IMPLEMENTATION OF THE GLOBAL FRAMEWORK FOR CLIMATE SERVICES ADAPTATION PROGRAMME IN AFRICA

PHASE I AND II (GFCS APA I and II)

TANZANIA EXPERIENCE

GFCS GLOBAL FRAMEWORK FOR CLIMATE SERVICES

TMA TANZANIA METEOROLOGICAL AUTHORITY

WFP World Food Programme

TANZANIA RED CROSS SOCIETY

INTERNATIONAL FEDERATION

World Health Organization

Norad

Director General,
Tanzania Meteorological Authority (TMA),
P. O. Box 3056,
Ubungo Plaza, 3rd Floor,
38816102 Morogoro Road,
Dar es Salaam, Tanzania.

Tel: +255 22 2460706
Fax: +255 22 2460735
Email: met@meteo.go.tz

Authors and contributors

Tanzania Meteorological Authority (TMA)	Dr. Agnes Kijazi, Dr. Ladislaus Chang'a, Mecklina Merchades, Isack Yonah, Hellen Msemo, Pamela Levira, Mathew Ndaki and Dr. Habiba Mtogori
Norwegian Capacity (NORCAP)	Jacqueline Tesha

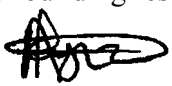
NOTE
The content of this book relied solely on the information gathered during implementation of GFCS APA I and II activities in Tanzania. The findings, interpretations, expressions and conclusions made in this publication, reflects authors' opinions and not necessarily TMA or any other organisation mentioned.

FOREWORD

The impacts of climate change are progressively being felt across Tanzania with overwhelming consequences. Extreme weather events are now occurring with increased frequency and severity threatening to reverse the development gains on the country while making it harder to attain the Tanzania development Goals, the Regional climate commitments, the continental blueprint "Agenda 2063", and the Sustainable Development Goals. Enhancing climate change adaptation through research and sharing of experience remains the most critical avenue to enhance resilience to the most vulnerable communities worldwide. However, financial and technical capacity constraints mainstreaming of weather and climate information to adaptation programs, strategy, policy and practices.

This book contributes to filling this gap. It identifies how the Global Framework for Climate Services Adaptation Programme in Africa (GFCS-APA) can increase climate change resilience through promoting the use of climate services at all levels**.** The book also comes at the time most needed when countries are updating, revising, and implementing their Nationally Determined Contributions (NDCs) to comply with the Paris Agreement. The book also provides insight for TMA stakeholders in mainstreaming climate services to adaptation programs, polices and strategic processes. It further enhances collaboration, minimize duplication of efforts, and maximize adaptations gains with minimum inputs.

It is my expectation that the GFCS-APA programme highlights promising practices and provides transferable lessons and opportunities for building resilience to climate-related risks and impacts.



Dr. Agnes Kijazi
Director General - TMA, PR of Tanzania with WMO and Third Vice President of WMO

ACKNOWLEDGEMENT

The Global Frameworks for Climate Services Adaptation Programme in Africa (GFCS -APA), is a multi-agency programme aimed at enhancing resilience of the most vulnerable communities to the adverse impacts of climate variability and change. Phase I was intended to be a "proof of concept," which turns out to be successfully and hence led to Phase II, which built on the accomplishments of the initial phase. This book shares experience of the GFCS-APA programme in Tanzania and also serves as a reference document in mainstreaming climate information and products to adaptation programmes, policies, and practices. The experience shared in this book will be a catalyst to similar initiatives in other parts of the world, particularly in Africa.

I wish to express gratitude to the National Steering Committee (the Tanzania Disaster Management Council -TADMAC) and Tanzania Meteorological Authority (TMA) management for technical support in the preparation of this book. Special thanks go to the Royal Government of Norway through WMO for the financial support for development of this book. I recognize the endless effort and dedication of my fellow Project Delivery Team (PDT) members, for bringing this book into existence. Further vote of thanks goes to Ministries' PDT Team members represented by Dr. Freddy Manyika (VPO-Vice President's Office); Mr. Edgar Senga (PMO-Prime Minister's Office); Mr. Geofrey Mchau, Mr. Theophil Likangaga, and Mr. Anicetus Honest (MoHCDGEC-Ministry of Health Community Development Gender Elderly and Children); and Ms. Jane Marwa and Mr. Ombaeli Lemweli (MoA-Ministry of Agriculture). I also commend contributions from Prof. Pius Yanda (IRA UDSM-Institute of Resource Assessment from University of Dar es Salaam) and Dr. Patric Ndaki (CCCS UDSM-Centre for Climate Change Studies from University of Dar es Salaam) whom both represented higher learning

institutions. In addition, my appreciation goes to Mr. Renatus Mkaruka and Mr. Allen Mutalemwa (TRCS-Tanzania Red Cross Society), Mr. Juvenal Kisanga (WFP-World Food Programme), and Mr. Barthazary Rweyengela (WHO-World Health Organisation) who represented International organization.

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Dr. Ladislaus Chang'a
TMA Director of Research and Applied Meteorology
and GFCS PDT Chairperson

EXECUTIVE SUMMARY

The available body of knowledge confirms that climate variability and change are the global challenges of our time and their adverse impacts are evident across countries and communities worldwide. These impacts pose high risks and threaten livelihoods of millions; and negatively affect ecosystems. The adverse impacts of climate variability and change have increased recurrence and intensity of extreme weather events such as floods and drought, sea level rise and incidences of pests and diseases in some areas. All these have had far-reaching negative implications on food and nutrition security, livelihoods, and the economies at large. The least and developing countries are more vulnerable to extreme weather events and slow-onset events such as drought, due to their overdependency on climate-sensitive sectors such as agriculture, forestry, tourism and fisheries.

Considering the increasing adverse impacts of climate variability and change, mainstreaming climate services and information cannot be overemphasized. This calls for a need to support vulnerable communities, governmental and non-governmental entities to access and use relevant climate information for planning and decision-making, therefore enhancing adaptive capacity at all levels.

With support from World Meteorological Organization (WMO), Tanzania Meteorological Authority (TMA) as a Lead Institution, implemented a pilot program titled GFCS –APA; with the overarching goal of enabling better management of climate risks, variability and change at all levels, through development and incorporation of science-based climate information and prediction services into planning, policy and practice. This multi-agency programme was implemented from 2014 to 2016 (Phase I) and from 2018 to 2020 (Phase II). The pilot areas for this program were Longido, Kondoa and Kiteto districts

in Tanzania. This book presents experience emanating from the implementation of the program, and provides key recommendations for relevant stakeholders to empower governments to mainstream climate information and services in decision-making.

This book contains four chapters which provide overview of implementation of GFCS proromme in Tanzania.

Chapter 1 provides details of the programme's background and its implementing partners. For both phases, partners of the programme were the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC), Ministry of Agriculture (MoA), Tanzania Meteorological Authority (TMA), University of Dar es Salaam (UDSM), CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Tanzania Red Cross Society (TRCS), World Food Programme (WFP), and World Health Organization (WHO).

Chapter 2 of this book provides highlights of the activities that were implemented during both phases with regard to the five components (pillars) of the GFCS programme, namely Observations and Monitoring; User Interface Platform; Climate Services Information System; Research, Modelling, and Prediction; and Capacity Building. Activities implemented in this multi-agency programme were carried out from 2014 to 2016 (Phase I) and from 2018 to 2020 (Phase II) in two African countries namely Tanzania and Malawi. In Tanzania, pilot areas were Longido, Kondoa and Kiteto districts.

Notable achievements in the implementation of GFCS programme in Tanzania include, designation of the Tanzania Disaster Management Council (TADMAC) formerly known as TANDREC (Tanzania Disaster Relief Committee) chaired by the Prime Minister's Office to serve as the National Steering Committee of the Programme; development of

the National Framework for Climate Services (NFCS); rehabilitation of earth dam; establishment of environmental clubs in primary and secondary schools; inclusion of climate and health module in 6 health institutions; formation of community listening groups; development of climate change, health communication strategy; and capacity building interventions. Other achievements are provision of tailor-made climate information; and enhancing availability, accessibility, and application of climate information to users in Agriculture and Food security, Health and Disaster Risk Reduction (DRR).

Nevertheless, a number of best practices highlighted include, the use of mobile phones both voice and SMS for climate information sharing, use of community radios for disseminating weather and climate information, translation of weather information to Maasai language, having in place a GFCS governance mechanism at national level, and existing dialogues between climate service providers and users.
The lessons learned during the implementation of the programme include; the need for participatory approach during programme designing for project ownership and sustainability; the need for adequate climate observation network, to enhance production of high-resolution climate information; and the availability of feedback mechanism between the provider and user of climate services.

A number of challenges encountered during implementation of the programme include limited awareness on the importance of climate information and products in planning, increasing demand for high-resolution information, and sustaining initiatives and expectations beyond the programme life span. The details on achievements, best practices, lessons learned and challenges are further explained in Chapter 3.

Chapter 3 of this book acknowledges challenges and gaps in provision of climate services that were observed during implementation of both phases in Tanzania. The gaps need to be addressed through enhancing

technical capacities and the use of technology in systematic observation and monitoring; enhanced technical capacities in packaging and delivery; enhanced user capacities in interpretation and application of climate information; and enhanced capacity in research to generate more information relevant to support continued service provision. Lastly there is a need for coordinated efforts to ensure mainstreaming and integration of such relevant information into policies, strategies, plans and budgets across levels and sectors.

It is imperative that most of the adaptation programmes in developing world collectively focus to build resilience to the impacts of climate change. This programme builds to already available policy guidance and tools. The findings to this programme points ten key recommendations for policy-makers and development practitioners to ensure that climate information services are at the heart of climate change adaptation agenda in developing countries:

i. Promote collaboration between government bodies, international communities, local and non-governmental actors;

ii. Promote digital technology (radio, Farm-SMS through mobile, internet) in disseminating climate information services;

iii. Participatory approach at all level is key to enhance project ownership and sustainability;

iv. Improve climate observation network for production of high-resolution climate information;

v. Feedback mechanism between the provider and user of climate services for continuous improvement;

vi. Enhance technical capacities on the use of technology in systematic observation and monitoring, packaging and delivery of climate information;

vii. Enhance user capacities in interpretation and application of climate information;

viii. Enhance capacity in research and information sharing to generate more information relevant to support continued service provision;

ix. Coordination of efforts is key to ensure mainstreaming and integration of such relevant information into policies, strategies, plans and budgets across levels and sectors.

x. Mobilizing political will at all level is key to sustain all the efforts.

Chapter 4 provides conclusion and recommendations for sustaining the initiative in enhancing climate services and its applications in socio-economic development. Key recommendations for mobilizing and enhancing policy and strategic process to increase mainstreaming of climate information and products in planning and implementation of all socio-economic activities are provided in this chapter. The chapter also provides recommendations on research priorities underpinning enhanced accurate and reliable weather and climate information, as well as cost effective dissemination and application of high-quality climate services.

LIST OF ACRONYMS

AR5	Fifth Assessment Report
CAN	Climate Action Network
CCAFS	Climate Change, Agriculture and Food Security
CCI	Centre for Community Initiatives
CICERO	Centre for International Climate and Environmental Research – Oslo
CMI	Chr. Michelsen Institute
CSIS	Climate Services Information System
DFID	Department for International Development
DRR	Disaster Risk Reduction
GFCS	Global Framework for Climate Services
IBCS	Intergovernmental Board on Climate Services
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Inter-Governmental Panel on Climate Change
MoA	Ministry of Agriculture
MoHCDGEC	Ministry of Health Community Development Gender Elderly and Children
NFCS	National Framework for Climate Services
NORCAP	Norwegian Capacity
NDC	Nationally Determined Contributions

NSC	National Steering Committee
PDT	Project Delivery Team
PMO	Prime Minister's Office
PSC	Project Steering Committee
SDGs	Sustainable Development Goals
TADMAC	Tanzania Disaster Management Council
TANDREC	Tanzania Disaster Relief Committee
TMA	Tanzania Meteorological Authority
TRCS	Tanzania Red Cross Society
UDSM	University of Dar-es-Salaam
UIP	User Interface Platform
UN	United Nations
UNDP	United Nations Development Programs
WFP	World Food Programme
WHO	World Health Organization
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMO	World Meteorological Organization
VPO	Vice President's Office

CONTENTS

1.0 CHAPTER 1: INTRODUCTION

1.1 Background

Tanzania is thriving to reduce vulnerability to climate variability and change aggravated by multiple stresses including high dependence on rain-fed agriculture, ineffective climate services, poor information capabilities, and weak adaptive capacity. Societies in developing countries including Tanzania, have suffered from climate variability for centuries, and are now experiencing impacts of climate change including increase in frequency and magnitude of extreme weather and climate events such as floods and drought. The three Inter-Governmental Panel on Climate Change (IPCC) special reports (i.e. IPCC special report on global warming of 1.5^0C, IPCC special report on climate change and land, and IPCC special report on climate change, ocean and cryosphere) in the sixth assessment report cycle (AR6) are consistently and more clearly highlights the aggravated and consequential impacts of climate change in human and social systems, particularly in developing countries. Increasing frequencies and insecurity of weather and climate extreme are gradually causing devastating socio-economic impacts and possess greater challenges and risks for achievement of SDGs and national development strategy. This requires enhanced generation and utilization of high quality and more reliable and actionable climate services to underpin effectiveness in adaptation and mitigation efforts, and reducing risks attributing to climate variability and change.

One of the measures to address climate-related risks and the impacts of climate change challenges is the use of climate services. Climate services refer to scientifically based information and products that enhance users' knowledge and understanding about the impacts of climate on their decisions and actions. It involves the provision of tailored information and its impacts on natural and human systems,

as well as the application of that information for decision-making at various levels of the society. Climate services can help vulnerable communities to address climate-related risks by providing timely and accessible tailored climate information needed to make well-informed decisions. This underscores the need for better integration of climate services into socio-economic activities, through the implementation of Global Framework for Climate Services (GFCS).

1.2 Origin and overview of GFCS

The GFCS programme started as an UN-led initiative spearheaded by the WMO in 2009 at the third World Climate Conference, held in Geneva, Switzerland. In 2010, WMO formed a high-level task force that was responsible to design and propose elements of the framework. The task team was then established in 2011 and developed the GFCS implementation plan. In 2012, the WMO Extraordinary Congress adopted the plan and established the Intergovernmental Board on Climate Services (IBCS).

On 20th November 2013, WMO and Norwegian Ministry of Foreign Affairs signed a Memorandum of Understanding (MoU) for the implementation of the project in Africa. The GFCS programme was first implemented as a pilot project for three years (2014-2016) in Tanzania and Malawi, and was known as "Climate Services Adaptation Programme in Africa (APA)". Phase II commenced in 2018, and was implemented for two consecutive years. Phase II builds on Phase I and aims to further improve national and regional coordination in Malawi and Tanzania. The goal of the programme was to enhance the capacity of National Meteorological and Hydrological Services (NMHS) to respond to extreme weather events and climate change through improved provision of climate services. The implementation of Phase II was expected to improve climate services delivery for agriculture and food security, health, and Disaster Risk Reduction (DRR).

The implementation of the programme in Africa was a joint effort between WMO, the CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS) and the Centre for International Climate and Environmental Research – Oslo (CICERO). Other implementing organizations were the Chr. Michelsen Institute (CMI); the International Federation of Red Cross and Red Crescent Societies (IFRC); the World Food Programme (WFP); and the World Health Organization (WHO).

These agencies worked together on delivering climate services and represented a unique approach that included natural and social scientists, as well as development and humanitarian agencies. The WMO was the lead organization of the partnership. This was the first multi-agency initiative to be implemented under GFCS programme in Africa. The programme represented a unique partnership between climate and social scientists, researchers, development and humanitarian agencies, and users of climate services such as farmers and livestock keepers. It facilitated the development of high-quality climate services and promoted its use for management of risks attributed to the impacts of climate variability and change. The Framework was designed to mainstream climate information into decision-making at all levels and ensures every climate-sensitive sector is well equipped to access and apply relevant climate information.

1.3 GFCS priority areas

The implementation of GFCS APA in Tanzania focused on three priority areas:

Agriculture and Food Security: about 80% of Tanzanians rely on subsistence agriculture, such as crop production, livestock keeping and fishing for their livelihoods. These sub-sectors are highly vulnerable to the adverse impacts of climate variability and change. Marginalized communities are the most impacted due to limited assets, tools, and

technology to absorb shocks emanated from recurrent drought, floods, and increased incidences of pests and diseases. GFCS programme aimed to facilitate the timely provision, access of weather and climate information the most vulnerable communities to reduce climate impacts through timely planning and making informed decisions.

Disaster Risk Reduction: studies show that about 90% of disasters occurring around the world are hydrometeorological related including cyclones, storm surges, strong winds, extreme temperatures, landslides and wildfires. The Intergovernmental Panel on Climate Change (IPCC) Special Report on Managing the Risks of Extreme Events and Disasters concludes that all sectors of the economy and environment will be impacted by climate variability and change, particularly increased frequency and intensity of extreme weather events. Disaster preparedness managers need to have advance warning of weather and climate extremes, to help communities proactively plan their resource allocation for water, food, medication and other core services. GFCS implementation has contributed to availability and accessibility of early warning information to facilitate disaster response and preparedness.

Nutrition and Health: Many infectious diseases have seasonal cycles that are influenced by changes in spatial and temporal prevalence. The seasonality of the diseases is driven by changes in weather and climate elements such as rainfall, temperature and humidity. The use of weather and climate information is key to improve public health under changing weather and climate and is a priority to GFCS-APA programme. Timely production, delivery, and use of weather and climate information are crucial to minimize health and nutrition emergences.

1.4 GFCS vision

The vision of the GFCS is to enable better management of risks of climate variability and change, and adaptation to climate change through development and incorporation of science-based climate information and prediction into planning, policy and practice on global, regional and national scales.

1.5 Goal

The goal of the framework, which supports the vision, is to increase resilience of the most vulnerable communities to impacts of climate change through timely production, delivery, and use of climate information for planning and decision-making.

1.6 Objectives

The key objective of implementing GFCS-APA programme in Africa is to strengthen capacity of government institutions to co-produce and to timely disseminate climate services, to the end users to better reduce vulnerability to climate-related hazards and impacts. Other objectives include:

i. Strengthening Observation and Monitoring meteorological data networks and infrastructure for improving quality of climate data;
ii. Strengthening collection and archival of weather and climate data;
iii. Improving mainstreaming of climate information to key climate sensitive sectors of Agriculture, Health and Disaster department through promoting uptake of climate information by demonstrating the value of the services in socioeconomy, safety and sustainability;
iv. Strengthening research, modeling, and prediction of weather and climate through addressing data gaps;

v. Strengthening capacity building through engagement of providers and users of climate services at both technical and decision-making levels; and

vi. Maximizing the utility of existing climate service infrastructure

1.7 Pillars of GFCS

The GFCS program is a user-driven process with five essential components or pillars (Figure 1) that are needed to ensure effective climate services are possible. The pillars are primarily meant as conceptual models of which in practice there has been some overlapping of functions and responsibilities. The pillars are as follows;

- **Observations and Monitoring:** This pillar aims at ensuring availability of climate observations necessary for provision of the required climate services. Effective climate services require well-distributed observations at spatial and temporal scales. Climate observations are critical for the generation of tailor-made climate information and products useful for monitoring and managing climate-related risks. Thus, long-term observations and improved weather observation network are essential for better climate services.

- **User Interface Platform (UIP):** This pillar provides a means for users and providers of climate services to interact. It strengthens the interactive communication mechanism for information exchange between users and providers at national and local levels, which is vital for enhancing access to climate services in various sectors. It also facilitates users of climate services to understand and effectively utilize climate information and products. The UIP includes climate forums and information dissemination channels.

- **Climate Services Information System (CSIS):** This pillar provides mechanisms through which information about climate (the past, present, and future) is routinely collected, archived, and generated. This pillar fosters on delivery of climate information and products through operational mechanisms, technical standards, communication, and authentication. Digital technology is key to facilitate on time delivery of climate information and services.

- **Research, Modeling, and Prediction:** This pillar assesses and promotes research, modeling, and prediction of weather and climate information. Strengthened climate research, modelling, and predictions are key to develop climate application that serves a wide range of socio-economic sectors, across landscape. It could also target tailored research aimed at meeting individual stakeholder's needs. GFCS-APA programme builds on existing research, modelling achievements and promotes further research on climate services through collaborations with other institutions to close the existing research gaps.

- **Capacity Building**: This pillar supports systematic development of institutions with necessary infrastructure and human resources. GFCS program focuses on strengthening institutional capacity in production and delivery of climate services for improving health, food security, and disaster risk reductions. It enhances the existing capabilities to provide climate services more effectively by establishing information sharing mechanisms and providing climate services to support sector needs.

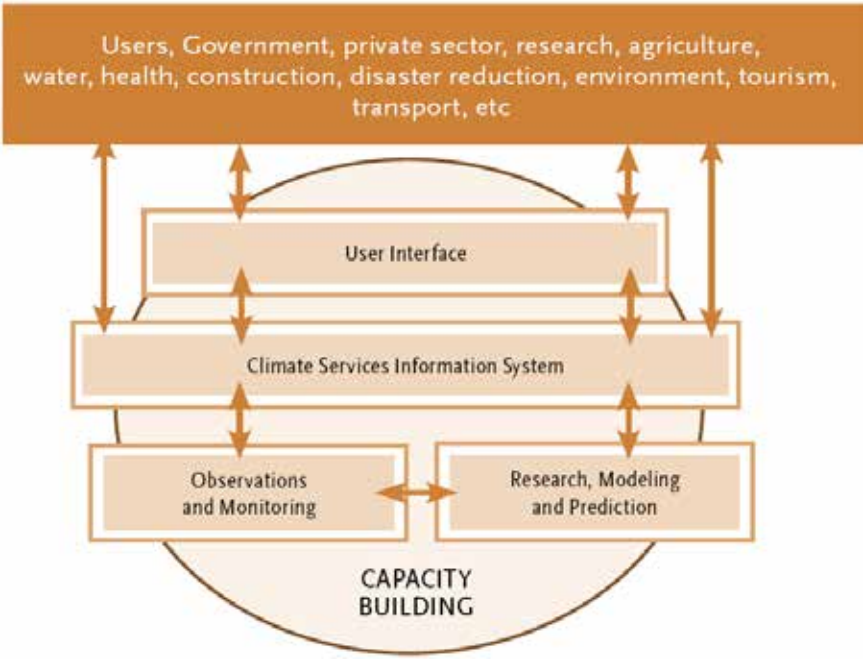

Figure 1: Pillars of the GFCS Program

1.8 GFCS programme governance mechanism in Tanzania

GFCS APA was governed by three bodies, namely; the Project Delivery Team (PDT), National Steering Committee (NSC) and the Global Program Steering Committee (GPSC). The composition and roles of each body are outlined below:

i. **PDT:** This is a national level organ responsible for planning and implementation of joint activities as well as monitoring progress of programme activities. The PDT meets on quarterly basis and is chaired by TMA, a WMO's main local partner for the program. Members of PTD includes Vice President's Office (VPO), Prime Minister's Office (PMO-Disaster Management Department), TMA, WFP, TRCS, MoA, WHO, UDSM,

NORCAP and MoHCDGEC. The program has a designated desk officer, who works on GFCS on daily basis in consultation with a senior technical advisor, who provides technical support on the implementation of the project. Depending on nature and sensitivity of the agenda, the PDT invites other stakeholders to participate in its meetings to share their roles and experiences in supporting the development of climate services. Invited participants have included development parties, non-governmental organizations, UN agencies and other private sectors. Some of the invited participants who have participated in PDT meetings include World Bank (WB), Department for International Development (DFID), Centre for Community Initiative (CCI), Climate Action Network (CAN) and United Nations Development Program (UNDP).

ii. **NSC:** This committee is a national level organ mandated to oversee the implementation of GFCS including the development and the implementation of the National Framework for Climate Services. The formerly Tanzania Disaster Relief Committee (TANDREC) currently known as Tanzania Disaster Management Council (TADMAC) serves as the National Steering Committee (NSC) for Tanzania. TADMAC is a high-level council bringing together permanent secretaries from all key climate sensitive ministries and meet on a bi-annual basis, under the chairmanship of the permanent secretary of the prime minister's office.

iii. **GPSC:** This is a committee at global level responsible for

overall management and oversight of the programme and strategic decision making. The Global Project Steering Committee (GPSC) comprises of representatives from each GFCS partner organization at the global level including WMO, WFP, WHO, IFRC and NORCAP. GPSC meets biannually and is chaired by WMO. In addition, GPSC meets annually with the donor (NORAD) and reports implementation progress of the programme.

2.0 CHAPTER TWO: IMPLEMENTION OF GFCS ADAPTATION PROGRAMME IN TANZANIA

The GFCS implementation for phase I in Tanzania started in February, 2014 with the kickoff meeting which aimed at creating understanding of the programme; whilst phase II commenced on September, 2018 with a technical meeting, that discussed the achievements, challenges and lesson learned during phase I, and then plan activities for phase II. The technical meeting was followed by a launching event. The implementation of GFCS phase I and II focused on areas with existing initiatives towards climate change adaptation. WFP in collaboration with the Ministry of Agriculture (MoA) implemented project activities in Longido, Kondoa and Kiteto districts, while TRCS focused in Kiteto district. These three project pilot areas of Longido, Kondoa and Kiteto districts are located in the north-eastern part of Tanzania. WHO in collaboration with the MoHCDGEC implemented their activities primarily in the three pilot districts and in other parts of the country. The project being a multiagency programme, the coordination, implementation and reporting of activity progress were discussed during quarterly PDT meetings, where each partner presents the implementation progress and the plan for the next quarter.

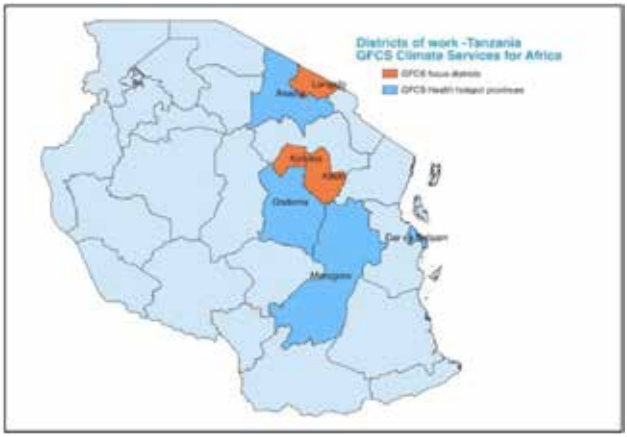

Plate 1: GFCS project areas in Tanzania

2.1 Steps towards implementation of GFCS programme in Tanzania

The implementation of GFCS programme in phase I had three steps, which were the, Kick off meeting, National stakeholders consultation workshop, and baseline survey. The details of the implementation steps are as follows:

2.1.1 Kick-off meeting

The kick-off meeting was organized in Dar es Salaam, Tanzania with the objective of enlightening participants on the program, validating the process for the national consultation, and formulation of the governance mechanism. The meeting brought multi institutional stakeholders that included the implementing partner organizations namely World Food Programme (WFP), World Meteorological Organization (WMO), International Federation for Red Cross and Red Crescent Societies (IFRC), Center for International Climate and Environmental Research-Oslo (CICERO), World Health Organization (WHO), Tanzania Meteorological Authority (TMA), Embassy of Norway, CIGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Chr. Michelsen Institute (CMI), International Research Institute (IRI). Representatives from Government Ministries and institutions that attended the meeting were, Ministry of Agriculture (MoA), Ministry of Health, Community

Plate 2: Participants of the Kick off meeting held in February, 2014 in Dar es Salaam –Tanzania

Development, Gender, Elderly and Children (MoHCDGEC), National Malaria Program (NMP), Disaster Management Department (DMD), University of Dar es Salaam (UDSM), Sokoine University of Agriculture (SUA). Also, there were participants from the Non-Governmental Organizations (NGOs) including Climate Consult, Centre for Weather Climate Application and Research (CWCAR), Environmental Protection Management Services (EPMS) and Tanzania Red Cross Society (TRCS).

The meeting addressed an overview of GFCS programme and its sustainability (i.e. programme financing), partnership arrangements, overall aim of the program, outcomes, outputs, activities, as well as the governance mechanism and its composition. The meeting outcomes were the agreement of a three-tier governance mechanism namely Global Program Steering Committee (GPSC), National Steering Committee (NSC), and Program Delivery Team (PDT). The GPSC is composed of the global project partners while PDT is composed of their counterparts' national organizations. Formulation of PDT also took consideration of including other partners in the programme such as Disaster Management Department (DMD), vice president's office (VPO), higher learning institutions, etc. so as to have an in-depth composition of key stakeholders for climate services and political recognition of the programme as well as involvement of policy makers.

2.1.2 National stakeholders consultative workshop

The National stakeholders' consultative workshop was organized in Dar es Salaam, aiming at identifying the institutional and operational needs, gaps, and capacities of climate services in the agriculture, food security, health, and disaster risk reduction sectors in Tanzania. The meeting brought multi institutional stakeholders that included the implementing partner organizations and institutions, including the Norwegian Embassy, International Research Institute (IRI), representative

from Government Ministries and institutions, as well as Non-Governmental Organizations (NGOs). The workshop deliberated on planned activities, coordination between partners, and delivery of climate services according to user needs. Moreover, the governance mechanism was discussed with more focus on the structure of NSC and formulation of the task team to oversee the implementation of the recommendations of the workshop. The meeting outcomes included identification of user needs, which includes timely delivery of climate services and provision of specific weather information; the meeting also recommended TANDREC currently known as TADMAC to be the NSC and the Disaster Management Platform to serve as a forum for sustained dialogue between providers and users of climate services. TADMAC (Tanzania Disaster Management Council) has replaced TANDREC (Tanzania Disaster Relief Committee) in order to improve national disaster management. TADMAC is composed of same members of TANDREC who are the permanent secretaries from different ministries responsible for disaster managements and heads of early warning institutions in which Tanzania Meteorological Authority (TMA) is among them. TADMAC was enacted to be the NSC for GFCS in Tanzania since it has immeasurable experience in responding to disasters of different nature, and providing early warnings to communities. Also, it has members from different government ministries and institutions that can be key in supporting and guiding the successful implementation of the programme.

Plate 3: Participants of the National Stakeholders consultation workshop identifying climate services needs in May 2014 in Dar es Salaam

2.1.3 Baseline Survey

The baseline survey was conducted in GFCS pilot areas of Longido and Kiteto districts. The survey aimed at conducting a situation analysis of climate information and advisory services available in GFCS pilot areas. The key insights and findings from the survey guided GFCS partners in the implementation of program activities. The tools developed for the baseline survey include both structured individual household questionnaire and key informant interview guide. During questionnaire administering, gender aspects were reflected as men, women, youth and elderly in providing their views on the need for climate services. The preliminary findings of the survey showed that the communities were relying on indigenous knowledge for crops and livestock management. They were trusting information delivered by the government extension officers, as there is a well-established network of government extension services that often serves farmers and livestock keepers. Further, the scientific information was not disaggregated at village scale and not disseminated on a timely manner, and thereby of low relevance and usefulness for farm households' decision-making. The findings of the baseline survey facilitated the setting of indicators on access, needs, and use of climate services that were monitored during the project implementation for assessing changes in the beneficiaries' livelihood as a result of the program.

2.2 Activities implemented under GFCS APA Phase I and II in Tanzania

This section provides a detailed description of implemented activities and outputs of the project. The description of activities hereunder is based on the five pillars of GFCS program.

2.2.1 Activities implemented under the pillar of User Interface Platform (UIP)

GFCS implementation emphasized to reduce the gap between providers and users of climate services, so as to facilitate understanding and effective use of climate services and information. UIP is a means for interaction, which enhanced communication mechanism for information exchange between users and providers of climate services. The activities conducted under this pillar included identification of user needs, sensitization seminars and community education on climate services, exchange visits, formation of community listening groups, etc.

i. Identification of user needs in climate services

Implementation of GFCS program emphasized the identification of user needs in climate services, in order to provide sector specific tailor-made climate information and products. Stakeholders workshops and seminars were conducted to identify user needs for climate services in agriculture, food security, health, and disaster risk reduction in Tanzania. The workshops methodology included presentation on climate services provided by TMA then followed by group discussions and presentations. Participants were able to understand climate information provided by TMA and proposed their climate service needs. The needs

Plate 4: Participants of the stakeholders' workshop to identify users' needs, March 2015, Dar es Salaam

for climate services recommended by participants were; downscaled weather forecast, the use of extension officers to disseminate weather information and the use of Swahili language when communicating weather information. Moreover, end users proposed suitable dissemination mechanisms for climate information such as mobile phone-based system (SMS or phone call), E-mail, media (Television and Radio) and social media (Facebook, Twitter, and Instagram).

ii. Sensitization seminars and community education on the application of climate information and products

Amongst the findings of the baseline survey was stakeholders' limited awareness on climate services provided by TMA in the pilot districts. This hinders effective application of climate services in socio-economic planning and development. To address this challenge, TMA as the designated authority in provision of climate services in Tanzania has organized and conducted several sensitization seminars and meetings in Longido and Kiteto districts. The major aim of the meetings and seminars was to sensitize the farming and pastoralists communities on the use of climate information and services provided by TMA, as an adaptation measure to the impacts of climate change. The meetings were conducted at village levels, whereby all key stakeholders from all identified project villages were invited, this include but not limited to smallholder farmers, livestock keepers, extension officers and other district officials, students, e.t.c. About 641 farmers and pastoralists were

Plate 5: The Director General of TMA, Dr. Agnes Kijazi addressing farmers and pastoralists from Longido district

reached in 14 villages in both districts during phase I implementation and during phase II more than 460 farmers and pastoralists from 8 villages were reached. In addition, during seminars and meetings, user needs were also identified, these include improvement of dissemination system and the use of simple language when communicating climate information.

In adjacent to sensitization seminars, TMA also conducted awareness raising campaigns on the use of climate forecast to the general public in pilot project districts. The campaigns were carried out through public meetings, churches and mosques services, household visits as well as notice boards posters. These campaigns aimed at providing understanding and raising public awareness on climate forecast and its use in reducing risks of climate variability and change in socio-economic activities. The campaigns also emphasized on the understanding of forecast contents especially the onset, cessation, rainfall amount, intensity and distribution.

iii. Knowledge sharing exchange visits

As a way of learning, exchanging and sharing knowledge on climate change adaptation, TRCS organized several exchange visits for Red Cross volunteers, farmers, and livestock keepers from Ndaleta, Makame, Olpopong and Kibaya villages in Kiteto district. During the exchange visits,

Plate 6: A pastoralist sharing his experience during an exchange visit that was organized by TRCS in Kiteto, Tanzania

the participated communities were able to learn rotation livestock management, methods for reserving pastures, use of seasonal calendar (timely planting and field management), farmer field schools, preparation of compost manure, dam management, establishment of water user committees, managing tree nurseries and tree planting, etc. These exchange visits enabled participants to grab necessary skills and knowledge from best practices, testimonies and through hands-on activities. Exchange visits were conducted in both implementation phases, and have been a wonderful opportunity for farmers and pastoralists to learn from their peers. During the visits, participants shared their best practices, achievements, and lesson learned so that other participants can learn. Challenges were also shared by those who have encountered some, so that they can be advised by their peers and how to address them. Overall, these visits were very successful as they have provided an avenue for farmers and pastoralists in the pilot project district of Kiteto to meet, network and learn from each other.

iv. Identification of community radios and formation of community listening groups

Due to high impact and the role played by community radios in rural areas, GFCS programme engaged with Farm Radio International (FRI) to disseminate seasonal and dekadal weather forecasts with their corresponding advisories to farmers and livestock keepers in Longido, Kiteto and Kondoa districts. FRI conducted a qualitative formative research through focus group discussions in all three pilot districts. The formative research team learned on the preferred methods for farmers and pastoralists to listen and be involved in the radio programs (i.e. time of listening, preferred format, use of SMS or IVR, etc.). Also, the team explored with listeners what kind of ICT tool they would prefer to access information from remote locations where there is weak or no radio coverage (e.g. WhatsApp group, IVR, voice messaging or recorded programs played on MP3). During the research, the team also

assessed the stations' technical viability and checked on the coverage of potential radio stations, so as to understand and ensure how best to reach the widest area of targeted listeners. The identified radio stations were Mwangaza Fm in Kiteto district, Irangi Fm in Kondoa district and Olkonorei radio in Longido district.

Plate 7: Identified women listening group in Kolo village in Kondoa district, in August 2019.

During the formative research, the district extension officers worked hand-in-hand with the project team to identify existing farmer groups who would listen to radio programs every week as a group activity. About 60 Community Listeners Groups (CLGs) across the three districts were actively engaged and benefited from climate and weather information services provided by the project. Therefore, 20 CLG were identified in each district. Out of the 60 CLGs, 38 CLGs had exclusively female members, this was so in order to involve more women in the project, since they are the main work force in the villages, and also have been affected easily and extensively be climate change. The CLGs were expected to listen to the radio programs and provide feedback on the effectiveness of the programs to the broadcasters, extension officers and the project team to enhance the delivery of the programs. The CLGs had a good representation of women in particular, to ensure that women listen to the programs and provide feedback on how the project can better address their priorities and needs.

The CLGs were using solar-powered MP3 radio in remote areas where there is no radio coverage; the radios which were provided by the project.

The role of the CLGs commenced immediately when the first program goes on air. The CLGs used SD cards and mobile phones as mechanisms for sending their feedbacks to the broadcasters. The broadcasters reviewed the feedbacks and respond to issues or questions during the programs, supported by the project officer or extension/TMA expert as relevant.

Plate 8: The farmer tuning the solar-powered MP3 radio provided by the project.

2.2.2 Activities implemented under the pillar of Climate Services Information System

Climate Services Information System (CSIS) is an important factor in operationalization of GFCS. It involves collection and processing of data to generate and deliver climate information and products to stakeholders. Several activities were implemented under this pillar as follows:

i. Production of downscaled seasonal forecasts

TMA has been producing seasonal weather forecast for planning and decision-making for various socio-economic sectors in Tanzania. The downscaled seasonal forecasts were produced to respond to user needs which rose during stakeholder meetings and seminars conducted under GFCS programme. Before implementation of GFCS programme in Tanzania, seasonal forecast was merely downscaled for Lushoto and Sengerema districts. GFCS program through CCAFS and IRI has built the capacity and skills of TMA staff to downscale seasonal

forecast by using Climate Predictability Tool (CPT). The downscaling was performed for every seasonal outlook (i.e. "Masika" (March, April, May) and "Vuli" (October, November, December). This has resulted into the upscale of downscaled seasonal forecasts for Kiteto, Longido, and Kondoa districts. The downscaled seasonal forecasts were disseminated to end users of Longido, Kondoa and Kiteto districts through sensitization seminars, intermediaries, volunteers, media, website, emails, community radios and mobile phones (FarmSMS and Beep4Weather). Availability of downscaled seasonal forecasts in these districts has contributed to effective use of climate information in socio-economic activities.

Plate 9: TMA staff during downscaling of seasonal weather forecast (MAM) for project pilot districts in February 2019

ii. Co - Production of the seasonal forecast

The national climate outlook fora (NCOF) have been routinely conducted by TMA as part of the seasonal forecasting process. The overall aim of the NCOF was to receive comments on the package of seasonal forecast and build capacity to all stakeholders who have been using and/or reporting weather information. Also the fora were used to verify and evaluate performance of the previous seasonal forecast. The fora brought together key stakeholders from different sectors at national level, this include stakeholders from Government institutions, sector ministries, district officials, community representatives, NGOs, Civil Society Organizations (CSOs), Community Based Organizations (CBOs), UN agencies and media (television, newspapers, radio, blogs, etc.) to mention a few. The workshops addressed and discussed

various seasonal forecast aspects such as the MAM (March April May) and OND (October November December) weather outlook, expected impacts, understanding of meteorological terms in seasonal weather forecast, dissemination of seasonal weather forecast, etc.

Plate 10: Participants of the National Climate Outlook Forum in February 2019

During the fora, the forecast process of the seasonal outlooks was presented, followed by verification of the past seasonal outlook. Participants were informed on the performance of the previous season forecast, by pointing out the percentage correctness of the forecast and explaining scientific reasons for the deviation in predictability. Then the expected forecast for the next season is presented. Participants were divided into different sector groups (agriculture, health, energy, local government, natural resources and tourism, infrastructure, disaster management, etc.) for discussion on seasonal forecast, expected impacts, forecast packaging, language and dissemination methods to the general public. When the seasonal forecast is complete, it is disseminated through a press release and other proposed dissemination channels for public use. GFCS programme facilitated the inclusion of a wide range of stakeholders in the fora for tailoring seasonal forecast for stakeholders' use.

iii. Media engagements in dissemination of seasonal forecast

Plate 11: Packaging of MAM seasonal forecast with Media in February 2019 in Dar es Salaam

Media has an important role in climate services in facilitating dissemination of climate and weather information to communities. However, limited understanding of climate information by media has been impairing effective communication of climate information. In bridging this gap, TMA as the authorized provider of climate services took the initiative to engage with media and build them with required capacity in understanding and reporting weather and climate information. TMA organized a series of training workshops before launching of the seasonal forecasts. The aim of the training was to build capacity of media participants in reporting weather information. The training workshops were attended by participants from various media houses including television (TBC, Channel Ten, StarTv, Azam Tv, ITV, etc.), radio (Kiss FM, Clouds FM, Radio One, etc.), newspapers (Habari Leo, Mwananchi, etc.) and blogs (Michuzi blog, etc.).

The workshops addressed various aspects including the role of media for effective implementation of GFCS in Tanzania, understanding meteorological terms in seasonal weather forecast, how to report seasonal weather forecast without distorting the intended message, and receiving comments on the package of seasonal weather forecast. The workshops were a great avenue for media representatives to provide suggestions on the content, language and format of weather forecasts.

Most of the suggestions were addressed during implementation of GFCS such as the availability of forecast in social media, the use of simple language and reduction of the number of pages on the seasonal forecast statement. These media training workshops were very effective in enhancing understanding of climate information and in ensuring timely, accuracy and efficient dissemination of climate information in the country.

iv. Content development for community radio programs

Dissemination of well packaged radio programs is imperative for GFCS APA Programme, this is why Farm Radio International (FRI) organized workshops to develop content relevant to farmers and pastoralists for the programme districts. The workshops brought together different project stakeholders to develop a detailed outline of the radio program structure and contents. Stakeholders involved were radio broadcasters; technical staff e.g. representatives from the TMA, MoA, DMD, District extension officers; representatives from the group of Traditional leaders; farmers and pastoralists as well as NGOs working in the project area such as Pastoral Women Council (PWC) and Maasai Women Development Organization (MWEDO).

During the workshops, participants performed resource allocation mapping to identify resources/inputs that farmers and pastoralists need as well as products and outputs they get from activities they do. Participants also explored different gender roles or differentiate sources of labour depending on the activity. Farmers and pastoralists were among the participants and they provided in-depth information on their core activities for every week in a month. Participants also explored timing of the main agricultural activities (crop, livestock and livelihoods) by drafting a seasonal calendar. They explored how these activities can be affected by weather and climate and identified how weather and climate information could help in constructing seasonal

calendar for better management of their activities in the face of the changing climate.

Plate 12: Participants of the Program Content Development Workshop in Arusha, October 2019.

Participants also had an opportunity to discuss on the crops, livestock and livelihood options that may be suitable for their households. This exercise enabled participants to identify resources needed for implementation of seasonal activities.

All the information provided during the workshops enabled the project team and participants to come up with the format for the radio program that will be aired before, during and after the forecasted seasons (MAM and OND). For OND 2019 seasonal forecast the project team prepared 22, 18 and 19 topics for Kondoa, Kiteto and Longido district respectively. These topics were used by the broadcasters to produce episodes for community radio programs.

Plate 13: Participants during group discussions that resulted to the development of 59 radio programs.

The workshop also came up with Swahili drafted agri-tips which were short statements that convey key messages to farmers and pastoralists related to the topics for every week in each district. These agri-tips were

translated to Maasai so as to enable the message to reach Maasai communities who are mostly found in Longido and Kiteto districts. The key issue to be taken into consideration when broadcasting the programs was to ensure integration of seasonal weather forecasting, monthly weather forecasting and dekadal weather forecasting that is disseminated by TMA. The interpretation of the forecast and warnings will inform the decision-making process on the livelihood options for farmers and pastoralists in Kondoa, Kiteto and Longido districts.

To promote sustainability and effectiveness of the radio programs, FRI enacted a Content Advisory Panel, that were meeting once each quarter to provide technical backstopping and advice to the project team. The panel included the representatives from MoA, Disaster management department, District Agricultural, Irrigation and Cooperatives Officer (DAICO) from Kondoa, Kiteto and Longido districts, NORCAP, TMA, TRCS, MWEDO and FRI staff. The main roles of the panel were to identify information gaps and standardize the content/messages; identify if any misinterpretations existing regarding the content; ensure that the contents broadcasted on the radios are in line with what is being disseminated by stakeholders and development agents on the ground; create a synergy on the dissemination work in the fields and the media; ensure the information transmitted through radio is reliable and correct; assign one expert to be responsible in the content monitoring task; discuss and recommend on issues on risk management on the content; conduct field visit to assess progress of implementation in the respective districts; and also monitor and evaluate the implementation of the radio program activity.

The participatory and inclusive panel meetings assessed the processes and procedures that were undertaken from the commencement of the radio program activities. They were also observing the participatory tools and techniques used in the production and broadcasting of the radio programs. As part of promoting sustainability and increase

coverage of the program FRI partnered with MoA who was working closely with the Tanzania Broadcasting Corporation (TBC) in production of 52 radio programs that reach the entire nation in a year. FRI planned to integrate/engage the GFCS radio program activities with TBC to widen the coverage and enhance sustainability of the radio programs.

Plate 14: Members of the Content Advisory Panel during their second quarter meeting in August 2019, Arusha.

v. Climate information dissemination through FarmSMS system

In the quest of having increased number of reliable and effective ways of disseminating weather and climate information, TMA via GFCS programme enhanced a mobile phone SMS database system (i.e. FarmSMS), which is used to disseminate weather and climate information. FarmSMS is a mobile phone system operated by TMA, which aims at improving dissemination of weather and climate information to end users. FarmSMS has tremendously increased the number of climate information users by 60%. During phase I of GFCS programme there were 7,387 registered users and currently (as of January, 2020) there are about 15,883 registered users, and more users are still being registered to the system. Registered FarmSMS users receive dekadal and seasonal forecasts as well as extreme weather alert information. Each SMS sent to the users contains the forecast, impact of the forecast and advisory, this has improved planning and decision-making processes.

Weather information disseminated by TMA is customized based

on region and/or district in which the users are located; some users receive downscaled weather information based on their location, while other users receive generalized weather information for that particular region based on their geolocations. Currently, registered users are from 30 regions from both Tanzania mainland and Zanzibar. Due to the effectiveness of the FarmSMS system, TMA continued registering more users into the system so as to ensure each interested user receive weather information on a timely manner. Also, efforts werebeing made to extend the number of downscaled weather information to other districts, to ultimately increase the access and usage of the delivered weather information. Generally, FarmSMS system enhanced timely dissemination of climate information and had a potential of improving feedback mechanism between service providers, intermediaries, and users of climate services and information.

Plate 15: Registration of farmers and pastoralists into FarmSMS database system in Longido district during climate service sensitization meeting.

Despite its success, there are challenges that have been impairing the effectiveness of the FarmSMS system, this include charges incurred by TMA in disseminating climate information; TMA was using its internal funds to send SMS to end users, so increased number of registered users reflect increased cost in disseminating climate information. To respond to this and ensure its sustainability, TMA had a sequence of dialogues

and negotiations with mobile service providers and TCRA to see how they can intervene and cooperate in subsidizing the associated costs. Another challenge faced the operation of the SMS system was delayed response to troubleshoot technical issues. During system shortfalls, it sometimes took longer than expected for technicians to respond and solve the problems. To counteract this challenge, TMA trained her staff so that they can be responsible to monitor and troubleshoot all technical problems of the FarmSMS database system.

vi. Dissemination of climate information through Beep4Weather and Uliza poll services

GFCS programme in collaboration with Farm Radio International (FRI) introduced the use of phone-based voice services (i.e. beep services) to complement the community radio programs. These services were used by communities to ask questions and/or receive an update on dekadal weather information via voice. To promote equal benefit to all community members from these services, all dekadal forecasts and advisories as well as the response from their questions were also made available in Maasai language, considering that most of the Maasai communities in the project site had difficulties in understanding and interpreting the way the information was previously packaged. The project team took time to explain to community members especially the community listening groups (CLGs) how both systems work. The project team and extension officers were constantly explaining to farmers and pastoralists how to use Beep4Weather and Uliza poll services.

Uliza Poll is an internet-based platform that enables interaction between listeners and broadcasters or other intermediaries. The most common use of Uliza is for weekly poll questions, known as Beep2Vote. After every radio program the broadcasters provides questions either open or close ended for listeners to respond. Uliza Poll service allows farmers/

listeners to record their answers using SMS and voice services, and the results of the poll is displayed using internet-based platform which is accessible to the radio station. The responses from listeners are incorporated into future radio programs.

Beep4Weather is an advisory service developed to meet small-scale farmers' needs for meteorological information paired with agricultural advice. Weather information is vital to all farmers, but it has never been more crucial to the success of Tanzania's small-scale farmers. In recent years, weather patterns have become more erratic and traditional weather indicators (such as the bloom of particular wild plants or the migration of certain wild animals) have become increasingly unreliable. Beep4Weather responds with local weather forecasts paired with practical farming advice developed by local agricultural extension workers.

Plate 16: A farmer from Kondoa district listening to weather forecast via Beep4Weather service

Due to large gaps in information dissemination in the rural areas, Uliza poll and Beep4Weather services provided opportunity for communities to receive weather information via voice. Initially it was difficult for them to integrate weather information in their socio-economic activities as it was difficult for them to understand and interpret weather information that were sent to them via text messages. These services were popular in the project districts as farmers and pastoralists were using the Uliza poll and Beep4Weather services, and for any queries the extension workers and farmers were free to contact the FRI digital innovation team.

vii. Mainstreaming Climate Change in Health Sector

Mainstreaming climate change into health is fundamental when taking preventive measures against climate related health risks. In efforts to mainstream climate change issues MoHCDGEC and WHO via GFCS programe had supported the development of Climate, Health Risk Communication Strategy for 2019 – 2023. This was due to the fact that health sector is among the climate-sensitive sectors in Tanzania, and is already experiencing the impact of climate change. Four key areas of health aspect have been pronounced to be most affected by climate change in Tanzania were; vector-borne diseases (e.g. malaria, dengue, rift valley fever), water related diseases (e.g. cholera, diarrhea), malnutrition and climate related disasters such as floods, heat waves and droughts.

There have been several initiatives that emphasize mainstreaming of climate change issues into health sectoral policies, plans, programs and strategies. Despite these initiatives the MoHCDGEC in Tanzania was still having a gap in knowledge and skills in communication and dissemination of information on climate change and health issues. This resulted into lack of awareness among communities and other actors on the relationship between climate change and health, and how they can adapt to climate change and mitigate its impacts in health sector. To bridge this gap, WHO in collaboration with MoHCDGEC, via GFCS APA II programme in Tanzania, were engaged with different stakeholders from different sectors and organizations to formulate a strategy that integrate climate change and health issues. The development of this Strategy contributed to effective communication of climate change and health information at all levels. The Strategy set out mechanisms, principles and guidance on how issues related to climate change and health should be documented, communicated, adapted and mitigated.

The five-years National Climate Change and Health Communication

Plate 17: Stakeholders that participated in the development of climate change and health communication strategy, in Morogoro, 2019

Strategy (2019 – 2023) was developed in a series of expert consultative meetings between the MoHCDGEC, and other stakeholders to gather facts and opinions. Team of experts involved were from the National Environmental Management Council (NEMC); TMA; Institute of Resource Assessment (IRA-UDSM); PMO-DMD; National Institute for Medical Research (NIMR), Muhimbili University of Health and Allied Sciences (MUHAS) and the Vice President's Office – Division of Environment (VPO-DoE). Review of literatures and various communication strategies and relevant national policies and legislation within and outside the country were also conducted. The content of the developed strategy was harmonized and refined via vast range of experts from both the public and private sector to produce a final strategy document.

The National Climate Change and Health Communication Strategy (2019 – 2023) focuses on communicating climate change and health issues, key themes and messages. The Strategy provides a framework for delivering key messages on climate change issues related to health that are tailored to targeted audiences. This strategy also focus on how to communicate and engage using systematic and effective approaches

at national to community levels, linking to regional and international communication strategies. The Strategy is used by the Ministry responsible for Health and other stakeholders for the communication on climate related health issues. Regional Secretariats and Local Government Authorities (LGAs) will also benefit from the Strategy to ensure that populations are furnished with appropriate information and messages relevant to climate change and health. Training institutions, academicians and other stakeholder's will also benefit from this Strategy as a reference material when addressing issues of climate change adaptation, mitigation and health.

viii. Development of DHIS2 dashboard for integration of climate/ weather data

District Health Information System version 2 (DHIS2) is a tool for collection, validation, analysis, and presentation of aggregate and patient-based statistical data, tailored (but not limited) to integrated health information management activities. DHIS2 is a generic tool rather than a pre-configured database application, with an open meta-data model and a flexible user interface that allows the user to design the contents of a specific information system without the need for programming. Through the GFCS programme, the Ministry of Health integrated climate/weather data on DHIS2 to help health practitioners plan ahead of time and thus reduce the impact of climate variability and change on human health. The goal was to have an early warning system that will be generated in the dashboard by using climate/ weather data. The team developed the dashboard for early warning by using data source system such as DHIS, data element indicators, etc. Dengue fever and cholera were used during pilot of the dashboard, in Kiteto, Longido and Kondoa districts.

ix. Establishment of environmental clubs in primary and secondary schools

TRCS via the GFCS programme established environmental clubs in primary and secondary schools in Kiteto district. During phase II implementation five environmental clubs were established, two in secondary schools (Ndedo and Njoro secondary schools) and three in primary schools (Ndaleta, Olpopong and Makame primary schools). Each environmental club had 25-35 members and issues of gender equity and equality integrated during formation of these clubs to ensure both boys and girls can benefit equally from the programme. These clubs were registered by Red Cross and serves as Red Cross branches at the grassroot level. Members of each environmental clubs met weekly and participated in different activities such as establishing and managing tree nurseries, planting trees, receive and discuss climate and weather information received from TMA, trained on agriculture and livestock keeping, etc.

Environmental clubs were also members of Farm Radio International listening groups been provided with solar-powered MP3 radios so that they can listen to climate services and information radio programs. These groups have been receiving dekadal weather information from TMA and as part of their activities, they were supposed to disseminate that information to their households and neighbors. To ensure sustainability

Plate 18: Environmental club from Makame primary school (left), and an advisory board from Ndaleta Primary school (right), Kiteto district 2019

of these groups, when students finish school, they were replaced with newly ones to maintain the number of club members. Those students that finished schools were trained to become TRCS volunteers in their respective villages.

x. Recovery and digitization of climate and meteorological data

TMA through its observations of weather and climate conditions has accumulated a large amount of data that were archived in paper form and some of them had started wearing out, hence posing a threat of losing the valuable weather and climate data of the nation. Through GFCS programme, TMA carried out data rescue exercise by converting historical old paper-based climate records into computer based electronic images for long-term safety, and data management to improve the efficiency and effectiveness of the delivery of meteorological services in Tanzania. TMA continued to enhance efforts to ensure that all accumulated climate and weather data are digitized and stored in the CLIDATA data base system. This provided valuable additional data for a variety of applications, including monitoring of climate change, issue advisories and providing meteorological services much more efficiently and effectively.

During data resque, activities performed included updating of rainfall and climatological stations inventories; and entry of station metadata into developed inventory sheet, sorting, keying, scanning, cropping and uploading images into ELO system. These activities were implemented for nine regions in Tanzania namely Mbeya, Ruvuma, Songwe, Rukwa, Katavi, Tabora, Kigoma, Njombe and Iringa regions. The parameters that were imaged and digitized were rainfall and temperatures for 559 meteorological stations located in the aforementioned regions. The 559 meteorological stations include nine Synoptic stations, four Agrometeorological station, 40 Climatological stations and 506 Rainfall stations.

2.2.3 Activities implemented under the pillar of Capacity Building

One of the goals of both GFCS APA phase I and II was to build capacity to providers, intermediaries and users of climate services. Capacity building was provided to three different groups; the TMA experts as providers of climate services, to intermediaries (such as extension staff and media), and climate sensitive sectors and individuals particularly farmers and livestock keepers.

i. Capacity building for TMA experts as providers of climate services

Capacity building to TMA experts is imperative to foster accurate and improved production of climate information and products for different user sectors. Under GFCS, TMA experts such as agro-meteorologists, forecasters, observers, scientists, etc. were trained so as to improve their skills and competency and hence advance climate service delivery to user communities. Some of the trainings that were provided to these experts under GFCS programme include; training on extraction, processing and analyzing of rainfall intensities; training on application of new CLIDATA features and enhancing awareness and utilization of Maproom products; training on severe weather monitoring for disaster risk reduction and application of NWP and products in weather forecast; training on the use of best available tools for development of homogeneous zones; training on data analysis, management system and generation of tailored climate information; training on climate prediction and weather forecast; training of coding and decoding of weather and climate data, etc. The core aim of these trainings was to improve the capacity of TMA experts in data monitoring, handling and processing; interpretation of products and mapping of climate information and products; climate monitoring; and downscaling of seasonal forecasts.

Some of the climate products that were developed as the result of these trainings included climatological maps, tailor made climatological products for agriculture (onset, cessation and duration of the season and chances of dry spells), downscaled seasonal forecasts, severe weather forecasts, specialized forecasts such as marine forecasts, etc.

Plate 19: Capacity building to TMA staff (on the left TMA DG awarding certificates to TMA staff after training and on the right is TMA staff sharing experience during training session.

ii. Capacity building for intermediaries

Capacity building aimed at enhancing competence of extension officers and media personnel (television, radios, newspapers, and social media) to understand the content of the forecast, interpret and communicate effectively both climate information and products to end users. Activities that were implemented for this category included media training and Training of Trainers (ToTs) in Participatory Integrated Climate Services for Agriculture (PICSA). Several workshops and seminars were conducted to equip intermediaries with valuable skills in communicating climate and weather information to user communities, without altering the information of the intended message. Capacity building for intermediaries played a great role in ensuring climate information and products reach the majority within a short period of time, accurately and in a more cost-effective way.

Initially during phase I implementation, PISCA trainings were conducted for farmers and extension officers in Longido, Kiteto and Kondoa districts. During phase II implementation, a need arose to include pastoralists in the training after realizing the tool would also be useful to address climate change challenges in livestock keeping activities. A scoping study was carried out to explore how to customize and adopt PICSA for use with pastoralist and livestock-focused farmers in Longido and Kiteto districts.

Plate 20: Capacity building to intermediaries on understanding and communicating weather and climate information.

During training, males and females were guided to develop separate seasonal calendars were then synthesized into generic seasonal calendar. Since women in pastoralist communities are more sedentary with more diverse responsibilities than men, it was recommended for PICSA training for pastoralists to be conducted in separate gender groups with primary focus on women. Normally, PICSA training were conducted prior to the rainy season, but for pastoralists it was proposed to be conducted during the seasons since these are the times when pastoralists stay in one place for relatively long period.

From phase I and II implementation, all extension officers in Longido districts at all levels and about 99% of all staff in Kiteto district were trained on PICSA approach. Extension staff from Kondoa districts were trained and efforts were made to ensure all of extension officers in this district receive training on PICSA approach.

iii. Capacity building to District and Regional Environmental Health and Medical Officers

During implementation of GFCS APA activities, regional and district environmental health officers were trained on climate change and health. The training involved district and regional health officers and medical officers from Dar es Salaam, Dodoma, Kilimanjaro and Morogoro regions. Also, TMA representative and other people working in climate and weather sensitive sectors were part of the training. Before and after the training, a pre and post tests were conducted and analyzed to understand participants' knowledge before and after the training. Some of the topics covered included introduction to climate change; causes of climate change; major events of climate change; link between climate change and various sectors; impacts of climate change on the environment and on public health; human diseases influenced by climate change; climate change mitigation and adaptation measures; mainstream climate change aspects into health policy; health systems and climate change in Tanzania and communicating climate variability on health risks.

Plate 21: District and regional environmental health and medical officers during training sessions, 2019 in Morogoro.

The training was conducted using the package that was developed by the project team from WHO and MoHCDGEC in collaboration with other stakeholders from MUHAS, VPO–DoE, Nelson Mandela Institute of Technology and Ardhi University. The training package had four modules; Module I: Introduction to Climate Change and Health, Module II: Impacts

of Climate Change on the Environment and Health, Module III: Responding to Impacts of Climate Change on Human Health, and Module IV: Implementing Climate Sensitive Initiatives in the Health Sector. The training manual was previously used to train about 30 health professionals from districts and regions comprising of environmental health officers, environment management officers and planners; and based on their feedback the manual was improved during implementation of phase II. The improved training manual was used to train 38 district and regional environmental health and medical officers from the aforementioned four districts.

The outcome of the training was the development of an action plan by participants. The focus of the action plan was on adaptation on climate change impacts in the health sector. The action plans were further customized by each district during implementation based on the available resources and other existing situations.

Plate 22: Participants developing the action plans for their respective districts in August 2019 in Morogoro.

iv. Capacity building for users of climate services

For sector users, capacities provided included training on climate and health that aimed at building national capacity on climate and health, and the use of climate information for health planning whereby, a "national training package on climate and health" was developed, and 15 experts were trained as national facilitators.

Plate 23: Participants from Kiserian village in Longido district, 2019

At community level, stakeholders' workshops and sensitization meetings were conducted in different villages such as Kaskazini A, Kibaya, Olmolog, Relang'wa, Irkaswa, Kamwanga, Kiserian, Longido, Kimokouwa, etc. Participants in these workshops and seminars include government and non-government representatives at village level, farmers, pastoralists, women representatives, agricultural extension officers, livestock extension officers, leaders of farmers groups, members of community groups (e.g. Village Community Banka (VICOBA)), village leaders, IK group members, etc. The workshops and meetings aimed at improving communities' awareness on climate services provided by TMA, exploring opportunities for enhancing national observing systems and identifying user needs for climate services in agriculture, food security, health, and disaster risk reduction. Participants were acquainted with relevant knowledge on how to use climate services provided by TMA and how climate information can be integrated in decision making in their livelihood activities. Some of the products shared during the meetings and workshops include different agro-meteorological bulletins (i.e. seasonal, monthly and dekadal), downscaled weather forecast and seasonal weather forecast with their contribution in agriculture and livestock keeping.

In ensuring weather and climate change knowledge is imparted to young generation, students in different secondary schools were visited and trained on climate services. Some of the schools visited include Longido secondary school, Arusha secondary school, Joyland secondary

school, Tosamaganga secondary school, Bwawako secondary school, Enduimet secondary school, Olenaboishu secondary school, etc. Trainings were delivered in form of presentation, with the main aim of nurturing environmental management skills to youth, so that they grow up and become good ambassadors in protecting the environment and dealing with current and projected challenges of weather and climate change.

Plate 24: Training facilitators with students from Bwawako Secondary school, 2019

2.2.4 Activities implemented under the pillar of Observation and Monitoring

The activity conducted under observation and monitoring pillar was rain gauge installation in GFCS pilot areas. The programme installed six rain gauges in Tingatinga and Dosidosi villages. The extended rainfall network added climate data to TMA data repository, which is an input for downscaled seasonal forecast.

Plate 25: Installation of rain gauges at Lerang'wa primary school in Longido district, (on the left PDT Chairperson, Dr. Ladislaus Chang'a digging a hole to install rain gauge and on the right he is giving instructions for installing the rain gauge

2.2.5 Activities implemented under the pillar of Research, Modeling, and Prediction

A number of activities on research and training were implemented considering the fact that Research, Modelling, and Prediction is not only a significant pillar of GFCS, but also an important component for climate change adaptation and mitigation. In this regard, the implemented activities included a household level baseline survey on the use and need of climate information, ICT scoping study, Radio scoping study, Institutional Analysis, and Climate Change and Health Vulnerability Assessment.

The baseline survey

The baseline survey was conducted in GFCS pilot districts (Kiteto and Longido) to provide policy and technical baseline information, to ensure smooth implementation of the project activities, including scoping stakeholders' needs. The baseline survey findings showed that at least 80% of the farmers and pastoralists rely on indigenous knowledge and personal experience to make farm decisions. In addition, less than 50% of households acknowledged receiving climate information, with limited use of climate information to make farm decisions. In terms of delivering climate information, it was found that budgetary constrains, technology, the trust of the forecast, and feedback mechanism from the source of climate information to the user were the challenges. It was also noted that few farmers once had access to climate information though they found the information not relevant.

The baseline survey also documented climate impacts in the pilot areas. Drought was found the most significant threat to agriculture followed by pest and diseases. The drought had led to decline in crop yields, which often could result to food insecurity at household level. Longido and Kiteto communities have long lived with the climate change

impacts and have developed local strategies to overcome climate impacts. Some of the strategies include coping mechanisms that allow a certain level of risks to be tolerated or impact to be lessened. In case of prolonged drought with food shortage, the main coping strategy was selling available assets particularly livestock.

The survey report found that rainfall onset dates, expected amount of rainfall over the season, the end dates of the rainy season, the number of raindays, and the probability of extreme events, were identified as priority climate information needs. However, it was interesting to note that there was a significant difference between men and women climate information needs, particularly in Longido where men and women had different priorities. For women, the seasonal forecast on the amount of rainfall was their first priority. The reverse was noticed with men who prioritized seasonal forecast, especially the start dates of seasonal rainfall to be important than seasonal rainfall amount.

The baseline survey identified community radios as one of the appropriate channels for delivery of climate information to small-scale farmers and pastoralist. Respondents clearly declared that climate information accessibility, especially seasonal forecast on the start of rains and forecasts for extreme events, would be improved via community radio. Gender needs were as well identified during the survey as women preferred voice messages in cellphones, while men preferred extension agents' visits. Alongside radio, voice messages, as well as extension visits, word of mouth, were also found to be preferred channels of communication.

In addition, SMS and village communicator were found to be potential channels to reach communities since ownership of cell phones is higher than radio in Kiteto and Longido. However, lack of mobile phone service networks was found to be a barrier to climate information

delivery in many areas in both districts. The interventions identified to improve the use of climate information to farmers are capacity building trainings to agriculture extension officers, improving communication networks, and enhancing the capacity of end-users to interpret seasonal forecasts.

The institutional analysis

The GFCS programme undergone the study on Institutional Analysis for Climate Services and found that institutional, financial and human resource constraints, limit the ability of climate information providers to engage with end-users, and provide information that meet their needs in a timely manner. Engagement to facilitate effective user interfaces was time and resource intensive, and key government institutions were often understaffed, resulting in bottlenecks towards smooth implementation. Technical limitations include lack of monitoring networks and computing capacity. Effective delivery of climate information in Tanzania is currently hampered by bureaucratic protocols, because the information that TMA produces often passes through multiple institutional layers before it can reach the intended users, which/this may consume more time.

Similarly, the analysis highlighted that limited specialized knowledge and expertise and lack of dedicated government structures, may limit capacities for effective use of climate services within/including adaptation planning across sectors, at national and sub-national levels. Many MDAs at the national level do not have staff positions that are dedicated to climate-related issues and, even when they do, such staffs do not always have sufficient climate change expertise. Additionally, financing opportunities for climate change activities are available on ad-hoc and short-term basis and generally sourced through external donor agencies. Pressures and demands attached to these external funds have often produced tensions with national development priorities and conflicts with existing capacities.

As part of the study, it was found that there was a wide range of other stakeholders in addition to TMA who also produce climate information. Hence there is a clear need for an institutional mechanism that would support more direct and regular interactions between users and providers of climate information, and information intermediaries. It is encouraging that in 2014, Tanzania Disaster Relief Committee (TANDREC)–an inter-ministerial committee to oversee disaster prevention, preparedness, and response at the national level which is under the PMO agreed to expand its mandate to serve as a Steering Committee for Climate Services in the country. This mechanism had great potential to enhance coordination and harmony as well as effectiveness, but may be limited in its capacity to provide the expected climate information services. This was due to the fact that TANDREC was currently mandated under the National Disaster Relief Coordination Act (1990) to convene on an "as-needed basis", primarily for emergency or disaster response. This pose challenges to creating sufficient and appropriate opportunities for meaningful dialogue necessary for the co-production of climate services unless additional supporting mechanisms and resources are devoted to assisting TANDREC in its new role.

Climate Change Policy Inventory and analysis in Tanzania

Apart from those studies, the Centre for Climate Change Studies of the University of Dar es Salaam and the Centre for International Climate and Environmental Research in Oslo undertook a Climate Change Policy inventory and analysis for Tanzania. The objectives of the exercise were to assess the extent to which climate change concerns have been integrated or mainstreamed into national policy documents in mainland Tanzania. In addition, it also aimed to consider the role of climate services in achieving national sectorial policy goals and identify existing and potential entry points for the development of such services within the current policy frameworks.

Through this inventory, review of key policy documents that guide national development, climate change and environment, agriculture and food security, disaster management and risk reduction, and health planning was undertaken to assess whether and how climate change dimensions are addressed. Specifically, the review wanted to identify whether and how the policies respond to the objectives and prioritized measures that are outlined in the National Climate Change Strategy, highlight potential policy gaps and conflicts and; identify entry points for enhancing climate services provision across policies and sectors.

Three major findings emerged from this analysis. First, while climate change is discussed and/or addressed in a number of policy documents, climate services were never explicitly mentioned. It was found that when climate change is included in policy documents, its/the concerns are often addressed peripherally or indirectly. While there are objectives with regard to increased use of climate data and information, the concept of 'climate services' specifically is not reflected in any of the documents. Second, policy documents across all sectors, as well as those specific to climate change, identified improved early warning systems (EWS) as a specific objective. This represents a common entry point for development and delivery of climate services, as well as an opportunity to increase cross-sectorial/sectoral adaptation coordination and planning. Third, the analysis highlighted that efforts to manage short- and long-term climate risks are not well integrated under current policies and legislation in Tanzania. As such, short and long-term plans to climate risk management may remain segregated. This may prevent effective and robust adaptation planning, both across government institutions and timescales.

Additionally, it was found that the National Environmental Policy (NEP) and Environmental Management Act (EMA) are the primary policy documents that oversee climate change-related issues. Other climate change policy documents, such as the National Climate Change Strategy (NCCS) and National Adaptation Programme of Action (NAPA), have been designed to build upon the institutional structures and mandates put in place by the NEP and EMA. Therefore, it will be important to link the development and delivery of climate services with established institutional structures for climate change adaptation (e.g., National Climate Change Steering Committee) under the current policies and legislation, to avoid creating isolated or duplicative institutional arrangements. Importantly, while a National Climate Change Strategy is already in place in Tanzania, there is lack of overarching and binding climate change legislation to support implementation and enforcement of climate mitigation and adaptation activities.

Baseline for monitoring and evaluating user satisfaction with climate services in Tanzania

The research work was conducted by the Centre for International Climate and Environmental Research – Oslo (CICERO) and the Centre for Climate Change Studies of the University of Dar es Salaam (CCCS-UDSM). A qualitative approach incorporating multiple data collection methods (interviews, focus groups, and observation) was employed at three institutional scales: national, district, and local, with a focus on the programme target districts of Longido and Kiteto. The focus was mainly on understanding: the institutional coordination and steering mechanisms; awareness of and access to climate information and services; and perceptions of the 'usability' of climate information and services; and the role of indigenous knowledge (IK) in the development of the seasonal forecast.

Through the study, it was found that a national steering mechanism has been adopted, but there is a need to strengthen institutional coordination across all scales. Awareness of and access to climate information and services were reported to be highly variable across institutional scales. A common challenge to climate information access was the perceived lack of sufficient mechanisms to systematically deliver information, both within and across scales. Findings highlight that the credibility of climate information and services was seen as paramount to enhancing user satisfaction at all institutional scales. Perceptions of credibility are dynamic and non-linear and are highly dependent upon experience using climate information in practice. Improving the credibility of climate information and services is a long-term process.

Two challenges to the salience of climate information across scales include mismatches between the timing of decision-making and the production and delivery of forecasts, as well as the limited spatial and temporal resolution of climate information products. Additionally, the way in which forecasts are currently packaged and communicated presents significant challenges to understanding and interpreting them for practical decision-making. Efforts to improve the salience of climate information should simultaneously consider impacts on the credibility of information, balance user requests with current scientific capacities, and manage user expectations in a transparent manner. The inclusion of multiple perspectives and relevant stakeholders within knowledge production and decision-making at all scales is important to enhancing the legitimacy of climate information. The programme should continue and expand efforts to ensure that key stakeholders are included at all stages of climate services development. This is because disparities in capacities to access and benefit from climate information and services, and climate specific advice to be coded with political implications (particularly at local scales), pose challenges to legitimacy. The role of indigenous knowledge was seen as important across all scales, although perceptions of credibility were highly

variable, and there were challenges to enabling the use of IK at district and national levels. IK was perceived to be more salient and legitimate than scientific climate information, particularly at local levels. Findings highlight that the perceived credibility, salience, and legitimacy are often interrelated and cannot be treated or considered separately. It was important to consider both synergies and trade-offs among perceptions of these criteria to address user satisfaction. Based on this analysis twelve recommendations have been highlighted which may contribute towards developing strategies to improve user satisfaction with climate information and services in Tanzania, in the future.

The climate change and health vulnerability and adaptation assessment

Climate change and health vulnerability and adaptation assessment was carried out in 2015 with an objective of assessing the impacts of climate change in the health sector in Tanzania. The assessment carried out in regions representing hot humid climatic zones, high moist lake zones, and semi-arid climatic zones. The assessment found that droughts and floods are the primary hazards affecting the entire country with many low-lying areas and river valleys being particularly prone to flooding while semi-arid to arid areas are prone to drought. Tanzania has experienced several episodes of flooding which have resulted in infrastructure destruction and outbreaks of water-borne and vector-borne diseases like malaria and dengue among others.

3.0 ACHIEVEMENTS, BEST PRACTICES, LESSONS LEARNED, AND CHALLENGES

This chapter provides an in-depth review of achievements, lessons learned, best practices, and challenges emanated from implementation of GFCS programme in Tanzania. This chapter adds to world base of knowledge that could be referred by other countries to define priorities, address challenges, and create a clear pathway for project sustainability.

3.1 Key achievements in the implementation of GFCS

3.1.1 Improved capacity in production and dissemination of climate information

The capacity of TMA staff (climate service providers) and intermediaries of climate services were improved. This was achieved through different training, workshops and seminars that were organized to ensure these key project stakeholders are equipped with the fundamental knowledge and skills that are vital for the successful implementation of the project. GFCS programme has improved TMA's staff skills and capacity in preparing and disseminating tailor made climate information and products to various sectors including agriculture, disaster management, health, marine transport as well as aviation. Some of the climate products produced as the result of capacity building were downscaled seasonal forecasts for pilot project areas, Maproom products, marine products, and climate maps. Capacity was also built to intermediaries (extension workers, media, and Red Cross volunteers) so that they can be able to receive, interpret and disseminate climate information and products to end users without distorting the actual information. Moreover, to ensure effective and efficient provision of climate services to the end users, TMA via GFCS programme has procured various tools including twelve computers, two printers, tape recorder,

laptop, projector, and GIS software to facilitate smooth production and dissemination of climate information and services. Generally, GFCS implementation in Tanzania has played a significant role in enhancing availability, accessibility and applicability of climate information to users in the sectors of agriculture and food security, health and disaster risk reduction.

3.1.2 Improved awareness and accessibility of climate services

Through GFCS program, TMA conducted various awareness raising events to end users via sensitization meetings, seminars, workshops, household visits and dialogues. All of these were not only conducted in pilot project sites of Kondoa, Kiteto and Longido districts, but also in other nearby districts as well as in secondary schools. During the awareness raising meetings communities particularly farmers and pastoralist were trained on how to use the available products and services for planning and decision making in their socio-economic activities. The meetings, workshops and seminars also provided an avenue to train communities on how to develop and use seasonal calendars by using the available climate information. During the awareness raising meetings, stakeholders registered to receive climate information through mobile phones (FarmSMS and Beep4Weather) and also downscaled seasonal forecasts were disseminated via these mobile platforms. As part of ensuring climate information is easily reaching the communities, FRI via GFCS project established more than 60 listening groups in the project villages. These groups were meeting on weekly basis to listen to weather and climate radio programs and provide their feedbacks. These radio programs have contributed in enhancing the capacity of communities and promote accessibility of climate information and advisories. Through awareness raising meetings and workshops, TMA managed to reach more than 44,000 end users in the pilot districts.

3.1.3 Provision of downscaled seasonal forecast

GFCS programme has played a great role in ensuring the availablity of downscaled seasonal forecast for the pilot project districts. The downscalling of seasonal forecasts was carried out by using Climate Predictability Tool (CPT) and INSTAT softwares. TMA staff were trained on how to downscale seasonal forecasts for the project sites, which was very efficient in improving the availability of accurate, specific and reliable climate information to communities. This in turn improved the usability and usefullness of climate information by local communities in planning and making informed decisions for their livelihoods. For GFCS projects the downscalled forecast was produced for Kiteto, Longido and Kondoa districts.

3.1.4 Rehabilitation of earthdam

The earth dam in Olpopong village, Kiteto district was rehabilitated to enhance its capacity to conserve water. The rehabilitation involved planting of trees, construction of water reservoirs, and procurement of new gate valve for controlling water flows. The gate valves were used to connect the earth dam reservoir and the cattle trough. The programme acquired trees from the community tree nursery and planted around the dam. This is among the remarkable achievement of the programme as it has contributed in ensuring availability of water for agro-pastoral activities during dry seasons.

3.1.5 Enhanced Institutional collaboration

The collaboration between various institutions enhanced effective dissemination of climate services among stakeholders which supported mainstreaming of climate information in various institutions. An example is the enhanced collaboration during GFCS implentation between TMA and Ministry of Agriculture through FarmSMS, also

between TMA, WFP, and FRI via Beep4Weather services. This collaboration played a significant role in enhancing availability, accessibility, and applicability of climate information in agriculture and food security.

Through GFCS, TMA collaborated with the Ministry of Health to produce Climate Change and Health Communication Strategy (2019-2023) and Climate Change and Health Training Manual which were respectively used for health and communication purposes within the ministry and training students in 6 health institutions in Tanzania. Via the programme TMA and WFP collaborated with Farm Radio International to produce radio programs for farmers and pastoralists in pilot programme districts which contributed in bridging the gap between TMA and community radios. TMA also collaborated with BAKITA (The National Swahili Council) and other Swahili experts from different institutions to translate weather and climate terminologies into Swahili language. The translated weather and climate terminologies were used when communicating weather and climate information to end users. GFCS programme brought together different institutions during implementation of the project in order to promote collaboration, since it is the stepping stone towards enhancing and sustaining improved climate services.

3.1.6 Development of the National Framework for Climate Services

To ensure sustainability of GFCS initiatives, the National Framework for Climate Services (NFCS) was developed in Tanzania. This was accomplished through a series of stakeholders' meetings and workshops, which were convened to develop, review and finalize the framework. Different stakeholders from different government and non-government organizations and from different sectors were involved. NFCS was formulated and customized to reflect the context of Tanzania with the main aim of enhancing the provisional of climate services and

promote its use for risk reduction caused by the impacts of climate variability and change. During launching of the framework, it was agreed that TADMAC will spearhead and oversee the implementation of NFCS in the country. Launching of NFCS during implementation of GFCS phase I in Tanzania, was one of the remarkable achievements of the project; during launching of GFCS phase II, it was agreed that activities of phase II will focus on implementing NFCS in Tanzania. Effective implementation of NFCS will bring together all actors in climate services to engage in the provision, dissemination, and application of climate information, when developing plans and making decisions. This will ensure resilience to climate-related disasters through the development of climate adaptation strategies.

Plate 26: Delegates during NFCS launching in Tanzania in 2018 (from right is Dr Agnes Kijazi, Prof. Peteri Taalas, Hon. Anthony Mavunde and Prof. Faustine Kamuzora.

3.2 Best practices

3.2.1 Use of mobile phones for climate information sharing

GFCS programme ensured all end users can easily access climate information via methods that are affordable and easily accessible. This was accomplished through the use of SMS and voice services of mobile phones. End users in pilot project districts were receiving weather and climate information via FarmSMS system (text message) or through Beep4Weather system (voice message). The beep4weather system provide access of weather and climate information to those who

can't read text properly and to those who can't understand Swahili. The programme went further by translating climate information to *Maasai* language to enable the targeted community to not only receive but also understand the information. These two mobile phone services were more effective in disseminating climate information to communities in the project districts.

3.2.2 Dialogues between providers and users of climate services

During implementation of GFCS programme, dialogues platforms were enhanced among stakeholders, especially between providers and users of climate services, this assisted better understanding and dissemination of climate services provided by TMA. It was also an opportunity for climate service provider to understand user needs. Likewise, it was a platform for climate services users and providers to learn about challenges and opportunities, thus paving the way for effective implementation of GFCS (Geneva Environmental Network, 2012).

3.2.3 Use of participatory tools in designing and executing climate service programs

One of the participatory tools used during the implementation of GFCS programme was PICSA. It involved agriculture extension staffs working with groups of farmers ahead of the agricultural season and with pastoralists during the rainy season, to analyse historical climate information, choose a crop, livestock and livelihood options that best suit to individual farmers' circumstances. The tool facilitated small-scale farmers in GFCS pilot areas to improve their resilience in the face of erratic rainfall and increasing temperatures and enabled pastoralists to sustainably manage their livestock despite the changes in climatic conditions. Extension officers and NGO staff were able to facilitate farmers and pastoralists to use complex information on historical

climate, seasonal and short-term forecasts as well as crop, livestock and livelihood options in decision making. Also, the PICSA tool has facilitated smooth integration of meteorological information in various agricultural and pastoral activities, leading to improved outputs. However, the tool needs to be translated into local languages for better understanding by the community.

3.2.4 Presence of GFCS governance mechanism at national level

Project governance mechanism at national level is important for smooth implementation of projects and programmes. During GFCS implementation, NSC and PDT governed smooth implementation of GFCS activities at national level. The NSC had the role of overseeing the implementation of GFCS and development of National Framework on Climate Services. It provided political support, sustainability, and platform to assess and measure project achievements. Whilst PDT had the role of coordinating and managing the program activities and was supported by GFCS desk officer and GFSC senior technical advisor.

3.3 Lessons learned

3.3.1 Stakeholders' participation is critical for project ownership and sustainability

Successful implementation of the program requires strong collaboration and engagement among stakeholders. During project appraisal stage, focus should be on community needs through co-planning of project activities. Rural communities were not involved in the designing stage of GFCS programme and as a result, some of the communities did not feel sense of ownership of the project interventions. It is important for communities to be involved in the planning process as, it will be easy for the project to tackle climate problems that are priority to community. For example, the program rehabilitated the earth dam in Olpopong

village, in Kiteto district to fulfill community needs to improve water availability, even though it was not part of the programme activities. Community priorities change with local circumstance; hence it is a good practice if the project initiate an innovation platform where there is a co-planning of project activities with local community.

3.3.2 Effective use of climate services is a key for sustainable management of natural resources

With decreasing rainfall trend characterised by increasing climate variability, in some areas, shortage of water is the biggest constraint to livelihood wellbeing even if climate services are in place. The distribution of rainfall is erratic under the influence of climate change, and the dry season is becoming longer and hotter. Through GFCS, rehabilitation of Earth dam in Kiteto district was done to help rural communities respond to poor rainfall distributions and availability.

3.3.3 Feedback mechanism between users and providers of climate services is important

User feedback mechanism plays an important role in improving climate services. It helps climate service providers improve their efficiency and effectiveness, and could be a source of innovative ideas for improved climate services. During the design and implementation of GFCS programme, there was a challenge in feedback mechanism especially in FarmSMS which could interfere project results. It is a good practice to put in place feedback mechanisms for monitoring and improvement of the program activities.

3.3.4 Adequate climate observation network enhances production of high-resolution climate information

For better capturing of local climate features, it is important to extend climate observation network to local areas to/and enhance production of high-resolution climate information. During the implementation of the programme, insufficient observation network was a limiting factor for production of high-resolution climate information. Similarly, it has become increasingly difficult to recruit people to act as manual weather observers, and so installation of new technologies (automatic weather stations) can overcome shortfalls in human resources.

3.3.5 Reporting enhances transparence and success of programme implementation

Programme reporting is a key component in ensuring project objectives, output, outcome, challenges, best practices and lessons learned are well communicated and documented. Project implementers in Tanzania designed a clear template for reporting project progress on monthly and quarterly basis, additionally each activity has its own detailed report. During PDT meetings, each partner organization presented the progress of activities implementation in that quarter and the plan for the next quarter. This facilitated smooth understanding and easy documentation of progress of project activities. In designing the reporting template, it is crucial to ensure all key parts of the projects outcomes and outputs are covered in the report. Reports played a key part in monitoring and evaluation of project implementation in Tanzania.

3.3.6 Gender mainstreaming is a key towards successful program implementation

The effects of weather and climate are not gender neutral. Women and men are frequently and differently affected by weather and climate

impacts. During GFCS implementation gender aspects were reflected in project activities, with women participation comparatively fair. There was an observation that some women were not free to talk in front of men due to cultural norms. Women voices were only heard when they were encouraged to talk, as well as when providing them with gender specific needs. GFCS programme emphasized reflection on gender perspective during implementation and reporting, and this was the reason behind formation of women exclusive community listening groups for community radio programs and "Her voice on air" climate change radio segments. The female exclusive community listening groups and Her voice on air radio segments were very successful in ensuring gender issues particularly those of women are aired and addressed in the implementation of the project.

3.4 Challenges

During the implementation of GFCS in Tanzania the following challenges were observed:

3.4.1 Increasing need of high-resolution climate and weather information

There is a great demand for more accurate and reliable model-based climate information with high resolution for a variety of applications. This includes higher resolution climate simulations and predictions, and reanalysis or other monitoring products. GFCS programme successfully provided limited downscaled forecast for the programme pilot sites at Longido, Kondoa and Kiteto districts. However, due to increasing demand of site-specific forecast, the need for high resolution climate and weather information have increased and thus making it a challenge for GFCS to meet the high demand, and an opportunity for other projects to invest in high resolution weather and climate data.

3.4.2 Sustaining the initiative beyond the programme life span

Several initiatives were undertaken by GFCS programme to support generation and application of climate information. The initiatives include capacity building and awareness raising. It is expected for the knowledge and awareness gained during the implementation of GFCS to last longer among participating institutions and stakeholders. However, to sustain the initiatives there is a need for further funding on regular training and field visits. The challenge was, most of the funding was donor dependent and not always assured.

3.4.3 Balancing and harmonizing activities to avoid duplication of efforts

Analysis of the implemented activities revealed duplication of some of the GFCS implemented activities. For examples, TMA provided awareness raising and trainings on climate services which was the same with TRCS. Moreover, there has been some other programme apart from GFCS that implemented climate adaptation programme in the pilot areas. Conducting baseline survey and mapping climate actors in pilot areas is important to synchronise activities and minimize duplication of initiatives, hence improve efficiency of programme funding and sustainability.

3.4.4 Cultural barrier is a challenge to project implementation

In some communities such as Maasai, women cannot speak or contribute their ideas in the presence of men; this resulted into lack of valuable contribution from this group that may be useful in executing GFCS programme. It is important for programmes like GFCS to integrate cross cutting issues like gender empowerment in the implementation of its activities.

3.4.5 Low availability of quality agricultural inputs

To ensure availability of climate service contribute in halting the challenges of food insecurity, it is vital for all key stakeholders in food and agricultural sectors to play their roles. Inadequate availability of quality agricultural inputs has compromised the success of the project. During project implementation, some of the agricultural inputs such as seeds used by farmers in the pilot districts were not certified. Existence of uncertified seeds that resembles the certified ones caused losses to farmers and hence failure to realize the benefits of climate services. All key stakeholders should work together to ensure farmers are supported with quality and certified inputs and services so that they can realise the benefits of climate services.

3.4.6 Limited effective packaging and dissemination of weather and climate information

Sometimes, weather information and products can be distorted when the intermediaries are involved. The translation can be different from the intended message. Furthermore, some of the weather terms when translated into local languages have a different meaning to the intended one. As a result, packaging and communication of weather and climate information can distort its quality and accuracy. It is required that direct beneficiaries and all intermediaries to be trained on how to translate and communicate climate information, of which there were budgetary constraints.

4.0 CONCLUSION AND RECOMMENDATIONS

This chapter provides conclusion and recommendations for policy, technical and research to enhance collaboration in provision of and access to climate services for adaptation across sectors. The bottom line is, climate services should play a key role in enhancing adaptive capacity and long-term resilience in all aspects of life within the context of changing climatic conditions.

4.1 Conclusion

The implementation of GFCS programme in Tanzania has made substantial contribution in enhancing availability, accessibility, and applicability of climate information to stakeholders. The contribution of these achievements in supporting adaptation, particularly at local and central levels, cannot be overemphasized. Therefore, it is important to draw a number of conclusions as a result of the implementation of phase I and II programmes in Tanzania.

i. Successful implementation of GFCS implies that the impacts of climate change are multi-sectoral agenda which do not recognize political, administrative, ecosystem and institutional boundaries or mandates. This necessitates enhancing collaboration and cooperation, particularly in climate services to ensure that scientific knowledge and information serve the communities, through well-informed policies, decisions, and applications on the ground. GFCS implementation has demonstrated how the international community, countries, institutions, as well as sectors, need to work together to address climate change impacts, particularly in the area of its science, research, and development as well as technologies.

ii. The linkage between GFCS work and NAPs process is a

commendable case in informing policy and decision-making process. It is a good example one can use to upscale the effort for science to inform policy, strategic planning and budgeting process in the context of a changing climate. A number of areas which were identified and communicated to inform NAPs process can be highlighted for emphasis: the inventory of marine weather-related hazards; establishment of a sustainable documentation of marine weather-related hazardous events; and climate change policy inventory.

iii. In the efforts to improve climate services, concentrating on the five pillars should continue to be the main focus. These are the key areas through which climate services can continue supporting adaptation and addressing other sustainable development related challenges. It is through these pillars that it becomes easier to evaluate the success in climate services across levels and sectors. These can also be used to identify the challenges ahead and develop concrete interventions to address such challenges collectively and collaboratively.

iv. Development of the National Framework for Climate Services in Tanzania is among the commendable outputs of the implementation of the GFCS Programme in Tanzania. It is one of its kinds in the region and will serve as a good example for others to emulate. For Tanzania, it is a key milestone in further improving climate services to stakeholders across levels and sectors.

v. TMA acknowledges and takes a serious note of what remains ahead as gaps and challenges towards achieving more through *inter alia,* advanced technologies and technical capacities in systematic observation and monitoring; enhanced technical capacities in packaging, delivery and user knowledge in

interpreting and putting the information into timely and appropriate use; research to generate more information to support continued service provision; as well as coordinated efforts to ensure mainstreaming and integration of such relevant information into policies, strategies, plans and budgets across levels and sectors.

4.2 Recommendations

This section provides recommendations for policy and strategic processes as well as research and development in climate services.

4.2.1 Policy and strategic processes

i. Deliberate efforts are required for all stakeholders and partners to further engage policy and decision makers as part of capacity building, awareness and outreach interventions. This would be useful in enhancing provision of climate services and appropriate use of climate information for policy and decision-making at all levels

ii. The linkage between the programme activities and NAP process demonstrated during the implementation of the GFCS programme in Tanzania is another milestone in ensuring that science informs policy and planning process. It is important that this collaboration is enhanced such that all key policies and plans are well informed by climate services for enhancing adaptation to climate change impacts.

iii. As part of implementation of the GFCS programme in Tanzania, a number of studies were undertaken and findings documented. One of the findings was an ineffective use of modern climate services in many areas and strong reliance on

traditional knowledge. While acknowledging the significance of traditional knowledge as part of climate change adaptation, it is necessary to enhance outreach activities and awareness campaigns to ensure that all stakeholders, particularly in rural areas understand the role of climate services in improving their adaptive capacity. In addition, efforts should continue to bridge the gap between traditional knowledge and modern climate services to increase the trust of local communities to modern climate services as well as preserving their traditional knowledge and technologies, which are still working better in a changing climate.

iv. While the role and achievements of the implementation of the GFCS Programme is appreciated, it is recommended that a bottom-up approach should be employed in developing other similar initiatives to ensure ideas of the local institutions and stakeholders are considered in developing climate change interventions. This is because there are so many researches work and publications, which would otherwise strongly contribute to the process in such areas as stakeholders' communication and engagement, coordination approach, capacity building, etc.

v. It would be necessary to continue enhancing partnerships, collaborations, and cooperation (both local and international) aiming at improving climate services in Tanzania. The implementation of the GFCS Programme in Tanzania serves as a model on how such partnerships and collaborations can benefit both parties through *inter alia,* exchange of knowledge, experience and expertise; sustained technical dialogues that may be positive for policy; sharing of technological findings and ideas; and policy related exchange of ideas, findings and experiences.

vi. Since there is a number of interventions that have been made at district and local levels, related to climate services in Tanzania, it is recommended that a thorough evaluation of the situation be undertaken in selected areas, in order to identify key achievements and document challenges and gaps requiring more interventions. This will be useful for improvement on future programmes and for implementation of the National Framework for Climate Services.

4.2.2 Research and development

i. Enhancing research and development as well as training in climate services by all relevant institutions including research and higher learning institutions, as well as promoting and enhancing the public private partnership is highly recommended.

ii. Efforts to undertake more research should be strengthened to continue informing and influencing policy processes, planning, and budgeting in all sectors, including the private sector.

iii. Research and development activities geared towards enhancing accuracy and reliability of climate information and products, particularly early warning of hydrometeorological disasters, onset and cessation of rainfall is highly recommended to underpin advancement and achievement of sustainable development goals, particularly goal number 1, 2 and 3.

iv. Furthermore, research and development initiatives to enable and facilitate cost effective dissemination and utilization of climate information and products are highly encouraged.

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