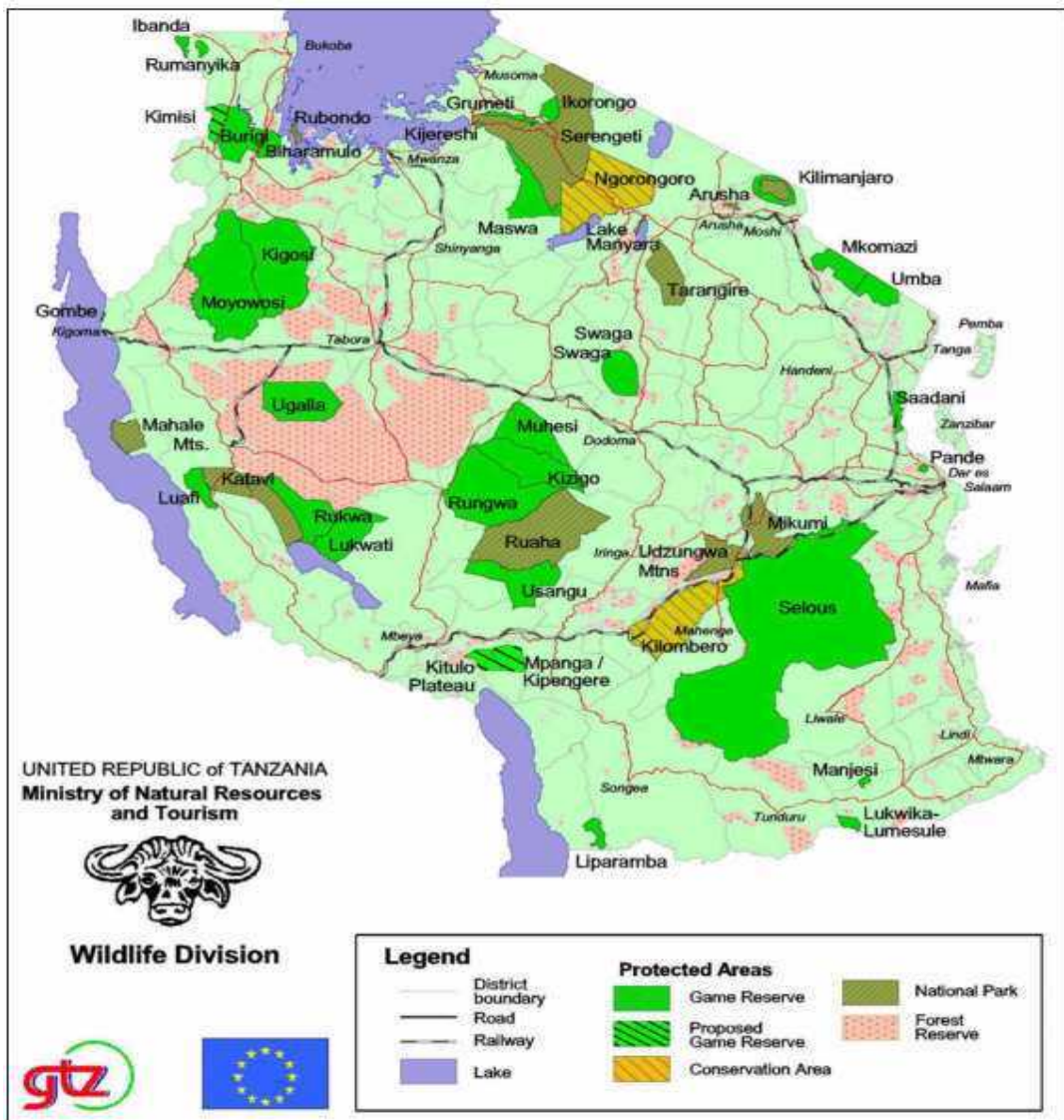
Due to the importance of the sea and coastline, the welfare of the population living by the coast and the socio-economic value to the country, the coastline has to be protected against any effect of climate change.

#### **2.4.7 Wildlife**

The wildlife of Tanzania is one of the richest and most diversified in Africa. Approximately 19 % of the country is protected as national parks or game and forest reserves. The country has a diverse spectrum of fauna and flora including a wide variety of endemic species and sub-species. The biological diversity and degree of endemism consist of primates, (20 species and 4 endemic), antelopes (34 species and 2 endemic) fish (with many endemic in Lake Victoria, Tanganyika and Nyasa and other small lakes and rivers), reptiles (290 species and 75 endemic), amphibians (40 endemic), invertebrates and plants caround 11,000 species including many endemic).

Tanzania's great reservoir of wildlife and biological diversity is increasingly under threat as a result of ecosystem fragmentation, over utilization of resources and conflicts between agriculture and wildlife. Persistent drought due to increase in temperature and unreliable rainfall pattern in the country is expected to affect the lifestyles of most of the migratory wild species, in particular the wildebeest and some bird species. The wildlife forms an important source of food and income for some local communities in Tanzania. Change in ecological systems will lead to disappearance of some wild animal species. Figure 12 shows the map of Tanzania showing areas with wildlife resources.

Figure 12 Map of Tanzania showing areas with wildlife resources



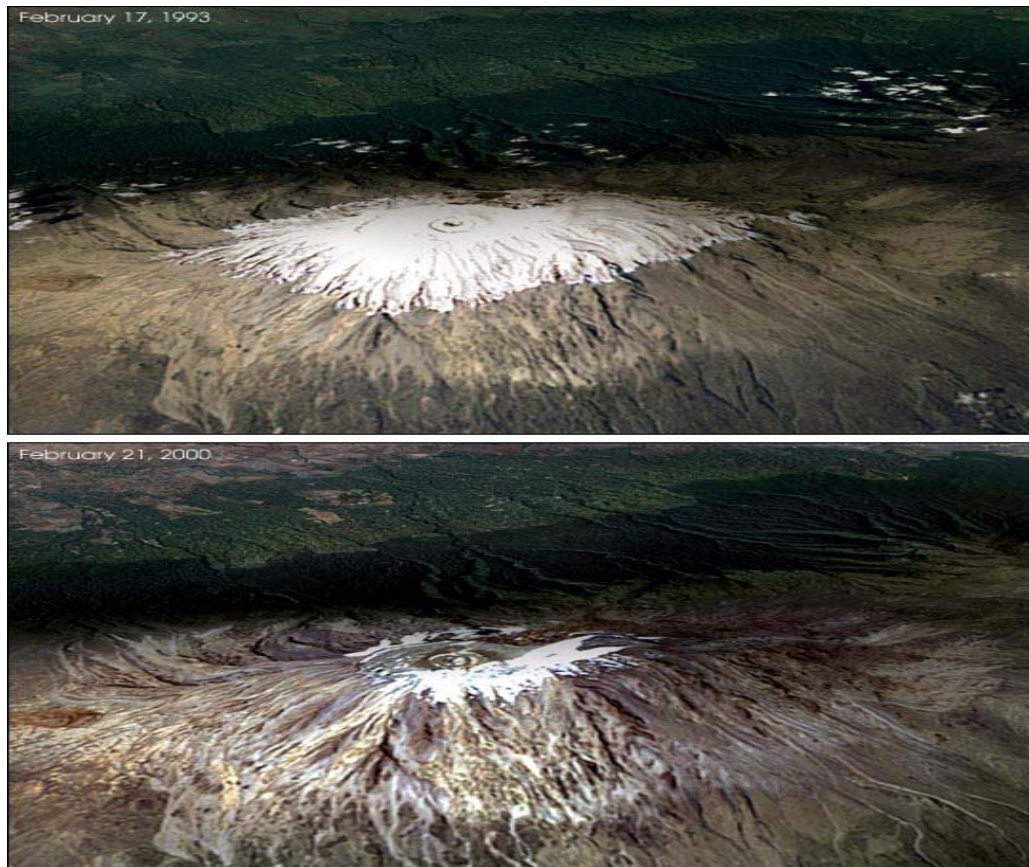
Source: GTZ 2005

### 2. 4. 8. Tourism

With a vast land area covered by forests as well as various species of flora and fauna, Tanzania is considered to be one of the premier tourism destinations in Africa. The country has beautiful natural resources including extensive tracts of wilderness and a rich diversity of scenery. Among the tourist attraction is 12 National Parks, including the famous Serengeti, 34 Game Reserves, and 38 Game Controlled Areas. Among many tourism sites, the prime tourist attractions include Mount Kilimanjaro, Zanzibar’s historic Stone Town, the Olduvai Gorge archaeological site and clean white sand beaches fringed by palm trees. However, due to increase in temperature some of these attractions such as the ice cap of Mount Kilimanjaro are under threat of smelting. Studies undertaken show that the ice cap of Mt. Kilimanjaro has decreased between 50-80%. Figure 13 shows the shrinking ice caps of Mt. Kilimanjaro between 1993 and 2000. It is estimated that about 80% of the snow at Mt. Kilimanjaro has disappeared leading to reduced water flow at the feet of the mountain where the local community live.



Figure 13: A Photo showing comparison of the area covered by ice cap (snow) at Mt. Kilimanjaro between February, 1993 and February 2000



Source: TMA, 2005

#### **2.4.9 Industry**

Manufacturing activities in Tanzania are relatively small and at an infancy stage. Its contribution to GDP has averaged 8% over the last decade, with most activities concentrated on manufacture of simple consumer goods - food, beverages, tobacco, textiles and furniture and wood allied products. However, the growth of industrial sectors is threatened by unavailability of sustainable and cheap energy source. Coping strategies in the energy sector are important for the growth of the economy in Tanzania.

#### **2.4.10 Other Assessment of Vulnerability and Adaptation in Tanzania**

Assessment of vulnerability and adaptation to climate change in various sectors also form part of the Initial National Communication (INC). In addition, there are two disaster vulnerability assessments reports conducted in 2002 and 2003 by the Prime Minister's Office (PMO) and University College of Lands and Architectural Studies

(UCLAS) which reveal the situation at the grassroots. All of these assessments contain very valuable information which contributes to an increased understanding of Tanzania's vulnerability to Climate Change.

Furthermore, there are two Food Assessment Reports conducted by Food Situation Investigation Team (FSIT) which shows that North Eastern and coastal regions received very little or no rains in Vuli season, a situation which led to food relief distribution to more than 56 districts out of 120. Kilimanjaro is now one of the hardest-hit regions although it used to be a heavy rain area in the past two decades.

The major causes of these vulnerabilities at village, district and national levels is climate change associated with prolonged heavy rainfall or drought. According to the V.A.R, the top four hazards in the country as indicated in Table 3 are: epidemics (43%), drought (47%), pest/vermin/plant diseases (50%) and floods (13%). These high ranked hazards have also been observed as commonly occurring in a period of less than five years, and have a positive correlation with the climate change observed throughout the country within the same time period. During the survey, the perception recorded from the local communities regarding the occurrence of these extreme weather events are:

- a. **Drought:** At household level drought was reported as a problem and 83% mentioned prolonged low rainfall to be the cause, followed by climatic variability in terms of onset of rainfall for cropping seasons 60% and increased deforestation 53%.
- b. **Pests:** Out of 995 respondents at village level who mentioned pest as a problematic hazard (37%) mentioned climate change to be a cause increased and new pests and diseases and prolonged rainfall/dryness (31%) and poverty 14%.
- c. **Epidemics:** Out of 852 respondents who were affected by diseases outbreak, 42% reported prolonged rainfall and drought to be the cause, climatic variability 30% health related 41% and poverty 10%.
- d. **Floods:** Was mentioned as been caused by prolonged rainfall (83%) while climate change scored (19%). Table 5 summarizes these findings.

Table 5 Major causes of Hazards at village and district level



S/N	Hazard type	Causes	Village %	District %
1	Strong winds	Desertification, poor farming methods, overgrazing	67	50
		Climate change	67	33
		Prolonged low rainfall/dryness		33
2	Drought	Desertification, poor farming methods, overgrazing	10	87
		Climate change	10	67
		Prolonged low rainfall/dryness	8	67
3	Diseases outbreak	Prolonged low rainfall/dryness	40	42
		Health related	28	45
		Poor house plan and drainage	-	50
		Climatic change	16	-
		Poverty	25	70
4	Floods	Prolonged heavy rainfall	53	75
5	Pest	Climatic change	27	45
		Prolonged low rainfall and dry spell	23	40
		Poverty	28	55
		Lack of expertise and technology	23	36

Source: Disaster Vulnerability Assessment Phase ii by PMO and UCLAS 2003

### 3.0 ADAPTATION STRATEGIES AND PRIORITIZATION

Various coping strategies are employed in each sector depending on vulnerability. Based on sectoral consultations, the NAPA team proposed the project activities shown in Table 6 as most urgent and needed in each sectors. The table shows the ranking that was done by the NAPA team.

Table 6: Summary of vulnerabilities and adaptation activities (existing & potential) of the sectors

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
<b>Agriculture Sector</b>	<ul style="list-style-type: none"> <li>• Unpredictable rainfall, uncertainty in cropping patterns</li> <li>• Shifting in agro-ecological zones</li> <li>• Prolonged dry spells beyond normal patterns</li> <li>• Increased weed competition with crops for moisture, nutrients and light</li> <li>• Ecological changes for pests and diseases</li> <li>• Decline of maize yields, the national food crop nationwide by 33% due to temperature rise; highest decline reported for Dodoma and Tabora</li> </ul>	<ul style="list-style-type: none"> <li>• Small scale irrigation</li> <li>• R&amp;D on drought tolerant seed varieties</li> <li>• Agriculture extension activities</li> <li>• Diversification of agriculture: growing different types of crops on different land units</li> <li>• Water harvesting</li> </ul>	<ul style="list-style-type: none"> <li>• Alternative farming systems</li> <li>• Promote indigenous knowledge</li> <li>• Change planting dates in some agro ecological zones</li> <li>• Increase irrigation to boost maize production in selected areas</li> <li>• Drip irrigation for specific regions</li> <li>• Reduce reliance on maize as staple food by growing short-season and drought tolerant crops such as sorghum and millet</li> <li>• Shift crop farming to more appropriate agro ecological zones</li> <li>• Change crop rotation practices</li> <li>• Integrated crop and pest management</li> <li>• Make better use of climate and weather data, weather forecasts, and other management tools</li> <li>• Create awareness on the negative effects of climate change</li> <li>• Sustainable water management to boost food crop production</li> <li>• Strengthen early warning system</li> </ul>
			<ul style="list-style-type: none"> <li>• Follow standard agronomic practices</li> <li>• Insist on annual and short term crops</li> </ul>
	<ul style="list-style-type: none"> <li>• Cotton yields could decrease by 10%-20% due to the impact of pests and diseases.</li> </ul>		

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
<b>Livestock Sector</b>	<p>Increased temperature and rainfall could result in:</p> <ul style="list-style-type: none"> <li>• Changes in plant species composition</li> <li>• General increase in Dry matter yields</li> <li>• Favorable condition for pests and disease</li> <li>• Livestock deaths due to heat waves</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen cross breeding for resistant breeds</li> <li>• Strengthen tick and tsetse control programmes</li> <li>• Strengthen livestock extension services</li> <li>• Improve livestock marketing infrastructure</li> <li>• Enhance research and development</li> <li>• Promote zero grazing</li> </ul>	<p><b>Reactive adaptation measures:</b></p> <ul style="list-style-type: none"> <li>• Change land use patterns</li> <li>• Tsetse fly control</li> <li>• Integrated pest and disease control</li> <li>• Sustainable range management</li> <li>• Infrastructure development</li> <li>• Research and development</li> <li>• Education of farmers/livestock keepers</li> <li>• Advocate zero grazing</li> <li>• Control movement of livestock</li> </ul>
<b>Forestry Sector</b>	<ul style="list-style-type: none"> <li>• Deforestation and desertification</li> <li>• frequent forest fires</li> <li>• Changes in forest types, species composition and distribution</li> <li>• Disappearance of medicinal plants</li> </ul> <p>vulnerable species are those with:</p> <ul style="list-style-type: none"> <li>• limited geographical range and drought/heat intolerant</li> </ul>	<ul style="list-style-type: none"> <li>• Collaborative forest management in various districts</li> <li>• Ensured ecosystem stability through conservation of forest biodiversity, water catchment and soil fertility e.g., SECAP usambara, Eastern Arc conservation project</li> </ul>	<ul style="list-style-type: none"> <li>• Develop community Forest fire prevention plans and programmes</li> <li>• Strengthen community based forest management practices</li> <li>• Afforestation programmes in degraded lands using more adaptive species</li> <li>• Establish multiple fast growing tree species in community woodlots</li> <li>• Control habitat destruction and fragmentation in high biodiversity areas.</li> <li>• Enhance the development of buffer zones</li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
	<ul style="list-style-type: none"> <li>• low germination rates</li> <li>• low survival rate of seedlings and</li> <li>• limited seed dispersal/migration capabilities</li> <li>• Unsustainable supply of forest products and services</li> <li>• Decrease in employment and foreign exchange earnings through forest based industries and trade</li> </ul>	<ul style="list-style-type: none"> <li>• National wide tree planting campaign</li> <li>• Participatory forest management</li> </ul>	<p>and wildlife migratory routes</p> <ul style="list-style-type: none"> <li>• Promotion of alternative sources of energy for both domestic and industrial use</li> <li>• Promotion of appropriate and efficient technologies to reduce use of wood</li> <li>• Promotion of natural forest regeneration</li> <li>• Enhance participatory forest management through benefit sharing from forest resources</li> <li>• Ex-situ conservation of important plant genetic resources</li> <li>• Promotion of use of non-timber forest products</li> <li>• Promotion of lesser unknown timber species</li> </ul>
<b>Water Sector</b>	<ul style="list-style-type: none"> <li>• Decreased and/or increased runoff in river basins</li> <li>• encroachment into stream ecosystems</li> <li>• water pollution</li> <li>• water logging due to increased water flow</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated water resource management</li> <li>• New Infrastructure</li> <li>• Conjunctive water Use</li> <li>• Inter-basin transfers</li> <li>• Protection of water Catchment</li> <li>• Rainwater Harvesting</li> <li>• New dam sites</li> </ul>	<ul style="list-style-type: none"> <li>• Develop alternative water storage programs and water harvesting technologies for communities</li> <li>• Strengthen integrated water resources management</li> <li>• Development of both surface and subsurface water reservoirs</li> <li>• Promotion of Community based catchments conservation and management programs</li> <li>• Promote new water serving technologies in irrigation</li> <li>• Development of recycle and reuse facility</li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
			<p>in industrial sector and potentially in households</p> <ul style="list-style-type: none"> <li>• Develop early warning systems</li> <li>• Desalinization and defluoridation of water in areas with fluoride and saline content</li> </ul>
<p><b>Coastal and Marine Resources</b></p>	<p><b>Sea-Level Rise</b></p> <ul style="list-style-type: none"> <li>• Land losses</li> <li>• Coastal erosion and damage to coastal structure and properties</li> <li>• Loss of coastal and marine habitats and resources (mangroves, sea grass-beds, fishes and corals)</li> <li>• Saline intrusion in fresh water bodies</li> <li>• Inundation of low-lying coastal areas and small islands</li> <li>• coral bleaching</li> </ul>	<ul style="list-style-type: none"> <li>• Marine and coastal environment management programmes and projects e.g : <ul style="list-style-type: none"> <li>• Tanga Coastal Conservation and Development Programme (TCCDP)</li> <li>• The National Integrated Coastal Environment Management Strategy,</li> <li>• Rural Integrated Project Support Programme (RIPS)</li> <li>• Mangrove Management Programme (MMP)</li> <li>• Rufiji Environment Management Project (REMP)</li> <li>• Conservation of Lowland Coastal</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Raise awareness on climate change</li> <li>• Desalination of saltwater where possible</li> <li>• Relocation of services, properties and existing infrastructures due to sea level rise <ul style="list-style-type: none"> <li>• Establishment of protected areas</li> <li>• Restoration of degraded habitats <i>e.g., beach nourishment, vertiva grass planting, mangrove replanting, stimulation of coral reefs growth</i></li> <li>• <i>Construction of artificial structures, e.g., sea walls, artificially placing sand on the beaches and coastal drain beach management system</i></li> <li>• Reduction or elimination of non-climate stress and monitoring; <i>e.g., Elimination of destructive fishing practices and over-fishing, Reduction of pollution and damaging extraction, proper management of salt production and seaweed farming, Coastal ecosystem monitoring</i></li> </ul> </li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
		<p>Forests Project</p> <ul style="list-style-type: none"> <li>• Zanzibar Coastal Zone Management Programme</li> <li>• Sustainable Dar es Salaam Project</li> <li>• Kinondoni Coastal Area Management Programme</li> </ul> <p>Conservation of marine and coastal resources measures:-</p> <ul style="list-style-type: none"> <li>• Mafia Island Marine Park</li> <li>• Mnazi bay Marine Park</li> <li>• Menai Bay Conservation Area</li> <li>• Misali Island Conservation Area</li> <li>• Chumbe Island Coral Park</li> </ul>	
<b>Health Sector</b>	<ul style="list-style-type: none"> <li>• More cases of malaria diseases due to higher temperature across the country</li> <li>• Emergency of highland malaria</li> </ul>	<ul style="list-style-type: none"> <li>• The Ministry of Health has an Integrated Diseases Surveillance Response System (IDRS) in place to prevent, mitigate and</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen malaria control programme.</li> <li>• Strengthen phyto-medicine programmes</li> <li>• Establishing and Strengthening community awareness programmes on preventable major health hazards</li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
	<ul style="list-style-type: none"> <li>• Water-related diseases such as schistosomiasis and cholera</li> <li>• Severe shortage of food and high increase in the rate of malnutrition, especially to children.</li> <li>• Increased the rate of outbreaks of water-borne diseases such as cholera and other gastro-intestinal diseases.</li> </ul>	<p>respond to epidemics in the country.</p> <ul style="list-style-type: none"> <li>• Available Infectious Disease Weekending (IDWE) reports at the Health Centres and District/Regional Hospitals. .</li> <li>• Presence of Emergency Plan Response Unit (EPRU) that coordinate and manage all health related hazards, which include epidemics, accidents, drought and floods.</li> <li>• Use of traditional/alternative medicines</li> <li>• A Traditional Medicines Research Unit established at Muhimbili Medical Research Institute</li> </ul>	<ul style="list-style-type: none"> <li>• Establish Health &amp; Climate collaboration &amp; synthesis programs</li> <li>• Develop early warning system and emergency measures</li> <li>• Establishment of efficient and well coordinated early warning system in all districts.</li> <li>• Provide efficient communication equipment to assist early diagnosis in the health centre.</li> <li>• Ensure availability of sufficient trained staff at all health facilities.</li> </ul>
<b>Wildlife</b>	<ul style="list-style-type: none"> <li>• Reduction in productivity of ungulates in different</li> </ul>	<ul style="list-style-type: none"> <li>• Wildlife management policy to ensure</li> </ul>	<ul style="list-style-type: none"> <li>• Development of migratory corridors and buffer zones for wildlife species</li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
<b>Sector</b>	<p>protected areas</p> <ul style="list-style-type: none"> <li>• Increase in production of DM and thousand production of animal biomass in some areas.</li> <li>• Shrinking of wildlife area with resultant habitat loss</li> <li>• Disappearance of wildlife corridor that impair wildlife movement and dispersal with impact on the productivity</li> </ul>	<p>conservation of wildlife resources</p> <ul style="list-style-type: none"> <li>• enhanced legal, regulatory, institutional environment for rural communities and private sector to participate in wildlife conservation through establishment of Wildlife management areas(WMA)</li> <li>• Developing appropriate regulatory mechanisms that will continue to set aside PAs where wildlife and natural areas will be conserved</li> </ul>	<ul style="list-style-type: none"> <li>• Development and implementation of management plans for protected and conserved areas.</li> <li>• Support implementation of Community Based Management (CBM) programmes of wildlife management areas surrounding the national parks and game reserves</li> <li>• Combating illegal hunting and forest fires</li> <li>• Developing wildlife information database</li> <li>• Enhance wildlife extension services and assistance to rural communities in managing wildlife resources</li> <li>• Enhance capacity building on wildlife management for sustainable development</li> </ul>
<b>Industry Sector</b>	<p>Poor rainfall and increased drought will lead to:</p> <ul style="list-style-type: none"> <li>• Shortage of raw materials</li> <li>• Shortage of power supply</li> <li>• Shortage of water supply</li> </ul>	<ul style="list-style-type: none"> <li>• Diversifying species, coupled with optimistic harvest of natural resources</li> </ul>	<ul style="list-style-type: none"> <li>• Improve, change and adjust land management practices and techniques, such as planting date, seeding rate, fertilizer application rate, change in crop regions;</li> </ul>



Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
		<ul style="list-style-type: none"> <li>• Building food and water reserves and maintaining social ties as a form of insurance, in coping with drought</li> <li>• In case of pastoralists, a diverse range of animal species are raised (e.g., cattle, camel, goats and sheep), and moved according to established traditional regulations between dry and wet season grazing areas</li> <li>• Diversification of process lines, importation of raw material and semi processed raw material</li> <li>• Application of cleaner production technologies</li> </ul>	<ul style="list-style-type: none"> <li>• Use climate information for land-use planning and early warning systems;</li> <li>• Adopt suitable crop varieties and develop new ones (use early maturing crops, draught resistant crops etc)</li> <li>• Promote herd diversification;</li> <li>• Plant trees and establish plantations;</li> <li>• Adopt sustainable forest management practice (Reduce tree harvesting, use efficient stoves, efficient charcoal production kilns/retorts)</li> <li>• Develop disaster resistant tree species</li> <li>• Promotion of efficiency energy saving technologies</li> <li>• Promote water resources conservation for stabilizing hydro power generation</li> <li>• Promote industrial self-energy production and use</li> <li>• Promote utilization of renewal energy alternatives that reduces environmental degradation</li> <li>• Promotion of water harvesting technologies</li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
			<ul style="list-style-type: none"> <li>• Promote cleaner production technologies</li> <li>• Allocate water supply through market-based systems for Irrigation, hydro electric power generation, etc.</li> <li>• Improve wildlife and ecological surveillance systems</li> <li>• Alternate grazing systems</li> <li>• Change stocking rates;</li> <li>• Change the timing of the grazing period.</li> <li>• Create better and permanent drainage systems</li> <li>• Water harvesting</li> <li>• Use better irrigation technologies such as rainwater harvesting schemes, drip irrigation, micro dams, irrigation canals etc</li> <li>• Develop early warning systems</li> <li>• Use new crop species/change crop type to suit current conditions.</li> <li>• Shift crop to new locations with now</li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
			favourable conditions of temperature and rainfall for crop growth. <ul style="list-style-type: none"> <li>• Practice water harvesting and irrigation farming</li> </ul>
<b>Energy Sector</b>	Biomass and Hydropower power are vulnerable due to reduced rainfall and high temperatures	<ul style="list-style-type: none"> <li>• Improving and increasing clean thermal power generation</li> <li>• Protection of hydropower water catchments</li> <li>• Increasing availability of biomass resources</li> <li>• Improvement of biomass to energy conversion efficiency</li> <li>• Increased use of modern biomass to energy technologies</li> <li>• Energy switching</li> <li>• End-use energy efficiency programmes</li> </ul>	<ul style="list-style-type: none"> <li>• Explore and invest in alternative energy sources</li> <li>• Develop community based mini-hydropower</li> <li>• Harness the proven coal reserves</li> <li>• Support programmes to develop alternative source of energy which is feasible and less polluting e.g. Wind, Solar, bio-diesel, etc.</li> <li>• increase use of geo-thermal power generation</li> <li>• Appropriate and efficient use of biomass resources</li> <li>• Enhance natural gas utilization</li> <li>• promotion of application of cogeneration in the industry sector</li> </ul>
<b>Wetlands sector</b>	<ul style="list-style-type: none"> <li>• In areas where there will an increase in temperature</li> </ul>	<ul style="list-style-type: none"> <li>• Assessment, inventory and monitoring of the types and</li> </ul>	

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
	<p>and decrease in rainfall will result to shrinking and actually drying of the wetlands</p> <ul style="list-style-type: none"> <li>• Destruction of breeding sites for fishes and other aquatic life</li> <li>• Reduction in surface runoff hence drying of some water springs and small tributaries that originating from wetland</li> </ul>	<p>spatial distribution of the wetland ecosystems and their component</p>	
<p><b>Human Settlement sector</b></p>	<ul style="list-style-type: none"> <li>• Coastal erosion and loss of settlements in the coastal areas.</li> <li>• Loss of infrastructure e.g. roads, buildings, crop loss in agricultural land.</li> <li>• Migration of people and livestock to other areas.</li> <li>• Land conflicts</li> <li>• Development of unplanned settlements</li> </ul>	<ul style="list-style-type: none"> <li>• Coastal and beach erosion: there are plans for development of tourist hotels or buildings situated along the seashore (mainly in Dar-es-Salaam)</li> <li>• Poor urban transport and drainage systems: preparation of town plans (Central Business District Schemes)</li> </ul>	<ul style="list-style-type: none"> <li>• Relocation of vulnerable communities to other areas</li> <li>• Establish good land tenure system and facilitate sustainable human settlements</li> <li>• establish rural areas improvement plan</li> <li>• sensitize the communities on the climate change related hazards</li> <li>• formulate a database for hazard prone areas and plan for appropriate measures -</li> <li>• Zoning planning</li> <li>• Establish disaster committee and plans at village level.</li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
		<ul style="list-style-type: none"> <li>• Unplanned settlements: Regularization and upgrading of unplanned settlements. This also includes low lying-flood prone areas, wetlands, hilly areas, and coastal areas along the oceans and lakes.</li> <li>• Housing Development Schemes in different regions of the country.</li> </ul>	<ul style="list-style-type: none"> <li>• Establish a Disaster planning framework</li> <li>• Improve building codes</li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
		<ul style="list-style-type: none"> <li>• Implementation of the National Land Policy (1995),</li> <li>• Implementation of the National human Settlements Development Policy (2000),</li> <li>• Implementation of the Land Acts No. 4 and 5 (1999),</li> <li>• The review of Town and Country Planning Act (2004)</li> </ul>	
<b>Tourism sector</b>	<ul style="list-style-type: none"> <li>• Shift in the preference from important tourist destinations such as Serengeti to less important areas. Coastal erosion may also result to the displacement of coastal communities.</li> <li>• Coral bleaching and related reduction of marine biodiversity.</li> </ul>	<ul style="list-style-type: none"> <li>• The establishment of national parks, forest, game and marine reserves to ensure the sustainability of tourism industry.</li> <li>• Protecting the seashore by building barrier walls, e.g. along the Ocean Road.</li> <li>• Implementation of the National Tourism Policy and Action Plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Relocation of people living in wildlife corridors</li> <li>• Development of buffer zones around the national parks and game reserves</li> <li>• Establishment of Community Based Fire Protection and Control Programme</li> <li>• Establish alternative source of income for the community in the tourist area</li> <li>• Implement sustainable tourism activities</li> </ul>

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
	<ul style="list-style-type: none"> <li>• Submerging of small islands e.g. Zanzibar, Mafia and Kilwa which are important tourist destinations.</li> <li>• Retreat of the ice cap at Mt. Kilimanjaro</li> <li>• . This alone, has not been shown to have a</li> <li>• Fire risk is a more serious threat to tourism since the effect may result to the loss of endemic biodiversity.</li> <li>• Changes in the hydrological cycles may affect the availability, patterns and distribution of endemic plants and animal species e.g. in the eastern Arc Mountains, and hence the income from these.</li> <li>• Prolonged droughts may result in the change of vegetation and ecological zones, thus affecting</li> </ul>	<ul style="list-style-type: none"> <li>• Protection of the wildlife corridors (such as the Derema corridor in Amani Nature Reserve) and along Kilimanjaro National Park.</li> <li>• Existence of Community Based Management Programmes in areas surrounding the National Parks and game reserves.</li> <li>• Strengthening Community Based Management Programmes in areas surrounding the national parks and game reserves</li> </ul>	

Sector	Vulnerability	Existing Adaptation Activities	Potential Adaptation Activities
	<p>the distribution of wildlife in some areas.</p> <ul style="list-style-type: none"> <li>• Increase in the frequency of floods, drought and land degradation will reduce the frequency of recreational activities and wildlife safaris. For example, hydrological changes in Lake Manyara may alter the migration and breeding patterns of the existing bird species such as flamingos.</li> </ul>		
<b>Land use</b>	<ul style="list-style-type: none"> <li>• Soil erosion</li> <li>• Degradation of soil structure</li> <li>• Declining soil fertility</li> <li>• Extinction of some animal and plant species</li> <li>• Limited pastures as a result of long droughts and outbreak of diseases</li> <li>• Low soil pH due to paddy cultivation</li> <li>• Variability of rainfall, floods &amp; drought affecting land management especially on slopes of Mt. Kilimanjaro</li> </ul>	<ul style="list-style-type: none"> <li>• Terracing, contour farming</li> <li>• Use of organic manure</li> <li>• Zero grazing</li> </ul>	<ul style="list-style-type: none"> <li>• encouraging Terracing, contour farming</li> <li>• Use of organic manure</li> <li>• Zero grazing</li> <li>• Specific land uses to be allocated for various development and informal sectors</li> </ul>



### 3. 1. Ranking of Sectors

Following a consultation done by the NAPA team to the stakeholders, the sectors were then ranked in their order of importance based on the criteria listed in section 1.5. Table 7 shows the ranking.

Table 7 Ranking of sectors according to priorities

<b>Sector</b>	<b>Rank order</b>
Agriculture and food security (including livestock)	1
Water	2/3
Energy	2/3
Forestry	4
Health	5
Wildlife	6/7
Tourism	6/7
Industry	8
Coastal and marine resources	9
Human settlements	10
Wetlands	11

### 3.2 Ranking of project activities

Regarding the activities in each sector, the ranking was also done as a result of NAPA team consultation with the stakeholders. Table 8 clearly shows this ranking in order of importance.

Table 8 Ranking of project activities per sector

Sector	Activities	Rank
Agriculture and food security (including livestock)	Increase irrigation to boost maize production in all areas	1
	Alternative farming systems	2
	Make better use of climate and weather data, weather forecasts, and other management tools and expand climate and weather data collection network	3
	Create awareness on the negative effects of climate change	4
	Increase the use of manure and fertilizer	5
	Range management for livestock production	6
	Change land use patterns	7
	Dip irrigation for specific regions	8
	Control pests, weeds, and diseases	9
	Biological control of tsetse fly	10
	Promote indigenous knowledge	11
Water	Develop alternative water storage programs and technology for communities	1/2
	Promote water harvesting and storage facilities	1/2
	Develop reservoirs and underground water abstraction	3
	Community based catchments conservation and management programs	4
	Develop new water serving technologies in irrigation	5
	Develop early warning systems on drought and floods	6
	Development of recycle and reuse facility in industrial sector	7
Energy	Explore and invest in alternative clean energy sources e.g. Wind, Solar, bio-diesel, etc.	1
	Develop community based mini-hydropower	2

	Improve biomass to energy conversion efficiency ( <i>improved charcoal production technology, improved charcoal and wood stoves, use of biomass waste briquettes, biomass waste gasification, promote fuel crop</i> )	3
	Increase use of geo-thermal power generation	4
	Harness the proven coal reserves	5
	promotion of application of cogeneration in the industry sector	6
	Enhance natural gas utilization	7
Forestry	Afforestation programmes in degraded lands using more adaptive and fast growing tree species	1
	Develop community forest fire prevention plans and programmes	2
	Strengthen community based forest management practices	3
	Promotion of alternative sources of energy for both domestic and industrial use	4
	Promotion of appropriate and efficient technologies to reduce use of wood	5
	Control habitat destruction and fragmentation along coast forest resources	6
	Enhance the development of buffer zones and wildlife migratory routes	7
Health	Establishing and Strengthening community awareness programmes on preventable major health hazards	1
	Ensure availability of sufficient trained staff at all health facilities	2
	Strengthen malaria control programme	3
	Develop early warning system and emergency measures	4
	Establish Health & Climate collaboration & synthesis programs	5
	Establishment of efficient and well coordinated early warning system in all districts.	6
	Provide efficient communication equipment to assist early diagnosis in the health centre.	7
Wildlife	Enhance wildlife extension services and assistance to rural communities in managing wildlife resources	1

	Support implementation of Community Based Management (CBM) programmes of wildlife management areas surrounding the national parks and game reserves	2
	Combating illegal hunting and forest fires	3
	Developing wildlife information database	4
	Development of migratory corridors and buffer zones for wildlife species	5
	Development and implementation of management plans for protected and conserved areas.	6
	Improve wildlife and ecological surveillance systems	7
Tourism	Establish alternative source of income for the community in the tourist area	1
	Establishment of Community Based Fire Protection and Control Programme	2
	Development of buffer zones around the national parks and game reserves	3
	Implement sustainable tourism activities	4
	Relocation of people living in wildlife corridors	5
Industry	Improve energy efficiency in industrial energy consumption	1
	Efficient use of raw materials	2
	Alternative use of raw materials	3
	Water harvesting and recycling	4
	Create better and permanent drainage systems	5
	Promote use of renewable energy sources such as solar, wind etc	6
Coastal and marine resources	<i>Construction of artificial structures, e.g., sea walls, artificially placing sand on the beaches and coastal drain beach management system</i>	1
	<i>Restoration of degraded habitats e.g., beach nourishment, vertiva grass planting, mangrove replanting, stimulation of coral reefs growth</i>	2
	<i>Reduction or elimination of non-climate stress and monitoring; e.g., Elimination of destructive fishing practices and over-fishing, Reduction of pollution and damaging extraction, proper management of salt production and seaweed farming, Coastal ecosystem monitoring</i>	3
	Relocation due to sea level rise of small island communities	4
	Establishment of protected areas	5

	Desalination of saltwater where possible	6
Human settlements	Establish good land tenure system and facilitate sustainable human settlements	1
	Relocation of vulnerable communities to other areas	2
	Establish disaster committee and plans at village level.	3
	Formulate a database for hazard prone areas and plan for appropriate measures	4
	sensitize the communities on the climate change related hazards	5
	establish rural areas improvement plan	6
	Establish a Disaster planning framework	7
	Zoning planning	8
	Improve building codes	9
Wetlands	Assess and conduct inventory of the types and spatial distribution of the wetland ecosystems and their components	1
	Develop wetlands monitoring programmes	2
	Propose more Ramsar Sites for sustainable management of wetlands	3
	Provide adequate capacity building, awareness and education on wetland management issues related to climate change	4

### 3.3 Proposed top most urgent and immediate projects

The following project activities were ranked (by the NAPA team in consultation with stakeholders) as the top most in terms of priorities:

- i. Increase irrigation by using appropriate water efficient technologies to boost crop production in all areas
- ii. Alternative farming systems and relocation of water sources including wells along the low lying coastal areas
- iii. Develop water harvesting and storage programs for rural communities particularly those in dry lands
- iv. Community based catchments conservation and management programs
- v. Explore and invest in alternative clean energy sources e.g. Wind, Solar, bio-diesel, etc.

- vi. promotion of application of cogeneration in the industry sector
- vii. A forestation programmes in degraded lands using more adaptive and fast growing tree species
- viii. Develop community forest fire prevention plans and programmes
- ix. Establishing and Strengthening community awareness programmes on preventable major health hazards
- x. Implement sustainable tourism activities
- xi. Enhance wildlife extension services and assistance to rural communities in managing wildlife resources
- xii. Water harvesting and recycling
- xiii. Construction of artificial structures, e.g., sea walls, artificially placing sand on the beaches and coastal drain beach management system
- xiv. Establish good land tenure system and facilitate sustainable human settlements

The project profile for the above prioritized fourteen project activities will be developed after the National Stakeholders Consultative Workshop.

### **3.4 Implementation strategy**

The above listed project activities will be implemented and managed by relevant sectors. However, the coordination role is vested to the Vice President's Office-Division of Environment which is the country's focal point regarding environmental issues. Furthermore, monitoring and evaluation of the projects will be done by the Vice President's Office in collaboration with other relevant stakeholders. Project profiles for project activities to be implemented are annexed as Annex I.

## **4. REFERENCES**

1. Initial National Communication under the United Nations Framework Convention on Climate Change (UNFCCC), 2003, The United Republic of Tanzania, Vice President's Office, Dar es Salaam, Tanzania
2. Vulnerability Assessment Report, 2003 PMO, 2003, Prime Minister's Office, Dar es Salaam, Tanzania
3. United Nations Framework Convention on Climate Change (UNFCCC) Least Developed Countries Expert Group, 2003: Selection of examples and exercises drawn from the regional NAPA preparation workshops.
4. Matari, E. E, 2006: Climate Extremes in Tanzania, paper presented at the Second Annual Scientific workshop on Climate Change, Moshi, Tanzania
5. Tanzania Meteorological Agency (TMA), 2005:

## **ANNEX I: PROJECT PROFILES**

Project Development Facility  
Request for PDF Block Funding for Full Sized Project

Project design to be continued once is selected and communities are consulted to decide appropriateness.

Objective: Food security through increased water efficiency and adaptable coping strategies for farmers
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Outcome 1:

Priority No. 1, 3, 4 and 12:

Output 1.1: increased water efficiency in agriculture to account for water stress and water efficient measures are installed to boost irrigation.

Output 1.2: water harvesting, recycling and storage programmes are used to increase water available for agriculture

Outcome 2: Farming are altered to buffer against variation in crop production

Priority No. 1, 2, 7, 14

Priority No. 2. Output 2.1: alternative farming systems are implemented to create greater buffers such as grain storages in good harvest years, re-distribution between communities, more drought, drought tolerant crops, etc.