The State of Climate Information Services for Agriculture and Food Security in East African Countries

Working Paper No. 5

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

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CLIMATE CHANGE AGRICULTURE AND FOOD SECURITY

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Abstract

The increase in extreme climate events that is expected to accompany climate change will have far-reaching impacts on agricultural production and food security, water availability, energy resources, health, biodiversity, and human settlement, especially in Africa. The timely provision of climate information may help vulnerable societies and individuals to prepare for these extreme events, thus mitigating the costs associated with bad years and allowing them to better capture the benefits associated with favorable climatic conditions. Through research conducted by way of questionnaires, consultations, visits, interviews, and websites, the current study sets out to inventory different types and formats of climate information used in East Africa. It also assesses current climate services, including how such services are disseminated and applied by various regional and national actors, and makes recommendations on the sorts of measures that might be taken in order to better satisfy climate information needs of the agriculture and food security sector in East Africa.

Keywords

East Africa; climate services; agriculture; food security

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Contents

Acronyms

ABS	Africa Biofortified Sorghum
ABSF	African Biotechnology Stakeholders Forum
ACMAD	African Centre of Meteorological Applications for Development
ACODE	Advocates Coalition for Development and Environment
ACPC	African Climate Policy Center
ACT	Agricultural Council of Tanzania
ACTS	African Centre for Technology Studies
AEWACS	African Early Warning and Advisory Climate Services
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
AHBFI	Africa Harvest Biotech Foundation International
ALDEV	African Land Development Unit
ALIN	Arid Lands Information Network
ALLPRO	ASAL Based Livestock and Rural Livelihoods Support Project
ARARI	Amhara Regional Agricultural Research Institute
ARIS	Agricultural Research and Investment Services
ASAL	Arid and Semi Arid Lands
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
AT	Appropriate Technology
ATIRI	Agricultural Technology and Information Response Initiative
AU	African Union
AUC	African Union Commission
BFALRC	Bahir Dar Fishery and Aquatic Life Research Center
BTA	Biotechnology Trust Africa
CAADP	Comprehensive Africa Agriculture Development Program
CABI	Centre for Agricultural Bioscience International
CAEC	Department of Continuing Agricultural Extension Education
CBOs	Community Based Organizations
CC	Computer Centre
CCADP	Comprehensive African Agricultural Development Program
CDMHA	Centre for Disaster Management and Humanitarian Assistance
CDW	community development workers
CGIAR	Consultative Group on International Agricultural Research
CHILD	Children in Local Development
CILSS	Permanent Inter-State Committee for Drought Control in the Sahel
CIMMYT	International Maize and Wheat Improvement Center
CIRDES	International Centre for Research and Development on Livestock in the Sub-humid Zones
COHESU	Community Health Support
COMESA	Common Market for Eastern and Southern Africa
CONDESAN	Consortium for the Sustainable Development of the Andean Eco-region
CORAF	Council for Agricultural and Research Foundation
CORDIO	Coastal Oceans Research and Development in the Indian Ocean
COWORASE	Concerned Women of Rakai, Ssembabule
CRF	Coffee Research Foundation
CRS	Catholic Relief Services
DANIDA	Danish Development Agency
DDAR	demand-driven action research
DFID	Department for International Development (UK)
DMCH	Drought Monitoring Centre Harare
DMCN	Drought Monitoring Centre Nairobi

DOM	Department of Meteorology, Uganda
DPPA	Disaster Prevention and Preparedness Agency
DRSRS	Department of Resource Surveys and Remote Sensing
DRT	Division of Research and Training
DSI	Development Studies Institute
EAAFRO	East African Agricultural and Forestry Research Organization
EAAPP	East African Agricultural Productivity Project
EAAVRO	East African Veterinary Research Organization
EAC	East African Community
EAFCA	Eastern African Fine Coffees Association
EARRNET	Eastern Africa Root Research Network
EARS	Ethiopian Agricultural Research System
ECAPAPA	Eastern and Central Africa Program for Agricultural Policy Analysis
EIAR	Ethiopian Institute of Agricultural Research
EPTHA	Eco-regional Program for the Humid and Sub-humid Tropics of SSA
EU	European Union
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EWS	early warning systems
FAO	Food and Agricultural Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FEWSNET	Famine Early Warning Systems Network
FIRRI	Fisheries Resources Research Institute of Uganda
FOODNET	Marketing and Postharvest Research in Eastern and Central Africa
FORI	Forestry Research Institute of Uganda
FOSRI	Food Science and Technology Research Institute
FRN	Swedish Council for Planning and Coordination of Research
FSD	Financial Sector Deepening
FSE	Faculty of Science and Engineering
GAW	Global Atmospheric Watch
GCOS	Global Climate Observing System
GEF	Global Environmental Facility
GFCS	Global Framework on Climate Services
GHACOF	Greater Horn of Africa Climate Outlook Forum
GHF	Global Humanitarian Forum
GIEWS	Global Information and Early Warning System
GOK	Government of Kenya
GPC	Global production centres
GTP	Growth and Transformation Plan
GWI	Global Water Initiative
GWP	Global Water Partnership
HCF	Health and Climate Foundation
HLIs	Higher Learning Institutions
HOARECN	Horn of Africa Regional Environment Centre and Network
HORTEXA	Horticultural Exporters Association
ICAO	International Civil Aviation Organization
ICCE	International Centre for Conservation Education
ICM	Information and Communication Management
ICPAC	IGAD Climate Prediction and Applications Centre
ICPAC	IGAD Climate Prediction and Applications Centre
ICRISAT	International Crops Research Institute for the Semi-Arid-Tropics
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IFRC	International Federation for the Red Cross
IGAD	Inter-Governmental Authority on Development's
IITA	International Institute of Tropical Agriculture

ILBI	Index Based Livestock Insurance Project
ILCA	International Livestock Centre for Africa
ILRAD	International Laboratory for Research on Animal Diseases
ILRI	International Livestock Research Institute
IMS	Institute of Marine Sciences
IPCC	Intergovernmental Panel on Climate Change
IRI	International Research Institute for Climate and Society
IRMA	Insect Resistant Maize for Africa
ITDG	Intermediate Technology Development Group
IUCN	International Union for Conservation of Nature
IWIN	International Wheat Improvement Network
IWMI	International Water Management Institute
JARC	Jinka Agricultural Research Center
JJA	June-July-August
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KAINet	Kenya agricultural information network
KARI	Kawanda Agricultural Research Institute
KARI	Kenya Agricultural Research Institute
KASAL	KARI The Kenya Arid and Semi-Arid Lands Program
KEBS	Kenya Bureau of Standards
KEMRI	Kenya Medical Research Institute
KETRI	Kenya Tripanosomiasis Research Institute
KEVEVAPI	Kenya Veterinary Vaccines Production Institute
KEWI	Kenya Water Institute
KFSM	Kenya Food Security Meeting
KFSSG	Kenya Food Security Steering Group
KMA	Kenya Maritime Authority
KMA	Korea Meteorological Administration
KMD	Kenya Meteorological Department
KMFRI	Kenya Marine and Fisheries Research Institute
KSA	Kenya Sugar Authority
KWS	Kenya Wildlife Services
LBDA	Lake Basin Development Authority
LVBC	Lake Victoria Basin Commission
LVEP	Lake Victoria Environmental Program
LVFO	Lake Victoria Fisheries Organization
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MAM	March-April-May
MARI	Mikocheni Agricultural Research Institute
MERET	Managing Environmental Resources to Enable Transition
MFI	Meteo France International
MISTRA	Foundation for Strategic Environmental Research
MMUST	Masinde Muliro University of Science and Technology
MoA	Ministry of Agriculture
MOLD	Ministry of Livestock Development, Kenya
MoU	Memorandum of Understanding
MUARIK	Makerere University Agric. Research Inst. Kabanyolo
MUCCoBS	Moshi University College of Cooperatives and Business Studies
MWA	Millennium Water Alliance
NAADS	National Agricultural Advisory Development Service
NAARI	Namulonge Agricultural and Animal Production Research Institute
NABC	National Agricultural Biotechnology Centre
NACRRI	National Agricultural Research Organization
NAGRC&DB	National Animal Genetic Resources Centre and Databank
NARI	National Agricultural Research Institutes

NARLI	National Agricultural Research Laboratories
NARO	National Agricultural Research Organization
NARP	National Agricultural Research Policy
NARS	National Agricultural Research System
NASA	National Aeronautics and Space Administration
NBEA	Nile Basin and Eastern Africa
NDVI	normalized difference vegetation index
NEMA	National Environment Management Authority
NEPAD	New Economic Partnership for African Development
NEWS	National Early Warning System
NGO	non-governmental organization
NIB	National Irrigation Board
NMA	National Meteorology Agency
NMC	National Meteorological Centre
NMHS	national meteorological and hydrological services
NOAA	National Oceanic and Atmospheric Administration
NOAA	National Oceanographic and Atmospheric Administration
NOVIB	Partners Forum on Sustainable Land Use in Ethiopia and Eritrea
OFDA	Office of Foreign Disaster Assistance
OKN	Open Knowledge Network
OND	October-November-December
PA	Practical Action
PARI	public agricultural research institutes
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
PELUM	Participatory Ecological Land Use Management Association
PMA	Plan for Modernization of Agriculture
PMC	Pest Management Centre
POLINOVA	Promotion of Local Innovation by Farmers
PRAPACE	Regional Network for the Improvement of Potatoes and Sweet Potatoes in Eastern and Southern Africa
PRRO	Protracted Relief and Recovery Operation
PSNP	Productive Safety Net Program
RAIN	Regional Agricultural Information Network
RANET	RAdio and InterNET
RARIs	Regional Agricultural Research Institutes/centres
RCMRD	Regional Center for Mapping of Resources for Development
RCoEs	Regional Centres of Excellence in East Africa
RCOF	Regional Climate Outlook Forum
REC	regional economic community
REN	Rural Empowerment Network
RITA-ALIN	Reseau d'Information des Terres Arides or the Arid Lands Information Network
RSP	research service providers
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SAARI	Serere Agricultural and Animal Production Research Institute
SADC	Southern African Development Community
SARI	Southern Agricultural Research Institute
SIDA	Swedish International Development Agency
SLP	System-wide Livestock Program of CGIAR
SLUF	Sustainable Land Use Forum
SMC	Solomon Mashlangu Campus
SNAL	Sokoine National Agriculture Library
SNNPR	Southern Nations Nationalities and Peoples Regional State
SPFS	Program for Food Security
SRO	sub-regional research organizations

SSA	sub-Saharan Africa
STPIL	Science and Technology Park and Industrial Linkages
SUA	Sokoine University of Agriculture
SUATF	SUA Training Forest
SWM	Solid Waste Management
TBK	Tea Board of Kenya
TMA	Tanzania Meteorological Agency
ToR	Terms of Reference
TRF	Tea Research Foundation
UCFA	Uganda Commercial Farmers Association
UDSM	University of Dar es Salaam
UFA	Uganda Floricultural Association
UFAL	Uganda Farmers Agribusiness Ltd
UHBKA	Uganda Honey Beekeepers Association
UN OCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNBRP	Ugandan National Banana Research Program
UNDP	United Nations Development Program
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNFA	Uganda National Farmers Association
UNFCCC	United Nations Framework Convention on Climate Change
UNFFE	Uganda National Farmers Federation
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UWA	Uganda Wildlife Authority
VEDECO	Volunteer Efforts for Development Concerns
WAMIS	World Agro-meteorological Information Service
WCC3	World Climate Conference
WEMA	Water Efficient Maize for Africa
WFP	World Food Program
WFP/VAM	World Food Program's Vulnerability Analysis and Mapping Unit
WIFA	Weather Information for All
WIOMSA	Western Indian Ocean Marine Science Association
WMO	World Meteorological Organization
WRMA	Water Resources Management Authority
WV	World Vision
WWF	Worldwide Fund for Nature
WWW	World Weather Watch

Executive Summary

Climate variability may occur either due to external forces such as changes in the sun's energy output that raises the earth surface temperature generating changes in atmospheric winds and ocean currents, which are the main distributors of energy and driving force of the global climate system or by interactions among the different components of the global climate systems, the atmosphere, oceans, biosphere, ice cover, and land surface. The recent assessments of the Intergovernmental Panel on Climate Change (IPCC) have shown that human activities including land use are changing the climate of the Earth. The IPCC assessments reports have also noted that the parts of sub-regions in Africa are among the most vulnerable to the negative impacts of climate variability and climate change associated with extreme climate event. The high frequency of occurrences and magnitudes of extreme climate events have contributed significantly to problems wiping out many years of national development investments in various social-economic activities, negating developmental efforts, as well as devastating livelihoods and national infrastructures in Africa. They have forced African nations to redirect most of the planned resources for national programs to relief and recovery activities.

The understanding, prediction and early warning of extreme climate events are therefore critical to regional climate risk reduction and sustainable development in Africa. Forecasts that address prospects for the next month and season ahead are most needed, but predictions of how natural variability and climate change will interact and impact on event frequency over the next decade and longer are also important to inform adaptation strategies.

There is evidence that substantial gains to sustainable food security and national development adaptation strategies can be achieved in Africa through provision and integration of improved climate information and prediction products into decision-making systems. Accurate monitoring, prediction and early warning of seasonal rainfall performance can be used to improve planning and management of various rainfall dependent socio-economic activities, and enhance the resilience and livelihood of the communities and services within the GFCS established by the declaration of the 3rd World Climate Conference (WCC-3) held in 2009 in Geneva, Switzerland. There is increasing services demand for sector-driven tailored climate information products and services for applications in agriculture and food security, pastoral systems, health, water, and energy resources in Africa. In agriculture and food-security, the climate information products derived from observational data for decision making and management actions include, the 10-day agro-meteorological and agro-hydro-meteorological bulletins, alerts, monthly and seasonal climate forecasts downscaled from consensus forecast issued at the regional climate outlook forum (RCOF). However, there is a need to undertake a scoping study to review and assess the existing climate information products and services targeting agriculture and food security in Eastern Africa region.

The study gathered information through circulated questionnaires, consultations, visits, interviews, and websites, the current study sets out to inventory different types and formats of climate information used in Eastern Africa. It also assessed current climate services, including how such services are disseminated and applied by various regional and national actors, and made recommendations on the kind of measures that could be taken in order to better satisfy climate information demands for agriculture and food security sector in Eastern Africa.

From the analysis of responses to the survey questionnaire and interviews, it was noted that at national level the national meteorological and hydrological services (NMHS) provide climate information

which includes observations, analysis and forecasts at short-range, medium-range, and long-range for various sectors decision making. In addition, the most basic types of climate information regularly used by most stakeholders are:

- Raw data, particularly rainfall at specific locations;
- Historical rainfall and other agro-climatic datasets, being used by agricultural experts to design agricultural calendars for farmers and other user communities;
- Rainfall, humidity, temperatures minimum and maximum are being used for monitoring crop development, crop diseases and estimation of crop yield and food production;
- Wind speed and direction are needed to monitor locust invasion, application of fertilizer and spray of pesticides.

The provision of the food security Early Warning Systems (EWSs) has improved the region's ability to deal with food crisis and famine. This includes the food security assessments provided at the RCOF, the Famine Early Warning System Network, national-level food-security authorities/commissions, and interdisciplinary working groups.

In assessing climate services, the scoping study found various applications of climate information and services as follows: Seasonal climate forecasts for informing stakeholders in agriculture and food security about potential risks, monthly climate watch for crop monitoring and food situation assessments, special alert bulletins for informing stakeholders on potential disaster risks while climate projection models are for formulating adaptation strategies to climate change in the agriculture and food security sector.

Providers and users expressed the need to develop focused or tailored climate services based on specific request of users in agriculture and food security. Risk maps for food security, heavy rains, strong winds, in addition to dust and sand storm products, information on dry spells, late onset or early cessation of rainfall would be useful for early warning, contingency planning and action in the agriculture and food security under climate variability. The climate and agriculture research communities are challenged to develop interdisciplinary databases and undertake research for adaptation to climate variability and change.

From seasonal to multi-decadal timescales, local forecasts and scenarios are required from the climate services community. Farming practices, agricultural calendars, food production models, crop-yield estimation and assessment tools, food demand, supply and market prices models are expected from the agriculture and food security community. Interdisciplinary groups should be established to analyse outputs of these models and tools together with other non-climate related risk factors to generate climate change adaptation options for the agriculture community of Eastern Africa region.

Climate analyses and outlooks are being progressively considered among advanced climate change adaptation tools. Even though there is increased awareness on climate change and the need for adaptation, more than half of farmers in countries are not yet exposed to research and extension services and where available, these services do not usually address effectively the demands of farmers. As a way forward, there is a pressing demand to improve farmers' capacity to articulate demands for agricultural advisory services, build partnerships between farmers and information service providers and build capacity of service providers to respond to expressed demands. Efforts are therefore required to make future outlooks more relevant to informing decision strategies, policies, plans and practices in the agriculture and food sector.

The following recommendations are expected to guide development of a roadmap underpinning scientific knowledge and prerequisite information to facilitate adaptation to climate change in the agriculture and food security sector of Eastern Africa:

Adequate engagement of the full range of actors and issues are needed to undertake research and development on better climate products and services for agriculture and food security, participatory approach in the design and implementation of joint projects involving experts in relevant sectors.

In collaboration with the agriculture community, climate experts should continue to improve content, format and relevance of climate information.

It is essential to go beyond concepts and methodological approaches and move toward feasible and cost-effective adaptation options using the next generation of climate products and services by:

- Better documenting types of agriculture practices and food security concerns in the region;
- Inventorying pathways of climate impacts on agriculture and food security;
- Inventorying indicators of impacts pathways; and
- Inventorying and scaling up best practices on climate information production and use in agriculture and food security.

There is increasing recognition of the climate change impacts on the frequency and magnitude of extreme events. Current climate products and services still fall short in providing relevant climate information for agriculture advisory services and food security. Mostly response and recovery are recorded in cases of extreme climate in much of the sub-region. Future efforts should shed some lights on balance intervention including prevention, preparation in addition to response and recovery by adjusting policies, plans, regulations, decisions and practices in the agriculture and food sector.

A standard feedback mechanism should be developed to improve weather forecasts needed in the agriculture and food security sector.

It was found from the study that there are several users of climate data and information. It is recommended that the provider of this climate information should improve on the quality and accuracy of these products in order to increase the usage of the products.

It was noted that due to the lack of sufficient cooperation and collaboration of various food security outlooks and early warning systems, the systems seem to compete for the same information sources and meet the needs of similar user groups resulting in unnecessary duplication. It is recommended that the institutional arrangements of existing monitoring systems should be strengthened and coordinated by the Governments.

Early warning systems should be evaluated on the accuracy of the data they produce as well as their capacity for data processing, analysis and interpretation. It is important that the information produced arrives in a timely fashion, giving decision makers enough lead way to produce the necessary policy responses.

In countries for example Kenya, the farmers get climate information from extension services, daily radio, television, newspapers and through community interactions. Experience has shown that the majority of farmers prefer indigenous forecasting knowledge more than contemporary forecasting. Their reasons are that indigenous information is more compatible with local culture and it has been tested, tried and trusted. In addition, it is more specific and is in a language that can be understood

better by communities passing clear message that integration of indigenous forecasting knowledge into science based climate forecasting will promote effective use and create ownership by communities.

In some countries there is need for paradigm shift and attitude change in order to expand services and seek partners to demonstrate relevance in socio economic development, for NMHSs to become semi autonomous by:

- Setting standards to maintain quality;
- Control mechanism to avoid contradictory weather products and services;
- Monitoring compliance;
- Establishment of regulatory bodies.

Better ways of integrating users and providers of NMHSs services include interaction with users in Regional Climate Outlook forums and National Climate Outlook forums, making agreements, building collaboration and partnership with NGOs through training as part of community engagement. Other ways of integrating user would through joint research with universities, participation in national programs and organizing local level-climate users groups and forums.

In order to develop strategy for better ways of delivering services, there is a need for branding, exploiting faster modes of delivery at low cost using appropriate Media (mobile phone technology, TV, social media, radio, SMS services, Updated websites). There has been a lack of connection in disseminating services to users hence need to translate the products into local languages. The services should be timely with continuous evaluation and feedback from users.

It is imperative to improve quality of information and services given to users and this can be achieved through understanding customer needs and the added value of integrated climate information in the growth of the national economy. In order to further improve the quality of services, there is a need for benchmarking against established NMHSs and carrying out socioeconomic-sector pilot projects is highly recommended. As part of benchmarking, NMHSs need to carry out institutional mapping to identify threats and opportunities within the country and the region.

The important aspect needed in assessment of climate information and services, is evaluation of impacts and measurement of benefits. Demonstrated impacts on decision-making and uptake of information by user may be through evident strengthened collaborations with customers and stakeholders, especially in particularly vulnerable risk areas and sectors. The benefits accruing from use of climate information and services are indicated through increased demands of pilot project demonstrations and contingency plans made to mitigate losses or maximize profits. For all the above to be achieved in the regions, the need to establish baseline information for impact assessment is very crucial.

Mobile phones could be an effective tool for communicating messages to poor small-scale farmers in developing countries. You would find at least one person with a mobile phone in a village; this person can be made the focal point and convey messages on actions to be taken through that person within the area.

In many instances, the installation of weather stations does not take into account, the quality of data generated, hence the WMO recommendation be observed during instruments installations.

The majority of the stakeholders interviewed in this scoping study indicated that rainfall and temperature data are very important if disseminated in time with good spatial distribution.

Introduction

The Eastern African region is highly vulnerable to the increased climate variability and change impacting adversely on major sectors that significantly contribute to the sub-region's economic growth and livelihoods. The anticipated increase in frequency and magnitude of extreme climate events such as floods and droughts will have far-reaching impacts on agriculture and food security, health, water and energy resources, biodiversity and human settlements in the sub-region. The areas already facing water scarcity may get drier raising disputes and conflicts on limited water resources. The parts of the sub-region ecosystems rich biodiversity will face further encroachment and severe degradation causing more human and wildlife conflicts.

In Eastern Africa, 80% of the population is involved in agriculture, which contributes to 40% of the sub-region's GDP. Climate change impact especially on the agricultural sector will cause severe reduction on subsistence crop yields, cash crops and livestock products. The worst hit by increasing climate shocks will be the highly vulnerable poor, who depend on agriculture for their livelihoods and have low adaptation capacity to cope with increasing climate-risks such crop failures and livestock deaths causing serious economic losses undermining food security in the sub-region. In order to feed the projected increasing population, a radical transformation is needed to enhance agricultural production to coping with climate change impacts without exacerbating environmental problems.

Although, some countries in the world are able to anticipate some climate events and related food production and market prices several months in advance, most of the developing countries are still facing low crop yields and unforeseen fluctuations in food production and market prices due to increasing climate variability and change. Increased global temperature due to climate change would alter the climate and the geographical food production due to shifts in rainfall with some areas becoming drier, some experiencing severe droughts while others will experience increased rainfall with frequent floods. In the Eastern Africa, the climate information products and services including historical data outputs have been used to inform agriculture policies, plans and practices. The countries have developed regional and national food security outlooks and famine early warning systems based on climate products and services to manage increasing climate risks.

There exist a number of constraints to reducing the vulnerability of socioeconomic systems to climate change. The key among these is a lack of connection between national adaptation efforts and research. Integrated climate information, products and services backed by intensive applied research will contribute immensely in the development of appropriate adaptation strategies to climate change. For example research has shown that several trees and shrub species found in Kenya and other parts of eastern Africa region have high potential in the treating malaria and other diseases turning around the fortunes of peasant farmers by generating income.

Despite the availability of relatively reliable climate information and products by the late 1990s, farmers seldom use these for farm level decision-making (Hansen 2002; Hammer et al. 2001). This is mainly due to lack of adaptability of the information to the locality and difficulties in accessing the information on time and in a format that decision makers can easily understand. In this regard, this study now intends to contribute to narrowing this gap through inventorying the climate information types, format and how they are disseminated from various regional and national actors.

In an attempt to better define activities to address these problems, it is necessary to carry out an inventory of the existing climate information types and format, assesses current climate services

including how they are disseminated and applied by various regional and national actors and makes recommendations on the way forward to better satisfy climate information needs of the agriculture and food security sector in the Eastern Africa region. The Consultative Group on Agriculture Research (CGIAR) and Earth System Science Partnership (ESSP) are collaborating within the framework of the Challenge Program on Climate Change, Agriculture and Food Security (CCAFS) on the research theme "Adaptation Pathways Based on Managing Current Climate Risk." This program concerns the evaluation of the existing climate products and services' existing in the Eastern Africa.

There is strong interest in the use of climate information and particularly seasonal forecast information in agriculture and food security, but the following constraints (Ingram et al., 2002, O'Brien et al. 2000, Ziervogel 2004) have been noted:

- Communication failures,
- Limited access to information,
- Mismatch between farmers needs (Hansen 2002); and
- Scale, content, format or accuracy of available information.

During the 2000s, there have been opportunities to address these constraints and improve climate information production and use. The climate outlook forums and users capacity building workshops have prompted a number of stakeholders to initiate efforts towards the development of integrated regional/national management policies (Njau et al. 2007). These include local downscaling to address spatial and temporal scale problem (Robertson 2008), presentation of predictive information on rainfall frequencies (Moron et al. 2007), risk of damaging dry and wet spells (Sun et al. 2007, Robertson et al. 2008), translating climate information into agriculture production (Hansen et al. 2006). In an attempt to review progress and better define activities to address these remaining problems, an assessment of current climate information, products and services available to assist agriculture and food security is necessary.

The interactions between producers of climate information, researchers and different categories of decision makers have been enhanced through regional climate outlook forums (RCOFs) organized by ICPAC in collaboration with NMHSs with partners. The dialogue has contributed significantly to the development of regional and national adaptation strategies focusing on agriculture and food security and water resources management.

The new initiatives in the region include the Bioresources Innovation Network for Eastern Africa Development (Bio-Innovate) that was officially launched in Nairobi on in March of 2011 with a five-year grant from the Swedish International Development Agency (SIDA). Bio-Innovate will be managed by the International Livestock Research Institute (ILRI) and hosted at its Biosciences Eastern and Central Africa centre. It will connect and fund Eastern Africa agricultural researchers and assist them in reaching out to the private sector and is expected to yield products to aid the region's development and fill a long-standing "missing link" between research and market products and inspire Eastern Africa bioscientists to generate research that will accelerate the region's development towards future that is food-secure and resilient to climate change.

This report assesses existing climate products and services in Eastern Africa as a contribution to better define and undertake research to support climate risk management in the agriculture and food security sector.

Conceptual and Methodological Framework

To highlight and underscore the important roles being played by national and international institutions or organizations who are providers and users of climate information products and services, there is need to conceptualize the framework of institutions involved in gathering of the data and other information involved in this study.

Scope of Climate Data and Information Useful in Agriculture and Food Security

Good quality and adequate historical climate data are indispensable for monitoring climate change impacts and vulnerability at global, regional and national levels. While climate science has made substantial advances in recent years with more reliable climate information products and services now becoming increasingly available, it is essential that this information be made locally accessible to the neediest, with full ownership by the relevant communities.

Planners have historically managed climate risks with differing degrees of success, depending, in part, upon the quality and scope of the climate information available to them (ADF 2010). Good climate services require improved capacity to tailor climate information products to meet specific user needs. Improved communication is also required between climate service providers and key climate sensitive sectors. Technical advisory services on climate risk management provided by experts with a view to enabling interpretation and effective applications of climate information products are apparently the missing link. While ClimDevAfrica has started investing in upgrading of regional climate services by strengthening regional and sub-regional climate for development institutions, there is still room for scaling up the climate-related efforts in data requirements at country level, in the context of the GFCS. Concerns still remain for CRM deliveries due to the data policies in force in countries that restrict access to data. Capacity for integrating data and information at the national level using multidisciplinary approaches currently established in the IGAD countries is needed in the Eastern Africa region.

Identification of Users and Providers

The climate information products and services providers are organization established as regional, sub-regional intergovernmental organizations by States governments or at national level by government for the purpose of carrying out meteorological and related functions which governments consider as a responsibility of the States in support of the safety, security and general welfare of their citizens and in fulfilment of their international obligations under the Convention of the World Meteorological Organization (WMO) (Zillman 1999). In many countries, the National Meteorological Services and Hydrological Services (NMHSs) have established agro-meteorological services with a view to producing climate information products for use in their national agricultural activities through regular provision of bulletins).

In November 2009, AGRA launched a partnership with the African Union's New Partnership for Africa's Development (NEPAD), in support of the Comprehensive Africa Agriculture Development Program (CAADP). The AGRA-NEPAD partnership recognizes that an African Green Revolution is essential to realizing CAADP's goal of at least six per cent annual agricultural growth in African countries. AGRA and NEPAD are working together through National CAADP Roundtable Processes to formulate national plans for agricultural development that benefits smallholder farmers.

The organizations used in this study were classified in two categories according to whether they provide or use climate information. Users of climate information products and services are divided into those that process climate information into possible impacts, proposed mitigation options and advices (boundary organizations) and decision, policy makers or end-users (e.g., farmers, managers, political leaders). Organizations such as ICPAC, ACMAD and the NMHSs are considered producers or providers of this climate information products and services while developmental organizations such as FAO, AGRA, ASARECA, WFP, FEWSNET, USAID, ILRI, CGIAR, ICRISAT play double role being users and in some cases producers. Boundary organization is an institution or entity that works with users in given sector(s) at various levels and that has, at the same time, certain in-house expertise in understanding and interpreting climate information and products. In this regard approaches used by each organization to reach various user communities in the countries have been documented to some extent.

Methodological Approach

The scoping study began with analysis of the web sites and literature review to determine institutions and organizations involved in the production and use of climate information products and services in agriculture and food security in Eastern Africa region. A questionnaire and visits to assess current climate services and identify needs were conducted by experts through visits to 3 of the 4 pilot countries (Kenya, Uganda and Tanzania) and in addition contacts were made with scientists in various fora including the ICPAC 27th Regional Climate Outlook Forum (RCOF), the GHACOF-27, held at the Snowcrest Hotel, Arusha, Tanzania on 28th February 2011.

Questionnaire

ACMAD prepared and circulated the questionnaire (Appendix 1) to carry out the survey on existing climate information products and services. Several questionnaires were sent to providers (National Meteorological Services and regional institutions) and different users in the agriculture and food security sector and research who were also requested to disseminate them as widely as possible in the 4 pilot countries in the Eastern Africa region.

The questionnaire aimed at profiling the institutions by describing their missions and activities including partnerships and networks in which they operate. Another objective was to identify what information they produce, how it is used and what are the limitations and opportunities for improvements. The received survey questionnaires responses were analysed through categorization of the distinctive roles of climate services by provider institutions and user communities and boundary/extension organizations including the existing support institutions and initiatives.

Analysis of responses to the questionnaire was instrumental in preparing relevant sections of the Report. Limitations and opportunities for improvements were deduced from recommendations. All partners who contributed by completing the survey questionnaire and others who supported this important scoping study for its successful completion are acknowledged in this Scoping Study Report.

Consultations, Visits, Interviews and Websites

Organizations in three (Uganda, Tanzania and Kenya) of the four pilot countries were visited by ACMAD experts involved in the study. The visits involved the holding of discussions, consultations and interviews with institutions/programs/projects professionals on climate products related to agriculture and food security. These interviews, web sites visits and reports from hired country expert

have made a major contribution to this scoping study report. Institutions and professionals interviewed are as in Appendix 2 and 3.

Inventory of Climate Services

The Heads of States and Governments, Ministers and Heads of Delegations present at the third World Climate Conference (WCC-3), held from 31 August to 4 September 2009 in Geneva, the Conference declaration, established a Global Framework for Climate Services to strengthen the production, availability, delivery and application of science-based climate prediction and services. Climate services can be defined as the provision of climate products to assist user's decision-making and planning in climate sensitive activities. A climate product is the result of a process of synthesizing climate data and information.

Noting that climate services depend critically on predictions of time-evolving regional climate on timescales from seasonal-to-interannual, multi-decadal, century and beyond, it is necessary that climate prediction science must be accorded an important part in organizing beneficial climate services.

The effective implementation of the GFCS is expected essentially to lead to widespread social, economic and environmental benefits through more effective climate risk management and increased capacities for adaptation to climate variability and change. To improve the delivery of tailored climate information products and services, it is imperative that an inventory of the users and providers of climate information is made for future collaboration and partnerships (Appendix 4)**.** The following subsections provide a review and details on climate information and services.

Categories and Types of Climate Information and Services

The institutions that provide climate information products and services include the countries NMHSs and the IGAD Climate Prediction and Applications Centre (ICPAC) located in Nairobi, Kenya among other institutions in the eastern Africa region. ACMAD also issue dekadal and monthly climate watch bulletins covering the Region.

There are several categories and types of climate information products and services existing in the countries for agriculture and food security. These include Daily Weather Forecasts; Dekadal Agro-meteorological Bulletins; Monthly Climate Outlooks; Seasonal Climate Outlooks; Climate Alerts; observed climate Impacts; and Tailored information for users (farmers) including various types of climate mean maps on different parameters as briefly presented below.

Daily Weather Forecasts

These are weather forecasts that are issued out to the agricultural communities and general public daily. They normally contain detailed likelihood of forecasts (possibility of showers and temperature) for the following day for every region in Uganda. They also include detailed daily weather statistics (usually for yesterday), including temperature and precipitation.

Dekadal Agro-meteorological Bulletins

This bulletin contains observed climate statistics for the previous 10-days over the country. These statistics includes spatial and temporal performance of rainfall within the country, temperature, relative humidity and winds among others. It also gives report on the stage of crop development,

general assessment of crop performance and yield expected (visual) from the farmers' farms on the basis of what they see from nearby farms and oral interviews with farmers by Kenya Meteorological Department (KMD) Agro-meteorological observers from 14 agro-meteorological stations across the country. Other crucial information on general assessment of crop performance is obtained from some District Agricultural Officers through emails and cell phone text messages. The bulletin also includes the weather systems that were responsible for the occurrence of the previous 10-day's weather. In addition, the weather forecast for the next ten days is also provided.

Monthly Climate Outlooks

This forecast is given out monthly especially to farmers. It gives the monthly updates of the rainfall and temperature performance for every climatological zone in the country. It contains statistics on the observed weather parameters like rainfall and temperature against long-term mean. It also gives out probabilistic outlook for the next month in three categories (Above normal; Normal; Below normal) in order to detect the evolution of any significant anomalies that could impact negatively on the socio - economic activities of the region

Seasonal Climate Outlooks

These are products that are given out to the farmers and general public during the three rainfall seasons, the March to May (MAM), June to August (JJA), and October to December (OND). The forecasts have been very crucial in the detection of the evolution of any significant anomalies that could impact negatively on the socio - economic activities of the country. These forecasts are derived from statistical models and dynamical model outputs from advanced prediction centers. Other information that is contained in the seasonal forecasts includes the performance of the previous season in terms of rainfall and temperature, performance of crops and observed impacts. Other information includes the onset and cessation dates, distribution of seasonal rains based on the selected analogue years. The regional climate outlook forum (RCOF), the GHACOF organized by ICPAC in collaboration with NMHSs of Greater Horn of Africa countries and partners provide a platform for interaction between providers and users of seasonal climate consensus forecasts downscaled at national level for decision-making in agricultural production and food security, health, water and energy resources management (Figure 1 and 2).

Climate Alert Bulletins

These are alerts normally given out when the need rises. These climate alert bulletins provide climate updates as well as timely information on major regional climate stress and impacts associated with extreme climate events such as drought and floods. Some of these climate extremes have been associated with El Niño / La Niña events. It also spells out cumulative associated impacts of previous extreme climate events that are similar to what is evolving phenomenon.

Tailored information for users (farmers)

This is type of information is normally given out on request. The major clients for this information are Agricultural Commercial Farmers, Insurance Companies and Community Based Organizations. Some of the climate information required includes onsets and cessation dates for localized places, distribution of rains including amount and time, climatological maps, climate change vulnerability assessment maps; observed climate change indices for specified places, and advice on types of crops to be grown for particular regions among many others.

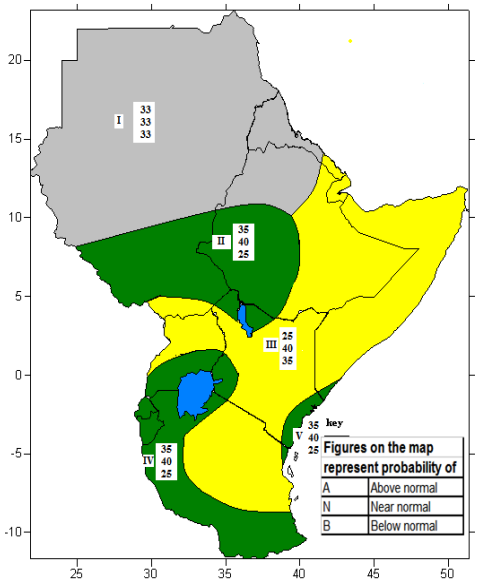


Figure 1: GHACOF 27 Seasonal consensus forecast for March-April-May (MAM) 2011 rainfall season (Source: ICPAC).

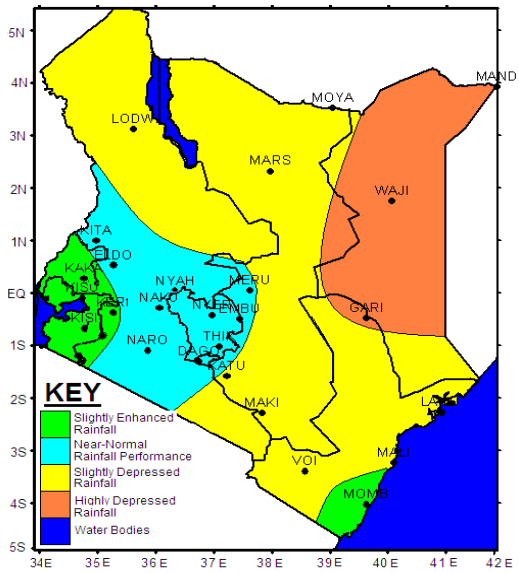


Figure 2: GHACOF - 27 Seasonal consensus forecast (MAM) downscaled for Kenya.

Review of Food Security Outlooks and Early Warning Systems

The devastating droughts associated with famines of the 1980s in sub-Saharan Africa (SSA) prompted the development of national and regional early warning systems (EWS) across the continent leading to the establishment of ACMAD and creation of the joint Drought Monitoring Centre in Nairobi (DMCN) currently the IGAD Climate Prediction and Applications Centre (ICPAC) and the Drought Monitoring Centre (DMC) Harare presently the DMC-Gaborone, through a UNDP project.

Strengthening EWS was identified in the Cairo Plan of Action of April 2000 as one of the priority areas for cooperation between the African Union (AU) and European Union (EU) to improve food security in Africa. Following this summit, the AU and EU agreed with the Food and Agriculture Organization (FAO) of the United Nations to conduct an assessment of existing EWS on food security in SSA with the following objectives:

- Obtaining a clear understanding of the efficiency and effectiveness of existing EWS;
- Reviewing strengths and weaknesses, credibility, cost-effectiveness and sustainability in regards to institutional, methodological, technical and resource issues; and
- Providing technical and institutional recommendations on actions to be taken to strengthen these systems for improved decision-making at national and regional levels.

This section provides review of different food security outlooks and EWS in the Eastern Africa region pilot countries, namely Ethiopia, Kenya, Uganda and Tanzania. The regional climate outlook forums (RCOFs) have been effective in alerting countries and donors of impending food crises largely in the context of seasonal droughts, helping to mitigate their adverse impacts. The existing early warning systems, together with poor communication and ineffective coordination and response mechanisms, have often contributed to acute food security emergencies that could have been prevented. However,

development partners have supported and also developed independent systems that are clearly important and highly influential playing an instrumental role in establishing and supporting EWS. Examples include the systems operated by the United Nations (e.g. FAO's Global Information and Early Warning System [GIEWS], FAO support to regional and national EWS and activities carried out under the World Food Program's Vulnerability Analysis and Mapping Unit [WFP/VAM]); and those operated directly by donors (e.g. USAID-funded Famine Early Warning System Network – FEWS NET) or non-governmental organizations such as Save the Children and CARE.

A working group of the Kenyan EWS, the Kenya Food Security Steering Group (KFSSG) of the Kenya Food Security Meeting (KFSM) oversees the work undertaken to adopt an integrated livelihood systems approach while the Ethiopian EWS conducts a range of rapid assessments (covering crops, pastoral areas and socio-economic, health and nutrition indicators) based primarily on expert opinion, combined with regular field-level monitoring by Ministry of Agriculture (MOA) extension staff to collect qualitative data for estimating a series of indicators relevant to early warning. According to Njau (2009), there are also potential socio-economic benefits that will be derived from applications appropriate climate indices in the provision of tailored early warnings for agricultural production and food security, health, water and energy resources management, including climate disaster risk reduction and in the development of adaptation strategies to cope with the anticipated increasing extreme climate events. In Eritrea, Ethiopia and Kenya, pilot initiatives with external support from technical partners have worked to complete baseline surveys to characterize and analyze livelihood systems (e.g. livelihood zoning and profiling) according to Tefft et al (2006).

Food insecurity continues to be a major development concern in the sub-region despite the well-endowed natural resource base and three rainfall seasons being experienced annually, the March-April-May (MAM); June-July- August (JJA); and October-November-December (OND)). It is important to ensure that all households have the access and ability to obtain minimum levels of food security and fulfill their nutritional needs - particularly in the most vulnerable groups that live in the chronically food insecure regions of the country or for those who reside in war-affected districts. Monitoring changes of food availability in areas affected by drought along with household coping strategies is useful for designing intervention strategies that are more decentralized and food security-oriented for the country. In order to achieve this food security, the climate outlooks and early warning systems are very crucial.

In Uganda there are several organizations engaged in food security, early warning and vulnerability assessment. However, only two major systems of information generation and dissemination are in operation for meeting food security and nutrition information needs for the whole country. These are the National Early Warning System (NEWS), implemented by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), and the Famine Early Warning System (FEWS), initiated and funded through United States Agency for International Development (USAID).

National Warning System (NEWS)

Food security monitoring began in Uganda in July 1991, with the establishment of the National Early Warning and Food Information Unit in the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). The unit was created to improve early warning of food deficit problems in the country in order to provide vital information on the food situation to government, donors and non-governmental organizations. NEWS was established under the Inter-Governmental Authority on Development's (IGAD) Regional Early Warning and Food Information System Project, which has initiated National

Early Warning Units in seven IGAD countries. FAO provided technical assistance with financial support from the Italian Government in the first phase of the project (1990 - 1994).

The main functions of NEWS included collecting, analyzing and interpreting crop, livestock, and agro-meteorological data, utilization of seasonal forecasts from DoM, early forecasting of the main food crops production situation, identifying surplus and deficit areas to guide seasonal marketing operations; carrying out pre and post harvest crops assessments; collaborating with other government and non-governmental organizations and institutions to generate appropriate early warning information and networking with regional and international early warning centers to foster information exchange and use.

The components of the NEWS project included periodic updates regarding growing conditions for the main food crops, such as cereals, pulses, oilseeds, root crops and plantains in order to forecast the likely crop yield and output. Weather forecasting was done in consultation and collaboration with the Meteorology Department of the Ministry of Water and Environment. NEWS collected information on agricultural inputs, especially on the supply of improved seeds and other farm tools before the start of the planting season. NEWS also collected data on farm gate prices of major food commodities from various districts. This information was supplemented with the price information collected through the Market News Service of the Ministry of Trade and Industry. These prices were compared with the rural average ones for changes in the food price levels. NEWS monitored livestock movements and seasonal changes in livestock prices and provided information on the likely outbreak of pests and diseases. In addition, the Nutrition Division in MAAIF would collect and analyze data on child anthropometrics and Body Mass Index for mothers for NEWS database. The project ended in 1995 due to lack of funding and some activities have been transferred to the Planning Department, which plans to strengthen them.

Famine Early Warning Systems (FEWS)

FEWS carries out vulnerability assessments in the East African region. The project has several bureaus in the region and a home office in Washington, D.C. The objective of the FEWS project is to provide timely information on impending food shortages that result from disasters like drought, and to warn policy and decision makers, along with donors of the need to assess famine threats and plan assistance accordingly. FEWS identifies populations and areas within Uganda where disruptions in food availability and accessibility are likely to have the greatest effect on food security. It also carries out vulnerability assessments to identify populations with risk of food insecurity, taking into consideration food availability and accessibility both at the national and regional levels. FEWS reports contain information on agro-climatic conditions, crop production, pasture and livestock, food stocks and markets.

It was noted that due to the lack of sufficient cooperation and collaboration, these systems seem to compete for the same information sources and meet the needs of similar user groups. The current institutional arrangements of existing monitoring systems have not been successful in strengthening the impact of information used in the food security decision-making processes. Given the limited in countries capacity for early warning of impending food shortages and related analysis, the existence of parallel systems of monitoring food security reduces the effectiveness of what is already available. This also gives mixed messages to those involved in food security issues on the earnestness of the government and donors in tackling the chronic food insecurity facing different parts of the country.

Although achieving food security for all parts of the sub-region is given a high priority by the governments and the donors, investments towards identifying the food as insecure have not been adequately realized. Further, there is a lack of co-ordination in the efforts by the donor community and the government in information generation, and its use for programming and policy planning activities. The diverse nature of information on the food security situation obtained from separate sources, leads to individual organizations designing their own strategies for solving the problem of food emergencies. Although they are well intended, these strategies often tend to conflict with each other and with those of the governments as well.

Institutional Profile

This section presents a brief profile of institutions/programs/projects in the four pilot countries; these were arrived at through ACMAD and local experts' visits, interviews, websites visits and survey questionnaire responses. These institutions/programs/projects were selected using criteria already discussed. They do not in any case exhaust those organizations relevant to climate change adaptation. The institutions are presented in their respective categories namely: climate services by provider institutions and user communities and boundary/extension organizations including the existing support institutions and initiatives. The visions, missions, areas of operation, current projects areas and, in some cases, the organizations they have partnered with are provided in each case.

Climates Service Provider Institutions

Regional Institution: ACMAD

ACMAD as a continental center is running the following projects aiming to strengthen African NMHSs and regional centers' capacities to improve their climate services to meet the increasing demand of users especially in agriculture and food security. The projects being conducted by ACMAD targeting the Eastern Africa include:

ClimDevAfrica –AfriClimServ. The Climate for Development in Africa (ClimDevAfrica) is a joint initiative of the African Development Bank (AfDB), the Commission of the African Union and the United Nations Economic Commission for Africa (UNECA), upon realizing that Africa is highly vulnerable to the adverse impacts of climate change and appropriate climate-related information and the policies to use the information effectively are not well developed. The ClimDevAfrica has 3 components. First: The Knowledge Management and Capacity Development Initiative known as the "Institutional Support to African Climate Institutions Project" or the "AfriClimServ" is a first contribution by AfDB to the Multi-Stakeholder "ClimDevAfrica" program from 2010 to 2012 coordinated by ACMAD as the Executing Agency in close partnership with the Global Humanitarian Forum (GHF) and the Climate Centers specific to each regional economic community (REC). The IGAD Climate Prediction and Applications Centre (ICPAC) in Nairobi, Kenya is the Eastern Africa sub-region collaborating institution in this project. Second: Enhancing the capacity of end-users, particularly national development policy-makers, to be able to mainstream climate change into development plans on the Continent. Third: Implementing adaptation and mitigation programs and projects that incorporate climate-related information so that we can learn the lessons and define good climate change adaptation and mitigation practices.

This initiative will be implemented along the recommendation of the ADF-VII (2010) Consensus Statement (www.uneca.org/adfvii/) and Action Plan. AfriClimServ, the first component of ClimDev, a project which aims to "strengthen current African Regional and Sub-regional climate centers of excellence to address climate change and variability prediction as well as in the development of climate applications decision tools."

This Knowledge Management and Capacity Development Initiative known as the "Institutional Support to African Climate Institutions Project" or the "AfriClimServ" is a first contribution by AfDB to the Multi-Stakeholder "ClimDevAfrica" Program and will be coordinated by the African Center of Meteorological Applications for Development (ACMAD) as The Executing Agency, and implemented from 2010 to 2012 in close partnership with GHF and the climate centers specific to each regional economic community such as the Economic Community of West African States, IGAD, SADC, the Economic Commission for Africa, and Intergovernmental Oceanographic Commission.

The specialized Climate Institution beneficiaries of the project in Eastern Africa are:

- The IGAD Climate Prediction and Applications Centre (ICPAC), and
- Global Humanitarian Forum Weather Information For All initiative;
- The objective of this Climate Risk Knowledge Management project is to strengthen the capacities of African regional climate centers to generate and disseminate climate information to support economic development in the continent. To achieve this, the project comprises three components to achieve following planned activities in all sub-regions:
- Development of physical infrastructure including observation sites
- Improved access to climate observation networks
- Operationalization of climate information systems
- Downscaling global climate data and scenarios
- Climate impacts assessments
- Dissemination strategy development and implementation
- Workshops & knowledge sharing
- Networking
- Enhancement of capacities of scientists
- Student and professional training
- Enhancement of management capacity

VIGIRISC. To complement and enhance the foregoing initiative the ACMAD "African Early Warning and Advisory Climate Services" (AEWACS) known as ViGiRisC project has focus on adaptation of African countries to climate variability and change by delivering Early Warning Systems. Project aims to strengthen capacities of African countries in the prevention of risks and socio-economic impacts related to climate variability and climate change through relevant and adapted tools and services of climate early warning and advisory. It has five thematic areas covering five sub-regions and these include:

- Food security: rain fed agriculture and pastoralism
- Water resources and risks associated with river flow
- Health: malaria, meningitis or other diseases
- Coastal zone: high tides and sea swell
- Life & property protection: Severe and high impact weather phenomena

All these thematic areas revolve around food security as water resource will have direct impacts on irrigation, while health will affect productivity, high tides and sea swell on fisheries and severe and high impact weather have direct impact on crop production as they may lead to destruction of growing crops or stored produce.

WIFA is an African-led initiative to improve access to in situ weather and climate observations throughout Africa. It focuses on assisting NMHSs strengthen their capacity to deliver services to their clients, stakeholders and users. By demonstrating end-to-end improvements from observing networks to better services, WIFA will help quantify costs and benefits of investment in NMHSs by demonstrating social and economic value of the services provided. With ACMAD leadership, cooperation of the sub-regional climate centers, WMO, and civil society partners, WIFA will work closely with all of the NMHSs in Africa that need help to improve their meteorological observing networks and demonstrate the value of these improvements.

Ethiopia

National Meteorology Agency (NMA)

The national Meteorological Services Agency was established as an autonomous government organization in December 31, 1980, under the proclamation No. 201 of 1980. The main objective of the Agency includes:

- Provision of meteorological services,
- Control Air pollution and maintain the natural balance of the air, and
- Discharge better, Ethiopia international obligations regarding meteorological activities.

The provision of meteorological services has been growing qualitatively and quantitatively, and this made it imperative to build a more efficient organizational structure for the Agency leading to creation of a new organizational structure that came into force in 1994. In accordance with the Government's new restructuring policy, it was decided that the Agency maintains its name National Meteorological Agency without bringing about any change in its functions.

The vision of NMA is to be a World-class meteorological center in Ethiopia and its mission is "by collecting, analyzing and studying the atmosphere, provide weather forecast and early warnings on the adverse effects of weather and climate of Ethiopia." NMA-Ethiopia activities and products include; the weather analysis and forecast; provision of urban forecast on temperature, rainfall and weather for 24 hours and three consecutive days over selected cities and towns; National Forecasts containing weather assessments and forecasts in text description, maps, and statistical outputs covering the whole country in different time scales; provision of agro-meteorological bulletins, hydro-meteorological bulletins and climatological maps.

NMA-Ethiopia collaborates with Government ministries including Ministry of Water Resources (Ethiopia), RAdio and InterNET (RANET Ethiopia), and several international, regional and sub-regional institutions which include ACMAD, ICPAC, IRI, World Meteorological Organization (WMO), Intergovernmental Panel on Climate Change (IPCC), United Nations Framework Convention on Climate Change (UNFCCC), United Nations Environmental Program (UNEP), European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), National Oceanic and Atmospheric Administration (NOAA), Food and Agricultural Organization of the United

Nations (FAO), World Food Program (WFP), Disaster Prevention and Preparedness Agency (DPPA) and the World Agro-meteorological Information Service (WAMIS) among others.

Kenya

Kenya Meteorological Department (KMD)

The mandate of the KMD is the provision of Meteorological information and services for the safety of life, protection of property and conservation of the natural environment to ensure sustainable development of the nation. The mission is to facilitate accessible meteorological information and services and infusion of scientific knowledge to spur socioeconomic growth and development. In addition, the department has a wide range of functions, which include:

- Provision of meteorological and climatological services to agriculture, forestry, water resources management, civil aviation and the private sector including industry, commerce and public utilities for the better exploitation and utilization of natural resources for national development;
- Provision of meteorological services to shipping in the western Indian Ocean including the issuing of cyclone warnings for the safety of merchant and other ships;
- Provision of meteorological services to military aviation for the safety of the Kenya Air Force aircraft for national defense;
- Organization and administration of surface and upper air meteorological observations within its area of responsibility and the publication of climatological data;
- Maintenance of an efficient telecommunications system for rapid collection and dissemination of meteorological information required for national and international use in accordance with the World Meteorological Organization (WMO) and the International Civil Aviation Organization (ICAO) procedures;
- Co-ordination of research in meteorology and climatology including co-operation with other authorities in all aspects of applied meteorological research, and the maintenance of the National Meteorological Library;
- Evolvement of suitable training programs in all fields of meteorology and other related scientific subjects, which are relevant to the development of Kenya and other countries that participate in the department's training activities.

Whereas some of the functions like, provision of meteorological services to shipping in the western Indian Ocean including the issuing of cyclone warnings for the safety of merchant and other ships and Provision of meteorological services to military aviation for the safety of the Kenya Air Force aircraft for national defense are undertaken by the Department and may not be directly linked to agriculture and food, it was noted that during times drought and famine food imports have to be brought by sea and same distributed to communities through air force air-drops in some inaccessible areas. This creates a clear linkage of these services to food security.

Within the functions of the Department, several products are produced which have direct and/or indirect connection with agriculture and food security. The types of products include:

- **Daily weather forecast** for rainfall, temperature and areas expected to experience thunderstorms, which may be accompanied by strong winds and in some instances hailstones that can affect crops, are given. A general outlook of expected evolution of these parameters is given as in the case of rainfall in the map below and this information is used by farmers for daily on-farm operations planning,

- **4-day Forecast** contains information on how the weather performed during the last 4 days and how it is expected to be in the next 4 days. In conformity with the usually used Pentad, the Department is planning to change the time period to 5 days as this will allow for calculation of pentad indices,
- **7-Day Forecast** contains information on how the weather performed during the last 7 days and how it is expected to be in the next 7 days. In conformity with the usually used dekad, the Department is planning to change the time period to 10 days as this will allow for calculation of dekadal indices and have historical database already in place. The 4-day and 7-day the forecasts are used for short term agricultural planning such as planting, drying grains, applying fertilizer and insecticides etc. It is issued for the five climatologically divided regions of the country based on areal extent,
- **Monthly Forecast** contains review of the current month and the expected conditions during the coming month. The summarized contents of the forecast are; rainfall performance for the month under consideration, prevailing synoptic situation during the month, impacts experienced during month on various socio-economic sectors, forecast for the coming month and the expected impacts on socio-economic sectors during the coming month. Pictorial presentation of the forecast is given together with the mean conditions of rainfall during the month as shown in the Figures 3 and 4 below.

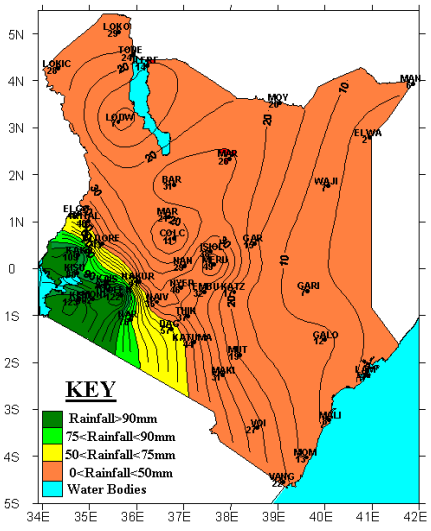


Figure 3: Normal Rainfall Performance in February (Source: KMD).

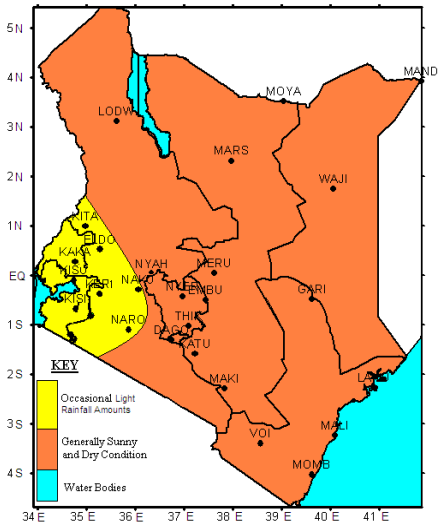


Figure 4: Rainfall Performance in February (Source: KMD).

Some of the experienced impacts during the month of January pointed towards insecure food situation, thus indicating that the bulletin usefulness in agriculture and food security assessments. An example for January was that the sunny and dry weather conditions that prevailed were associated with the following impacts:

- Further deterioration of foliage and pasture as well as water for the pastoralists in the pastoral arise specially in Northwestern and Northeastern Kenya. This has led to loss of livestock in the regions,
- Further reduction in water levels in the Seven-Folks hydroelectric power generation dams,
- Increased food shortage in various parts of the country and more so in the marginal areas, and

Water scarcity for domestic use, drinking and sanitation in some parts of the country, in particular, counties in Northern, Northeastern and Southeastern parts of the country.

Seasonal Forecast is the downscaled seasonal climate consensus forecast issued by ICPAC and NMHSs in liaison with Global Production Canters (GPCs), IRI, UK Met Office, the European Centre for Medium-Range Weather Forecasts, among other partners, at the Greater Horn of Africa Climate Outlook Forum (GHACOF). The downscaled for Kenya MAM rains where onset and cessation dates provided, Figures 5 and 6 below.

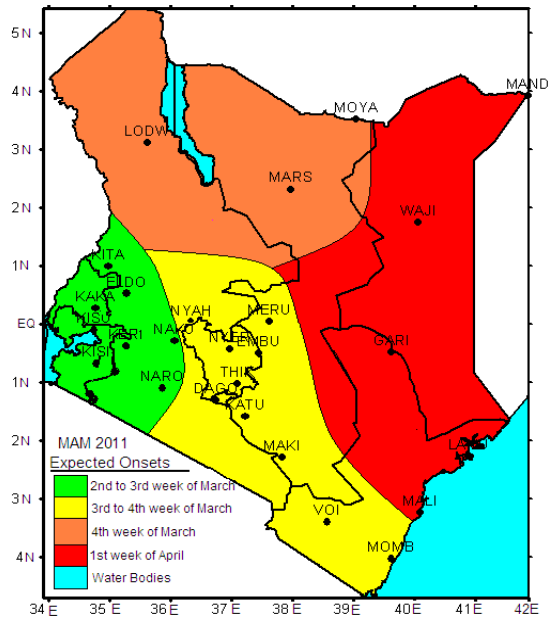


Figure 5: Expected MAM 2011 Seasonal Rainfall Onset (Source: KMD).

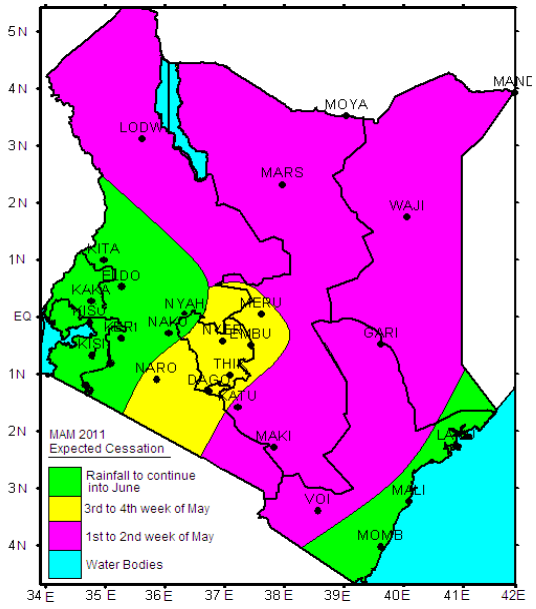


Figure 6: Expected MAM 2011 Seasonal Rainfall Cessation (Source: KMD).

The downscaled country forecast is released to various stakeholders who meet independently and make a statement on the expected impacts in their sector. All statements from those sectors are passed to KMD who in turn make a final statement to the government on the performance of the rains and the expected impacts. These impacts as noted earlier are fully owned by sectorial players. Agriculture, Food Security and Livestock Development Sectors, The sector served include, Disaster Management, Public Health, Transport and Public Safety, Water resources Management, Energy Generation, Peace, Security, Law and Order, Environment and Economic Development.

Agro-meteorological services (10-Day Bulletin). In Kenya there are two types of stations, namely GRADE A and GRADE B stations. Grade A stations are operated and manned by Kenya Meteorological Department (KMD) staff, while Grade B are run by other organizations, e.g., Ministry

of Agriculture, Universities and Agricultural Research Institutions. Currently there are 13 agro-meteorological stations in the country (11 Grade A and 2 Grade B).

In all these stations normal meteorological parameters are measured on daily basis and the data is conveyed to the agro-meteorological Section of KMD after every 10 days. These include:

- Air Temperature in Degrees Celsius (Maximum, Minimum, Wet bulb, Dry bulb, Dew point),
- Soil Temperature in Degrees Celsius at 5, 10, 20, 30, 50, 100 cm depths,
- Sunshine duration in Hours,
- Radiation in mega joules per meter square,
- Wind Speed in meters per Second at 2 meters height,
- Calculated Relative Humidity (%) at 0900 hrs and 1500 hrs,
- Pan Evaporation in millimeters per day,
- Calculated Potential Evapotranspiration in millimeters per dekad (10 - day period), and
- Rainfall in millimeters per day
- In addition to the above, crop data is obtained from the 13 agro-meteorological stations (Grade A and B) on:
- Variety of the grown crop,
- Stage of development attained by the crop,
- General assessment of crop performance,
- Damage by pests, diseases and adverse weather,
- State of weeding in the farm,
- Plant density, and
- Soil moisture

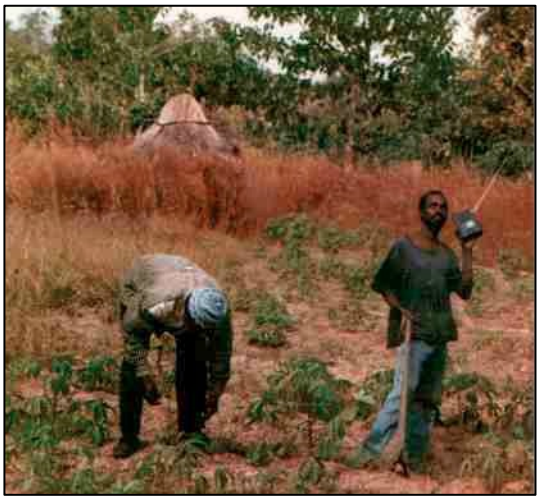


Figure 7: Visual assessment of the crop performance and expected yield from farmers' farms (Source KMD).

Expected yield (assessed visually, Fig. 7) is normally observed at the end of each 10 days and along with the meteorological data is communicated to the agro-meteorological section to facilitate crop-weather impact analysis. In order to obtain a general overview of crop performance in the country, especially on the main staple crops in the country namely maize, beans and wheat all the 32 stations report on the stage of crop development, general assessment of crop performance and yield expected (visual) from the farmers farms on the basis of what they see from nearby farms and oral interviews with farmers they come across from areas far from their reach.

The compiled information is released to various users via the Dekadal Crop and Weather Bulletin. The Department gives special alerts when some unexpected event may or a post-mortem of an unusual event if it has occurred. In this connection the Director, KMD set up a committee referred to as "El-Niño Command Post" in 2009 to be issuing El Niño La Niña alerts and undertakes public education on the 2 phenomena through preparation of documents explaining what they are and continuous provision of expected impacts whenever one of them occurs. Other special reports given by the Department are for specific user tailored information, which are prepared as per specification of the user.

Several modes of disseminating the above products are used, but the modes that make clear impacts were pointed to be as follows:

- Monthly brief to National Drought Crisis Steering Committee, done to senior government officers for planning and is located in office of the President,
- The Director, KMD gives briefs to the cabinet as he has done this year on La Niña and similarly last year gave brief to the Prime Minister,
- KMD buys space each month to publish the monthly forecast as well as seasonal forecast once it has been downscaled. It was pointed out that one media house "Kenya Today" usually publishes the 7-day forecast in their paper,
- Regional Directors of Meteorology hold public gatherings with user communities in each Region and disseminate climate information,
- In the western part of the country the scientific community has teamed up with traditional climate predictors and a "Climate Resource Centre" has been started and both partner to issues climate outlooks to the local communities.

RANET network is being used in communicating weather and climate information to communities. In addition to RANET, a Committee has been set up under the Deputy Director, Forecasting and Regional Services to oversee one of WIFA's (Weather Information For All) on going in the country project (named WIND) activities and how the same links with the local communities and weather insurance undertakings and propose a business plan. This project, funded by Bill & Melinda Gates Foundation, is conducted jointly by the consulting company Accenture and the humanitarian organization Nethope. KMD and ACMAD are involved.

Another WIFA Project, led under the patronage of the Kofi Annan Foundation (KA Foundation), by Health and Climate Foundation (HCF) in collaboration with the African Centre of Meteorological Applications for Development (ACMAD) and the Aga Khan University, Nairobi, Kenya will determine the use of weather information by the fisher community around the Lake Victoria.

Users: KMD has a wide variety of user of climate and weather information ranging from aviation to public safety law and order. With regard to Agriculture and Food security the Department offers services directly to the following:

- International Federation for the Red Cross (IFRC)
- Individual farmers pay visits. During this year they gave information to wheat farmers and for tree planting.
- Regional Directors of Meteorology consult with County Development Committees, farmers groups and give briefs to them
- FEWSNET

- ILRI Livestock mortality insurance model
- Marine Early Warning
- National Drought Steering Committee for interventions, and
- Kenya Food Security Steering group in which KMD is a member.

Weaknesses:

- Lack of hardware with large storage facilities as they have huge data to handle and process in real time,
- Most users they serve do not understand the influence of weather and climate on their socio-economic activities. In order to close this gap workshops should be organized to build capacities of these users thorough the KMD established Outreach Section of Public Weather Services Division,
- Stations are not regularly inspected due to lack funds especially those operated by volunteers. This is expected to lead to low quality data, which may give misleading direction/action. In most case some have closed leading to decline in the observational network.

Strengths:

The Department has staff strength of about 600 officers and the government has given it the authority to employ more as employment had earlier been frozen. Out of the 600 the Department has highly qualified human resource with several PhDs, MSc and BSc a critical mass that can handle emerging scientific issues. Currently they are carrying out climate scenario generation and maps have been produced on rainfall and temperature. The acquisition of the software for this activity, which they have tested and found okay, is a clear strength.

ICPAC

IGAD Climate Prediction and Applications Centre (ICPAC) is a specialized institution of the Intergovernmental Authority on Development (IGAD) working with the National Meteorological Services, World Meteorological Organization (WMO) and other partners to address regional challenges of climate risks including climate change. It has its headquarters in Kenya.

In 1989, 24 countries in Eastern and Southern Africa established a Drought Monitoring Centre with its headquarters in Nairobi (DMCN) and a sub-center in Harare (Drought Monitoring Centre Harare – DMCH) in response to the devastating weather related disasters. In October 2003, the Heads of State and Governments of the Intergovernmental Authority on Development (IGAD) held their 10th Summit in Kampala, Uganda, where DMCN was adopted as a specialized IGAD institution. The name of the institution was at the same time changed to IGAD Climate Prediction and Applications Centre (ICPAC) in order to better reflect all its mandates, mission and objectives within the IGAD system. A protocol integrating the institution fully into IGAD was however signed on 13th April, 2007. The center is responsible for ten member countries namely: Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan and Uganda as well as Burundi, Rwanda and Tanzania.

The vision is to become a viable regional center of excellence in climate prediction and applications for climate risk management, environmental management, and sustainable development. The mission of ICPAC is the provision of timely climate early warning information and supporting specific sector applications to enable the region cope with various risks associated with extreme climate variability

and change for poverty alleviation, environment management and sustainable development of the member countries.

The objectives of the Center are:

- To provide timely climate early warning information and support specific sector applications for the mitigation of the impacts of climate variability and change for poverty alleviation, management of environment and sustainable development;
- To improve the technical capacity of producers and users of climatic information, in order to enhance the use of climate monitoring and forecasting products in climate risk management and environment management;
- To develop an improved, proactive, timely, broad-based system of information/product dissemination and feedback, at both sub-regional and national scales through national partners;
- To expand climate knowledge base and applications within the sub-region in order to facilitate informed decision making on climate risk related issues; and
- To maintain quality controlled databases and information systems required for risk/vulnerability assessment, mapping and general support to the national/ regional climate risk reduction strategies.

The functions of the Center include:

- Acquisition of climate and remotely sensed data;
- Develop and archive national and regional climate databanks including calibration of remote sensing records;
- Process data and develop basic climatological statistics required for baseline risk scenarios and other applications;
- Monitor, predict and provide early warning information of the space-time evolutions of weather and climate extremes over the sub-region;
- Hazards and climate risk mapping of the extreme climate events thresholds;
- Networking with WMO, the National Meteorological and Hydrological institutions as well as regional and international centers for data and information exchange;
- Capacity building in the generation and applications of climate information and products;
- Applications of climate tools for specific climate sensitive sector risk reduction, environment management, and sustainable development, including integration of indigenous knowledge;
- Monitor, assess, detect and attribute climate change and associated impacts, vulnerability, adaptation and mitigation options;
- Develop relevant tools required to address the regional climate challenges through research and applications in all climate sensitive socio-economic sectors including addressing linkages with other natural and man-made disasters; and
- Networking and exchange of information regarding disasters in the sub-region

The Centre products are:

- Ten day, monthly and seasonal climate/weather bulletins,
- Climate watch/El Niño updates, and
- Annual climate summaries
- Produce tailor made forecast depending on requests

- Perform analysis to predict Onset and cessation dates and probability of dry and wet spells during the season
- Perform Climate scenarios up to 50 years
- Prepare National Climate Atlas containing several variables including rainfall variability, mean etc. and they are now compiling a Regional Atlas.

Within its core programs, it has computer services and climate data bank that is constantly updated. It has been involved capacity building in data processing, climate monitoring and modeling, and prediction. Upgrading of ICPAC computing facilities has improved regional climate modeling and prediction capacity. One of its major activities is the organization of Regional Climate Outlook Forum for the Greater Horn of Africa countries, the GHACOF, where the cooperating Institutions include Institut Géographique du Burundi; Météorologie Nationale de Djibouti; Eritrea Meteorological Service; National Meteorological Services Agency of Ethiopia; Kenya Meteorological Department; Rwanda Meteorological Services; Somalia Meteorological Services; Sudan Meteorological Authority; Tanzania Meteorological Agency; Uganda Meteorological Agency; ACMAD; Korea Meteorological Administration; World Meteorological Organization; USAID/OFDA; UK Met Office/Hadley Centre; IRI, UN OCHA and FEWS-NET among others.

Within the national level ICPAC deals with Government Ministries of Agriculture, Disaster Management, Health, Water Management, tourism, energy, livestock, gender as well as the media. With a view to enhancing their linkages with their users ICPAC organizes capacity building through visiting scientists program, workshops and On the Job Training. Initially the products of ICPAC were disseminated through hardcopy bulletins, but now the current mode of dispatch include; web, e-mail, forums and workshops and personal conducts if the product required is of regional scale. All information with regard to national level products is normally referred to the NMHSs.

To integrate climate information dissemination systems within the local communities, ICPAC has started a pilot project on “Integration of Traditional indigenous Knowledge with Modern Science” in Western Kenya. In this regard the downscaled forecast is compared with that of made by Traditional predictors and a consensus is reached to arrive at the final forecast.

Tanzania

Tanzania Meteorological Agency (TMA)

TMA an agency under the Ministry of Infrastructure of the Republic of Tanzania. The mandate of the TMA is the provision of Meteorological information and services for the safety of life, protection of property and conservation of the natural environment to ensure sustainable development of the nation. The vision of TMA is to stand out as a center of excellence in accelerating the National Development Vision through provision of world-class meteorological services by the year 2015. TMA’s mission is to provide quality, reliable and cost effective meteorological services to stakeholders' expectations thereby contributing to the protection of life and property, environment and national poverty eradication goal.

TMA Functions are to:

- Provide meteorological services for international air navigation on behalf of the United Republic of Tanzania as designated meteorological authority and according to Technical Regulations of the

World Meteorological Organization Doc. ([C.31] 2.1.4) and Appendix 3 (2.1.4) of the International Civil Aviation Organization,

- Organize and administer efficient networks of surface and upper air stations necessary to capture accurate records of the weather and climatic conditions of the United Republic of Tanzania,
- Observe, collect, archive and disseminate meteorological and related information for the United Republic of Tanzania,
- Take part in global exchange of meteorological and related data and products for the safety of humankind and to enhance the understanding of the global atmosphere,
- Provide weather, climate services and warnings for the safety of life and property to the general public and to various users including aviation, agriculture and food security, water resources, disaster management, health and construction industry,
- Carry out research and training in meteorology and climatology and in other related fields, and cooperate with other institutions where appropriate, for use in socio-economic development planning,
- Participate in the activities of international organizations and programs, in particular the World Meteorological Organization (WMO) e.g. World Weather Watch (WWW), International Civil Aviation Organization (ICAO), Global Climate Observing System (GCOS), the Global Atmospheric Watch (GAW), etc.
- Cooperate with other institutions concerned with issues related to climate variability, climate change and environment,
- Participate in activities dealing with meteorology under Regional Organizations e.g. Southern African Development Community (SADC) and East African Co-operation (EAC),
- Publish weather and climatological summaries, bulletins and other interpreted products,
- Collect fees and charges for data, products and services rendered, and
- Carry out any other function as the Minister may direct;

In addition, TMA produces daily weather forecast, 10 – Day (dekadal) Forecast, monthly forecast and seasonal climate forecast. TMA-RANET is being used in communicating weather and climate information to communities in the Republic of Tanzania.

Figure 8: TMA-RANET System Radio and Ranet receiver

Uganda

Uganda Meteorological Department (DoM)

The Uganda Meteorological Department was formed as a Government Department in 1978 after the collapse of East African Community in 1977, with mandate of establishing and maintaining weather and climate observing network, collection, analysis and production of weather and climate information and products, (including warnings) to support social and economic development.

DoM is currently placed in the Ministry of Water and Environment with its Headquarters located on the 10th Floor Postal Building, Clement Hill Road, Kampala. The operational center is located at Entebbe International Airport. DoM is headed by a Commissioner under the Uganda Pubic Service Commission structure. Under this structure, the Commissioner for Meteorology is also appointed as Uganda's Permanent Representative to the World Meteorological Organization.

Subsequently the Office of Commissioner is charged with the overall policy formulation of the Department, institutional development, cooperation with WMO and its Member States and advising the Permanent Secretary, Ministry of Water and Environment and indeed the Government of Uganda on weather and climate related issues. The Commissioner in his Capacity as PR is mandated to advise the Permanent Secretary Ministry of Foreign Affairs and Government on all matters related to the World Meteorological Organization and its Commissions. The Commissioner also provides guidance and direction to the divisions to ensure smooth functioning of the Department. The Office of the Commissioner also collaborates with other technical departments such as water, wetlands, agriculture and forestry on matters related to meteorology.

DoM carries out its responsibilities through four technical divisions that include Forecasting Division; Station Networks Division; Applied Meteorology and Data Processing Division; and Training and Research Division. Each division is headed by an Assistant Commissioner, and each division is charged with different roles to play in the provision of meteorological services. The vision of DoM is "to be a center of excellence on weather and climate services for sustainable development of Uganda." Its mission is to "to contribute to overall national development through provision of quality, customer-focused, cost-effective and timely information for weather and climate services to all users."

The overall goal of DoM is to improve technical and institutional capacity for providing weather and climate information, prediction products and services, early warning system, and related services for sustainable development in Uganda. The objectives include:

- To improve the quantity and quality of meteorological services to customers by strengthening the observing network, National Meteorological Centre (NMC), data and information exchange according to WMO and International Civil Aviation Organization (ICAO) standards.
- To build a skilled and motivated workforce through good human resource management practices.
- To promote greater awareness of the benefits of using meteorological services, information and products for public safety and social-economic planning
- To improve the accuracy and reliability of forecasts and advisory services to customers through the development of climate prediction and short-term weather forecasting capability
- To achieve a sustained increase in revenue generation besides earnings from services for public good to facilitate implementation of other strategic objectives.

The functions of DoM include the following:

- To interpret, review and recommend appropriate changes in the climate and weather policies as well as international instruments;
- To promote, guide and coordinate the implementation of policies and programs;
- To promote the use of weather and climate services in development planning;
- To analyze, document and disseminate climate and weather trends and their implications on socio-economic development;
- To provide guidelines for preparation and review of climate and weather profiles and plans of action;
- To build capacity at local government levels for the implementation of the climate and weather programs through DoM regional offices;
- To mobilize resources to support climate and weather programs and activities;
- To carry out research and policy oriented studies to inform policy and programming;
- To promote collaboration and strategic partnership with national and international governments, agencies, academic institutions, civil society organizations, cultural and other institutions at various levels in the management of climate and weather programs and projects;

Products: Daily weather forecasts**,** seasonal climate outlooks, Agro-meteorological bulletins, analysis of different climate statistics, documentation and dissemination of climate and weather trends and their implications on socio-economic development; climate information in the Ministry of Water and Environment and it provides guidelines for preparation and review of climate and weather profiles and plans of action among others. Other activities include, carrying out climate change awareness, adaptation and mitigation programs among the different stakeholders.

Climate Service User Communities

Agriculture is the economic mainstay and major employment sector in Eastern Africa region**.** The occurrence of extreme climate events such as floods and droughts has severe impacts on the agricultural yield, livestock and marine ecosystems. This, in turn, impacts heavily on food security often resulting to hunger, malnutrition, diseases and loss of lives. Studies have shown that the heat stress and drought are likely to have a negative impact on animal health, production of dairy products, meat and reproduction. Climate information can be used to develop strategies and programs for sustainable agricultural development. The integration of climate information in development as being practiced by agricultural farming communities has improved livelihoods and accelerated economic growth. The integrated applied research on crop production, livestock breeding, soil exploitation, water, forestry, agricultural engineering and socioeconomics conducted by institutions has contributed immensely to improved livelihoods and accelerated economic growth as demonstrated in this scoping study.

Ethiopia

Ministry of Agriculture and Rural Development

The vision of the **Ministry of Agriculture and Rural Development (Ethiopia)** is to have a well-developed agriculture that uses modern technology; and to have a developed community, which is free from poverty. Its mission is to do away with the problem of food insecurity and to enable the rural community get rid of poverty through enhancing the productivity of human resources, changing the outlook of the society, sustainability implementing the human labor and natural resources,

especially land and water, generating, introducing and promoting technologies, and setting up market-led agricultural system. Some of its research themes are Forest, Livestock and Crop. Some of the issues it handles related to natural resources and forests are water harvesting, land-use/cover, soil, forest and natural vegetables, wildlife, irrigation potential areas, grazing potential areas and forestry potential areas.

Tree Aid

Tree Aid Aims to help village communities in arid Africa to survive by achieving food, environmental and livelihood security through the planting and management of trees. It looks to support projects in Ethiopia that:

- Respond to local and national needs,
- Are community-based and work in partnership with beneficiary communities,
- Ensure equality of opportunity, particularly gender equality,
- Ensure sustainable benefit,
- Ensure equity in the distribution of benefits,
- Deliver benefits cost effectively,
- Help to achieve greater food, environmental and livelihood security.

CRS

The Catholic Relief Services (CRS) has been working in Ethiopia since 1958. CRS works with communities in need, helping them to alleviate poverty by increasing their food supplies and improving their ability to withstand disasters. CRS Ethiopia implements program activities in nine of Ethiopia's 10 regions, directly benefiting more than 589,000 Ethiopians without regard to religion or ethnicity. By working closely with local partners, including the Ethiopian Catholic Church, CRS leverages a powerful network across the country that supports service delivery in both urban and rural areas. Key program areas include water and sanitation; emergency preparedness and recovery; agriculture and livelihoods, including microfinance; and HIV and AIDS.

To help families grow more food and avoid destitution, the CRS Ethiopia supports projects that increase agricultural productivity and enable poor farmers to better access existing markets. CRS also rehabilitates degraded land, teaches better management of natural resources and promotes microfinance projects to help poor families increase their incomes. In particular, CRS Ethiopia supports small savings-and-lending programs for women in and around urban areas, enabling women to expand their business opportunities and eventually lead their families out of poverty.

The CRS Ethiopia's largest partner is the Ethiopian Catholic Church Social and Development Coordinating Offices of Harar, Meki, Adigrat and Sodda Hosanna. The CRS Ethiopia has partnered with these institutions in large-scale emergency relief and development programs since the mid-1980s. Three offices — Harar in the east, Meki in the central Rift Valley, and Adigrat in the north has implemented CRS Ethiopia's integrated watershed management programs. These programs incorporate agro-enterprise and natural resources management, water and sanitation, health, livelihoods recovery, and HIV and AIDS prevention and care projects. The Ethiopian Catholic Church Social and Development Coordinating Offices of Harar and Meki have also implemented U.S. Agency for International Development (USAID)-funded Title II food aid programs. The Sodda Hosanna office implemented the CRS Ethiopia's water and sanitation program funded by the Millennium Water Alliance.

OXFAM

This organization has worked in Ethiopia since 1962. Its focus is on education, sustainable livelihoods, and helping people have a say in the decisions that affect them. We work with communities to increase the size and quality of their harvests. OXFAM promotes new farming techniques and maintains reliable sources of water year-round. OXFAM also assists local communities influence government decisions that affect them.

About 85 per cent of the population in Ethiopia live in the rural areas and are dependent on crop and livestock agriculture to produce enough food for their living. Recurrent droughts, floods and conflicts have exacerbated their vulnerability. To help address the situation, Oxfam pastoral program is in place. Working in four pastoral regions (Afar, Somali, SNNPR and Oromia), the program focuses on education, health, market development, and supporting small business co-operatives. The OXFAM's agriculture work centers on capacity build for smallholder farmers to access markets, negotiating power, and getting enough income from their produce. OXFAM helps to improve conditions for up to 1 million smallholder farmers in Amhara, Oromiya, and Benishangul Gumez regions and is currently working with beneficiaries, focusing especially on crops such as soybean, sesame, coffee, bee products and malt barley.

CARE

CARE Ethiopia was founded in 1984 on the invitation of the Ethiopian Government to respond to the 1984/85 drought and famine in East Hararghe, West Hararghe, East Shoa and Borana Zones of the Oromiya Regional State. CARE's vision is a world of hope, tolerance and social justice, where poverty has been overcome and people live with dignity and security. Its mission is to work with poor women and men, boys and girls, communities and institutions, to have a significant impact on the underlying causes of poverty.

Since 1984, CARE Ethiopia has played a key role in Ethiopia's development in addressing the root causes of poverty and vulnerability. All CARE's efforts strive to empower people to overcome poverty and to promote social justice working in alliance with key development partners. CARE Ethiopia major relevant activities include the:

- Supports on-going efforts to strengthen good governance and policy implementation in areas (thematic and geographical), in the context of the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP)
- Strives to be an organization that applies its learning and impact, and commits itself to diverse national leadership at all levels, and competence in relation CARE's evolving role.
- Works with its partners and facilitates processes of capacity building of support structures so that sustainable benefits and impacts are achieved.

CARE Ethiopia is dedicated to facilitating women's empowerment and human rights attainment, anchored by a unifying theme of reducing the grinding poverty that relentlessly crushes Ethiopian people.

CARE's 2007-2012 Strategic Plan seeks to move CARE forward through capitalizing on its core strengths and values in line with the Government's strategic directions in the effort to address the underlying causes of poverty and vulnerability among the rural and urban populations. CARE

Ethiopia undertakes a range of rural and urban-based programs, addressing: Food and Livelihood Security, Pastoralist Livelihoods and Emergency Preparedness and Response among others

In the area of food security, CARE Ethiopia employs innovative approaches in the areas of dry land agriculture, community led nutrition, community based risk management, health, and productive safety nets. CARE has also demonstrated success in its family planning programs. CARE Ethiopia is also the host Agency for Millennium Water Alliance (MWA) Programs and the Global Water Initiative in Eastern Africa. Currently, CARE works in Oromiya, Amhara, and Afar Regional States and Dire Dawa.

World Vision Ethiopia

The population is overwhelmingly rural, with the highest density of people found in the central highlands. World Vision is helping Ethiopia's families by making improvements to their food security and water programs, education, and health care. Approximately 90 percent of the country's residents earn their living as subsistence farmers and they grow just enough food to feed their families.

Kenya

Arid Lands Information Network (ALIN)

ALIN, based in Kenya, is a network of community development workers established in the year 2000 to continue the work of the parent organization, *Reseau d'Information des Terres Arides* or the Arid Lands Information Network (RITA-ALIN). RITA-ALIN was established by OXFAM in 1988 as a platform to exchange experiences among Community Development Workers (CDWs). ALIN's vision is "a Knowledge-Driven Society" and its mission is "To enhance the livelihoods of communities through info exchange". Its core business is to facilitate the exchange of ideas, experiences and knowledge among communities to enhance learning in order for communities to manage their socio-economic issues using multi-media tools. Its countries of operation are Kenya, Uganda, Tanzania and Ethiopia. Due to successful involvement in using ICTs at community level, ALIN-EA was chosen to pioneer in Africa on pilot basis the Open Knowledge Network (OKN). The OKN is a global initiative linking thousands of marginalized and poor people through information sharing. ALIN has a one-year youth volunteer program whose purpose is to equip the youth with skills in community development, impart them with social responsibility and prepares them for the job market. ALIN membership consist CDWs drawn from NGOs, community-based organizations as well as government departments, all offering a form of extension service in their fields of expertise. They act as a source of information and knowledge for the rest of the community. ALIN has also partnered with other development agencies to develop a wider content for dissemination.

Lake Basin Development Authority (LBDA)-Kenya

LBDA was established under a Kenyan act of parliament. The act gives it the mandate to undertake overall planning, co-ordination, implementation, monitoring and evaluation of development projects and programs in its area of jurisdiction. The vision of the LBDA is to be a leading institution in the socio-economic development of the Lake Basin Region. LBDA's mission is to spearhead development in the region by undertaking integrated planning and sustainable management of the resources through the participation of local people as key stakeholders. It accomplishes this mandate by utilizing the abundant resources in the region for socio-economic development. The LBDA's area of jurisdiction covers the entire catchments areas of the major rivers that drain into Lake Victoria on the Kenyan side.

Practical Action

Practical Action (formerly known as Intermediate Technology Development Group, ITDG) aims to demonstrate and advocate the sustainable use of technology to reduce poverty in developing countries. Practical Action has a unique approach to development "we don't start with technology, but with people." It works with poor communities to help them choose and use technology to improve their lives for today and generations to come. The organization works towards fulfilling its mission in Eastern Africa – Kenya, Uganda and Tanzania, and will later cover Ethiopia, Eritrea, Somalia, Rwanda and Burundi – by increasing the choices of technologies and approaches accessible to the marginalized groups through establishing a broad range of highly regarded project work. The Rural Agriculture and Pastoralism Program is a food production unit of ITDG (Practical Action) in Eastern Africa. The program undertakes its projects in partnership with both dry land farmers and pastoralists in Turkana, Marsabit, Samburu, Tharaka and Makueni districts in Kenya.

Alliance for a Green Revolution in Africa (AGRA)-Kenya office

AGRA works to achieve African Green Revolution by putting smallholder farmers first while protecting biodiversity, promoting sustainability and advancing equity. AGRA's vision is a food secure and prosperous Africa achieved through rapid sustainable agricultural growth based on smallholder farmers who produce staple food crops. AGRA's mission is to trigger uniquely African Green Revolution that transforms agriculture into a highly productive, efficient, competitive and sustainable system to ensure food security and lift millions out of poverty. AGRA aligns its work with the Comprehensive Africa Agriculture Development Program (CAADP) developed by African Union's New Economic Partnerships for Africa's Development (NEPAD), which provides a framework for agricultural renewal. AGRA's Board is chaired by Kofi A. Annan, the former Secretary-General of the United Nations. With initial support from the Rockefeller Foundation and the Bill & Melinda Gates Foundation, AGRA maintains offices in Nairobi, Kenya and Accra, Ghana. AGRA dynamic partnership works across the African continent to help millions of small-scale farmers and their families lift themselves out of poverty and hunger. AGRA partnerships with private financial institutions have leveraged funds for small-scale farmers and small to medium sized African agri-business. The African Financial Institutions partners like Standard Bank and Equity Bank (Kenya); Kilimo Trust (Kenya) and the National Microfinance Bank (Tanzania) are partners for innovative funding programs for smallholder farmers in Kenya and Tanzania. AGRA programs develop practical solutions to significantly boost farm productivity and incomes for the poor while safeguarding the environment. AGRA advocates for policies that support its work across all key aspects of the African agricultural "value chain" ranging from seeds, soil health, and water to markets and agricultural education. AGRA's programs also work to strengthen agricultural education and extension, train youth, develop rural infrastructure, improve efficient water management and enable smallholder farmers to adapt to and mitigate climate change impacts.

Tea Board of Kenya (TBK)

TBK was established on 13th June 1950 under the Tea Act (Cap 343) to regulate Tea Growing and manufacture. Under the Tea (Amendment) Act 1999, the Board's mandate includes: licensing of tea manufacturing factories; carrying out of research on tea through its technical arm, the Tea Research Foundation (TRF) of Kenya; the registration of growers, buyers, brokers, packers, management agents and any other person dealing in tea; and promotion of Kenya tea in both the local and the international

markets. The Board also disseminates information relating to tea and advises the Government of all policy matters regarding the tea industry.

To discharge its mandate, the Board works closely with the Government through the Ministry of Agriculture and all organizations in the tea sub-sector which include the Kenya Tea Development Agency Limited, the Kenya Tea Growers Association and the East African Tea Trade Association, among others. All these organizations and interests are represented in the Board. The Board has 16 members, of whom six represent the smallholder farmers, four the plantation tea growers and one the tea trade. In the Board are two Government representatives - the Permanent Secretary, Ministry of Agriculture and the Director of Agriculture - and two members appointed by the Board. The Managing Director is an ex-officio member of the Board. Under the Tea (Amendment) Act, the Board appoints its own Chairman from amongst the members of the Board representing tea producers.

The vision of TBK is to make Kenyan tea the preferred tea of the world. Its mission is to promote the production and marketing of high quality tea to the domestic and international market. The Board does not directly deal on cereal and staple foods for the communities, but the role it plays in food security is significant given that tea is one of the highest foreign exchange earners for the country and poor tea performance will lead to unavailability of foreign exchange to buy imports of cereals. The industry has employed high number workers some who come from the marginal areas that are prone to food insecurity. The wages so obtained are used to meet food needs through purchase during the lean periods.

The main climatological information products and services are provided by the KMD and usually constitutes of a bulletin covering the tea growing areas associated with, high altitude, low minimum temperatures and high rainfall as indicated in the maps below. Regarding the products it was noted that the most crucial times for occurrence of severe weather phenomena are: Frost January to March in the West and December to March in the East. The tea damage by hailstones is most frequent in August to October.

Most of the climate information products are used by the Tea Research Foundation (TRF) of TBK, where the seasonal, monthly and 10-day outlooks are used. Using data available from the local weather station at the TRF location in Kericho, Kenya, the scientists have come up with drought resistant tea variety and also have yield prediction models based on climate and weather information.

The board would wish to know the climate situation in other parts of the world and the local communities do not understand the weather and climate terminologies and there need for KMD to hold regular workshops with them for education organized by the Provincial Directors of Meteorology.

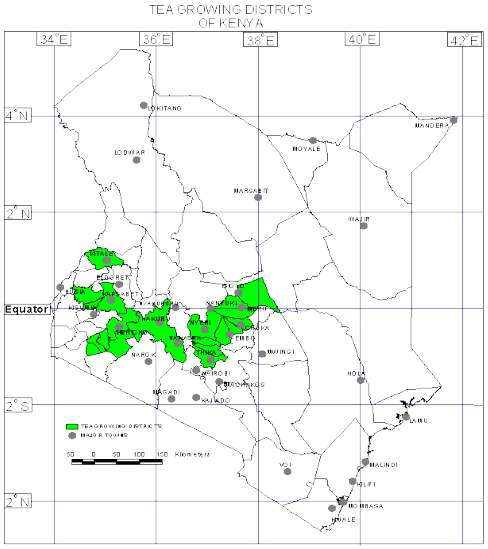


Figure 9: Tea Growing Districts (Source: TBK).

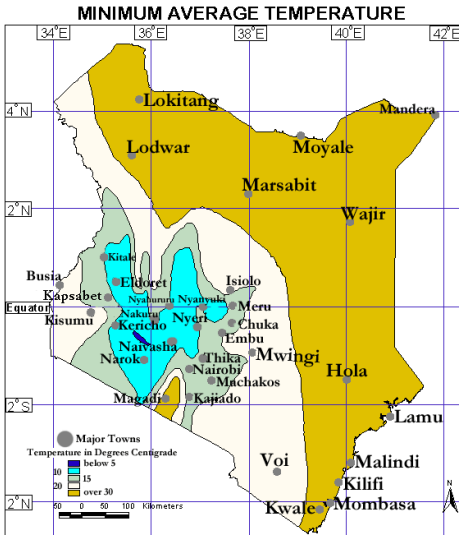


Figure 10: Long-Term Minimum Average Temperature (Source: KMD).

World Vision

World Vision partners with communities to improve their lives through these partnerships, communities access the knowledge and resources needed to improve the well-being of children and overcome poverty by providing a range of interventions tailored to the context, including programs in education, health, economic development, microfinance, agriculture, water and sanitation. World Vision identifies places at risk of disaster, prepares resources and staff in high-risk zones, and builds capacity and resilience among communities to help them protect themselves before an emergency. World Vision ensures that the process of positive change continues long after development staff have left through the built capacity that help community members to assist each other.

Ministry of Agriculture and the Ministry of Livestock Development (MOA/MOLD)

MOA/MOLD constitute a number of projects aimed at providing a pluralistic, efficient, effective and demand driven extension service promoted and functional. We have National Agriculture and Livestock Extension Program, Early Warning and Food Security, ASAL Based Livestock and Rural Livelihoods Support Project (ALLPRO). The goal of ALLPRO project is to contribute to poverty reduction at the national and household levels, consistent with the government's policies of mainstreaming the ASAL areas in the economic framework of the country. The Drought management and Food Security Initiatives whose mandate is to enhance the capacities of the pastoral and agro-pastoral communities and increase their resilience in managing the devastating effects of natural vagaries such as droughts and floods.

Kenya Food Security Steering Group (KFSSG)

KFSSG acts as a technical "think tank" and advisory body to all relevant stakeholders on issues of drought management and food security. The *steering group* provides effective guidelines on methods and approaches for the coordination of both information and appropriate response measures.

Furthermore, the KFSSG promotes, strengthens and supports the multi-agency approach to drought management and food security that has evolved in Kenya.

The KFSSG operating on a multi-agency basis with GoK leadership is chaired by Office of the President with World Food Program as co-chair. The line ministries/departments that participate are the Department of Drought & Disaster Emergency Response Coordination, Ministry of Livestock development, Ministry of Agriculture, Water Resources, Health, Works, Fisheries and international organizations including WFP, UNICEF, DFID, EC, Oxfam, Doctors without Borders – Spain, USAID/FEWS, WFP-VAMS, UN OCHA and World Vision. Kenya Meteorological Department is one of the government departments represented in the group. The KFSSG meets once in a month to get briefs from all the stakeholders and it is a primary consumer of monthly forecast issued by KMD. The group may meet more than once in a month if the situation so dictates. Specifically the Terms of Reference for the KFSSG are as follows:

- Develop and implement mechanisms to coordinate drought management and food security information in the country, and develop procedures to ensure appropriate dissemination of information,
- Receive and act upon EWS Bulletins,
- Coordinate the effective management of information and reporting for the KFSM and the Inter-ministerial Committee on Drought and Food Security. The latter will be the responsibility of an appointed GOK Officer such that when necessary the focus of such meeting can shift from information sharing to action planning and response coordination,
- Develop coordination response mechanisms to be adopted by all relevant stakeholders,
- Coordinate the process of developing a framework for targeting decisions and provide guidance on appropriate targeting and distribution mechanisms that can be utilised by all stakeholders for response purposes. The focus should be on avoiding parallel structures and improving efficiency and impact. Food and non-food aid will be the primary focus in this regard, and
- Coordinate and harmonize the existing sub-committees on food security.

The vision of the Kenya Food Security Steering Group is a safer, sustainable and resilient society. KFSSG's mission is to enhance food security and reduce livelihood vulnerability in drought-prone and marginalized communities in ASAL districts through sustainable people-driven development. One of the main activities is to carry out monitoring system within the arid and semi arid counties within the framework of Arid Lands Resource Management project which is a community-based drought management project of the Kenya Government that utilize a credit facility from the World Bank.

Seasonal Forecast given to Office of the president, Monthly Forecast updates and weekly updates done when extreme events occur such as floods. Once these products are given, a local level analysis is done to produce an early warning bulletin as indicated in Appendix 7 for Kitui County during the month of February 2011.

KMD gives briefs to Office of the President on monthly or weekly basis depending on the situation or if need arises. The bulletins prepared by the project are used to assess the performance of the forecast and consequently KMD is kept informed on the quality of their service. The various stakeholders mentioned as players in the group at times come to KMD for detailed information that may be touching on their activities.

The strength is that several players are involved in the final production of the Early Warning Bulletin hence it comes out as a hybrid. The main weakness is that in the arid and semi-arid land the meteorological observation network is poor thus making monitoring of the evolvement of events difficult hence need for more stations.

Kilimo Salama

The program "Kilimo Salama," which in Kiswahili means "safe farming," is a partnership between the Syngenta Foundation for Sustainable Agriculture, UAP Insurance, and telecoms operator Safaricom. The project offer farmers who plant on as little as one acre insurance policies to shield them from significant financial losses when drought or excess rainfall is expected to wreak havoc on their harvests. The extreme climate events, particularly drought, keep several African farmers in perpetual poverty by denying them the means to recover. "We have in that will work. By utilizing state-of-the-art risk management tools, revolutionary mobile phone technologies, and the knowledge and expertise of farmers and rural business men and women, the Kilimo Salama a micro-insurance strategy has developed for the first time a model for providing farmers with reliable, low-cost cover from the vagaries of extreme climate events."

Brookside Dairy Limited

Brookside Dairy Limited is committed to supplying quality products and excellent customer service to its customers and through its innovativeness and continues to diversify its range of dairy products and keep abreast with global technological changes. The institution is charged with milk processing and production. It was one of the private sector institutions that had prescribed for regular receipt of climate information from KMD. This information is used by their officers to carry out extension services with farmers in the country as well as plan on purchase and storage.

The climate information products and services received from KMD include: 4-day, Weekly, monthly and seasonal Rainfall and temperature including the seasonal outlooks. The company does not use NDVI products to monitor pasture development, as they were not aware of the same. KMD and ILRI who are routinely using this information on NDVI were asked to liaise and find out the best ways they can assist especially in pasture production models. The company is currently installing 6 rain gauges and they are already in partnership with KMD.

The company receives climate information via e-mail from KMD. Personal conducts are done especially with regard to 4-day forecast whenever the forecast seem to deviate from the observed situation. This is done by personal visits or by phone for clarification. Once the seasonal climate outlook has been prepared the company has as a priority ensured that its officers attends and gets briefing from KMD during the press release.

The company, due to it type of activities, collaborates with other institutions which include; Ministry of Livestock Development, Agriculture, KMD, Kenya Dairy Board, veterinary services, ILRI and other stake holders in the private sector such as animal feed manufacturers among others,

The strong part of the company is that it is ready to utilize it funds to expand rain gauge network in the areas where it is undertaking its activities. In this regard they are already paying for the climate information obtained from KMD. The company has expressed appreciation on promptness in delivery of KMD products that were utilized by the company. There is need to build capacity of farmers in utilization of climate information products. This is manifested by the fact that due to sparse

observation network the forecast given covers wide areas and the farmers may not be able to comprehend its meaning and to make use of it.

Financial Sector Deepening (FSD) Trust

FSD was established in early 2005 to support the development of financial markets in Kenya as a means to stimulate wealth creation and reduce poverty. FSD is a donor funded non profit making institution and has among the donors who are also board members, World Bank, DfiD, CED (Swiss), Bill and Melinda Gates and Rockefeller foundation.

Finance is provided by a number of development partners working with the GoK. Current donors include the UK's Department for International Development (DFID), the Ministry of Trade & Industry/World Bank and Swedish SIDA. A new law requires deposit-taking savings and credit cooperatives to meet strong regulatory standards. FSD Kenya is seeking automatic solutions for these cooperatives.

Due to the increasing impacts of climate change and variability some donors have facilitated avenues for loans to be given to farmer to mitigate against impacts of drought. DfiD have extended donation to cover livestock (see earlier activities of ILRI) while World Bank and Rockefeller Foundation have done so on crops. Currently wheat, maize, bananas and coffee are being covered while next in plan is to cover sorghum, tea, barley, sugarcane and dairy.

The program is due to make payments to farmers in Machakos county by beginning of March due to advance effects of the failed October-November- December 2010. These activities are as shown in the diagram below (Fig. 11).

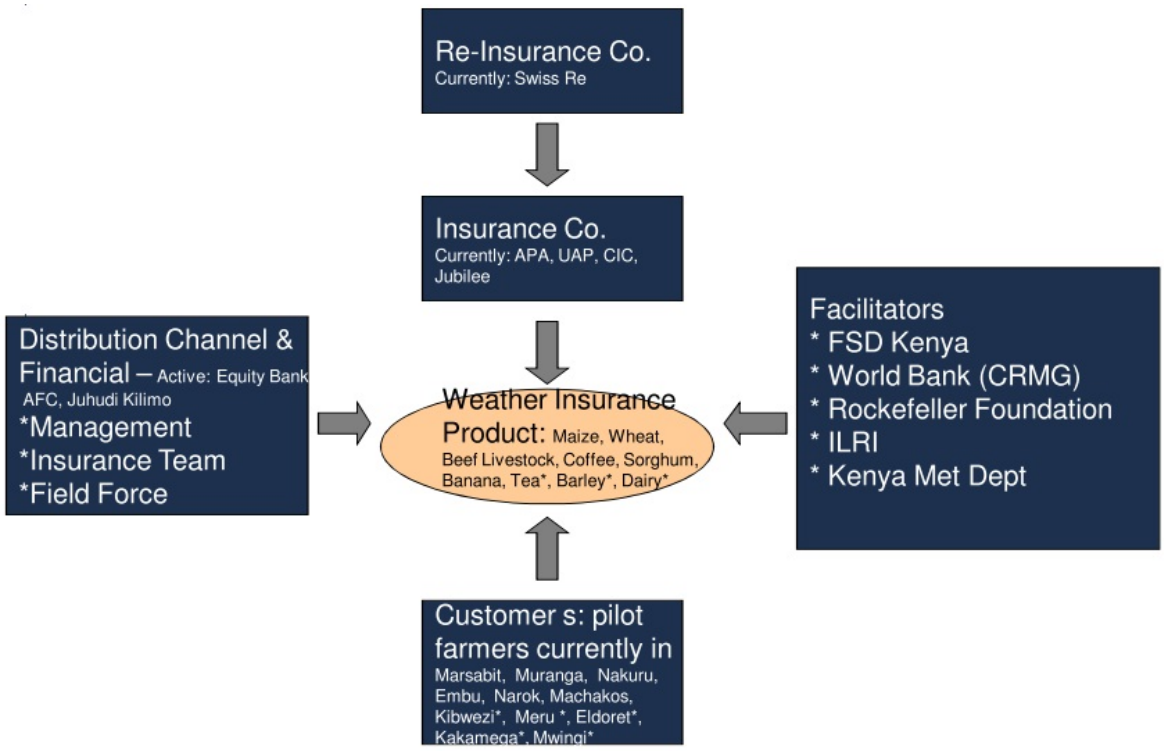


Figure 11: Schematic Diagram Showing Weather Insurance System (Source: FSD).

The products used in the FSD are:

- Rainfall
- Temperature
- Wind speed
- Soil moisture
- Growing degrees days
- Sea surface temperature
- NDVI

Collaboration and partnership: FSD locally is collaborating with WID (WIFA) in Embu, Machakos, Muranga, Nakuru and Narok and with its partners intends to install 40 automatic weather stations. Presently FSD has strong partnership with KMD and it is providing support to a program on Risk Mapping being done by KMD where information like metadata etc. will be collated. Terms of Reference (TOR) on this activity have already been completed.

The program's strengths include:

- Eliminates most of the asymmetric information problems of traditional insurance products (moral hazard and adverse selection)
- No loss assessment required
- Objective and transparent
- Simplified claim process
- Provides timely pay-out
- Reduces administrative costs
- Facilitates risk transfer outside of the local community (international reinsurance).

The program's weaknesses include basis risk – when the actual losses suffered by the insured and the payouts of the contract don't match perfectly. By definition, weather index insurance does not cover non-weather sources of risk: in a multi-risk environment this can be a limitation for the end user. For sustainability of index process FSD is of the view that government may give from it national budget 5% to maintain WIFA installed stations for sustainability.

RANET-Kenya

The RANET-Kenya project is based at the Kenya Meteorological Department (KMD) and is part of the global RANET project. It is a rural communications project that seeks to transmit vital weather and climate information to rural communities using Internet and Radio. To achieve this goal, KMD is working with many partners such as government departments, NGOs and CBOs operating in the local communities, addressing challenges that affect them particularly in food security and poverty reduction.

Tanzania

Lake Victoria Basin Commission

The Lake Victoria Basin Commission (LVBC) is a specialized institution of the East African Community (EAC) that is responsible for coordinating the sustainable development agenda of the Lake Victoria Basin. The Treaty for Establishment of the East African Community was signed on 30th November 1999 and entered into force on 7th July 2000 following its ratification by the original

3 Partner States – Kenya, Uganda and Tanzania. The Republic of Rwanda and the Republic of Burundi acceded to the EAC Treaty on 18th June 2007 and became full Members of the Community with effect from 1st July 2007. The Partner States, in the second EAC Development Strategy (1997-2000), designated the Lake Victoria and its basin as an economic growth zone to be exploited in a coordinated manner. The LVBC Secretariat, recognizing the role played by other stakeholders in the developments in the Lake Victoria Basin, has entered into partnerships and signed Agreements with governments and institutions so as to build up synergies in the implementation of its interventions areas in the EAC Development Strategy by the stakeholders.

LVBC serves as an overall institution for the management of issues related to the Lake Victoria Basin. The East African Community (EAC) established the Lake Victoria Development Program in 2001 (which was taken over by LVBC), as a mechanism for coordinating the various interventions on the Lake and its Basin; and serving as a centre for promotion of investments and information sharing among the various stakeholders. EAC had also designated Lake Victoria and its Basin as an "area of common economic interest" and a "regional economic growth zone" to be developed jointly by the Partner States (Kenya, Uganda and Tanzania). The program was the driving force for turning the Lake Victoria Basin into a real economic growth zone. The Commission is focusing on harmonization of policies and laws on the management of the environment in the Lake and its catchment area; continuation of the environmental management of the Lake, including control and eradication of the water hyacinth; management and conservation of aquatic resources, including fisheries; economic activities in the development of fishing, industry, agriculture and tourism; and development of infrastructure, including revamping the transport system on and around the Lake.

Agricultural Council of Tanzania

The Agricultural Council of Tanzania is the lead organization for the agricultural private sector in the country. It unites groups and associations of farmers, livestock keepers, suppliers, processors, transporters, researchers, in order to push for improved economical and organizational environment for the sector. The vision of the ACT is to be the most effective private sector leading organization pursuing a modernized and commercialized agriculture in Tanzania. Its mission is to:

- Unite and strengthen the private organizations in agriculture for rapid development including its modernization and commercialization,
- Actively undertake participative and consultative lobbying and advocacy role on key private sector agricultural issues on behalf of members and stakeholders
- Promote, coordinate and protect the interests of all stakeholders in the agriculture and agribusiness in the country, and
- Enhance agriculture position in the development of the country

The ACT engages in activities that include:

- Mobilizing members
- Strengthening capacity for policy analysis, research and communication
- Lobbying and advocacy
- Undertake stakeholder consultations
- Facilitate collaboration and networking
- Building the capacity of ACT Board of Directors and Secretariat
- Building the capacity of the members

- Promoting investments in the agricultural sector

In 2008 and 2009, ACT concentrated on developing its own structure especially on who should be members of ACT and which policy and advocacy issues the council should concentrate on and communicate. Networking with likeminded partners and not at least an assessment of members' and potential members' training needs and facilitation of their advocacy skills were also on the list of tasks. Members and potential members include**:**

- Farmers associations
- Associations of livestock keepers
- Cooperatives
- Associations of input suppliers
- Agro processors associations
- Transporters' associations
- Researchers

Southern Agricultural Growth Corridor of Tanzania

The Southern Agricultural Growth Corridor of Tanzania is an international public-private partnership launched at the world Economic Forum on Africa in May, 2010 in Dar es Salam, Tanzania. It is meant to mobilize private sector investments and partnership to help achieve the goals of Tanzania's agriculture strategy. Members of the partnership represent government, global business, the Tanzanian private sector, farmers, foundations and donor institutions. It is led by an Executive Committee co-chaired by the Minister of Agriculture of Tanzania and the Executive Vice President (North and Central Africa) of Unilever. The idea behind the initiative is to support and bolster efforts being undertaken to bringing about the green revolution.

By catalyzing private investment, the initiative aims to deliver rapid and sustainable agriculture growth, with major benefits for food security, poverty reduction and reduced vulnerability to climate change. Its objective is to leverage the agricultural potential of Tanzania and support green revolution. The partnership undertakes the following activities:

- Improvement of rural infrastructure,
- Facilitation of collaboration and coordination between public, private sector and small holder farmers, and
- Highlight investment opportunities that offer good financial returns and deliver benefits to smallholder farmers;
- Expected outcomes include:
- Increase in arable land for production to serve regional and international markets;
- Thousands of smallholders becoming commercial farmers, with access to irrigation and weather insurance;
- New employment opportunities in the agriculture value chain;
- Millions of people lifted out of extreme poverty;
- Increase in farming revenue; and
- Regional food security assured.

Uganda

National Agricultural Research System (NARS)

The National Agricultural Research ACT, 2005 provides for the development of an agricultural research system for Uganda, hereby referred to as the National Agricultural Research System (NARS), for the purpose of improving agricultural research services delivery, financing and management. The NARS means a cross section of stakeholders whether in public or private sector; and comprises of the organization, public agricultural research institutes, universities and other tertiary institutions, farmer groups, civil society organization, private sector and any other entity engaged in the provision of agricultural research services.

The NARS institutional framework encompass Public as well as Private sector institutions in implementing agricultural research, and promoting vertical and horizontal linkages with other national, regional and international institutions. The objectives of NARS in Uganda are to:

- Transform agricultural production into a modern science-based market oriented agriculture capable of greater efficiency, profitability and of sustaining growth in the agricultural sector while contributing to poverty eradication;
- Promote agriculture and related industry for the purposes of contributing to the improvement of the quality of life and livelihoods of the people, having regard to the protection of the environment; and
- Support the development and implementation of national policy with relevant information and knowledge.

The overall goal of the NARS is to address challenges presented in the Plan for Modernization of Agriculture (PMA) strategy and National Agricultural Research Policy (NARP) principles to provide research services that address in a sustainable manner, the needs and opportunities of the majority poor.

Sub-systems of NARS include Public Research Institutes, Universities and other tertiary institutions, Private companies/private sector, Farmers' organizations, Civil Society Organizations, Individuals, Advisory Service Organizations and NARS Linkage Institutions (the regional and international organizations). The key attributes of NARS include:

- The harnessing of knowledge and skills on what needs to be done;
- Deciding who does the research, i.e. hiring research service providers (RSPs) and the direct accountability to them;
- Agreeing on the research agenda;
- The need for farmers to organize themselves in groups for collective action;
- Facilitating farmer investment into research; and
- Recognition and utilization of farmers' own knowledge.

NARS are coordinated by NARO Council, which is a governing semi autonomous Apex body. This Apex body is composed of representatives from key Government departments & other stakeholder groups (farmers, concerned ministries & other PMA related sectors) Service provider agencies including NAADS with various Coordination Committees at District and regional/zonal level with legal status & regulatory functions. The Secretariat for the Apex Body (NARO Council Secretariat) is headed by the Director General. The following subsection gives the profile for NARO.

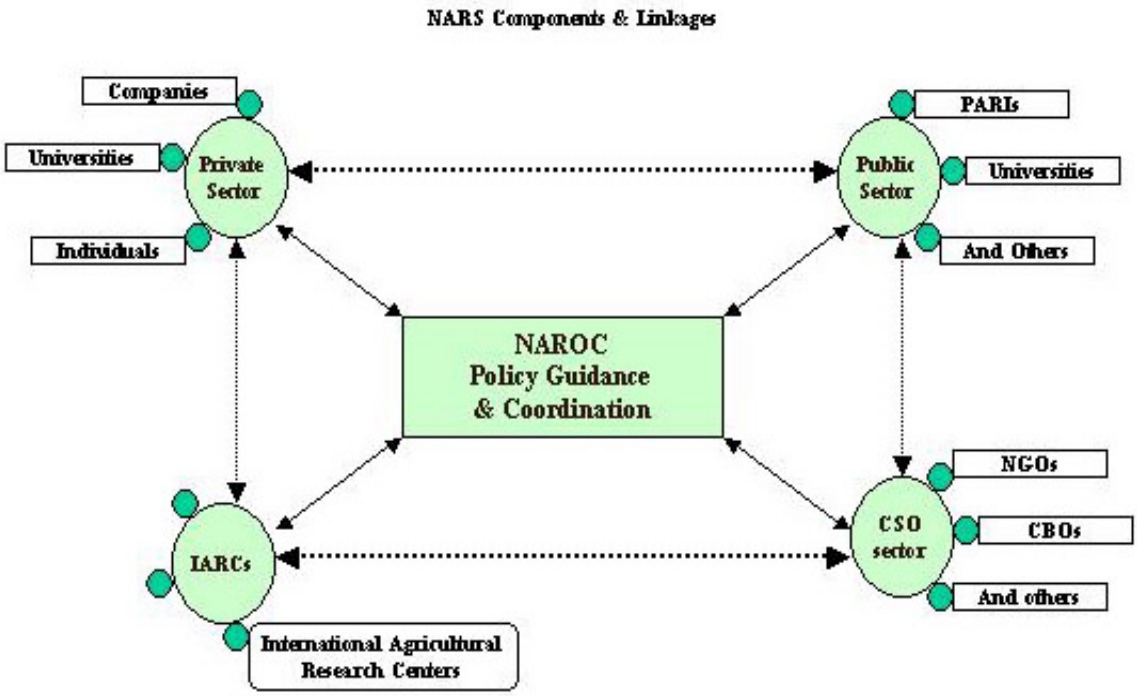


Figure 12: NARS Components with linkages

National Agricultural Research Organization (NARO)

NARO is the apex body for guidance and coordination of all agricultural research activities in the national agricultural research system in Uganda. NARO is a Public Institution established by an act of Parliament, which was enacted on 21st November 2005. NARO comprises of the council as its governing body, committees of the council as its specialized organs, a secretariat for its day-to-day operations with the semi autonomous public agricultural research institutes under its policy guidance. The Vision, the Mission and the Goal that guide the NARO are derived from the Plan for Modernization of Agriculture (PMA). The NARO vision is to create a "farmer-responsive research system that generates and disseminates problem-solving, profitable and environmentally sound technologies, knowledge and information on a sustainable basis." Its mission is the "generation, adoption and dissemination of appropriate and demand-driven technologies, knowledge and information through an effective, efficient, sustainable, decentralized and well coordinated agricultural research system."

The functions of NARO are:

- Provide strategic direction for publicly funded agricultural research in Uganda and act as a forum for agricultural researchers in Uganda;
- Coordinate and oversee, in collaboration with the Uganda National Council for Science and Technology and other lead agencies, the development, consolidation and implementation of agricultural research policy and national research strategies, plans and budgets relating to publicly funded agricultural research;
- Set national priorities and harmonize agricultural research activities of the national agricultural research system, constituent institutions and public agricultural research institutes, civil society

organization, private sectors and farmer organizations and promote delivery of quality and efficient agricultural research services;

- Advise and coordinate formulation of policy and legislative proposals, research standards, codes of ethics, conduct and practice; and guidelines for delivery of agricultural research services;
- Provide guidelines, guidance and ensure delivery of quality agricultural research by agricultural research service providers;
- In collaboration with other relevant agencies, provide policy guidance to local governments on matters relating to agricultural research;
- Carry out monitoring and evaluation of national agricultural research programs, projects and activities to ensure adherence to the set work plans, standards and regulations;
- Mobilize funds for agricultural research and manage the agricultural research trust fund including raising funds for research of national strategic interest;
- Coordinate and promote cooperation and collaboration between Uganda and other countries, institutions, scientific or professional societies and other agricultural research service providers, with regard to agricultural research, development and technology transfer in the agricultural sector so as to optimally utilize agricultural resources and improve production capacity of such resources;
- Provide leadership and advocacy for the promotion, protection and development of agricultural research in Uganda;
- Make grants or provide funds to any institution or person for the advancement of agricultural research and development on both competitive and non-competitive basis; and
- Perform such other functions as are conferred on the organization by this Act or any other law for the purpose of promoting agricultural research and development.

In carrying out the above functions, NARO is a forum for agricultural researchers in Uganda. NARO is mandated to convene a meeting at least once a year of representatives of agricultural research service providers, farmers, private sector and civil society and other stakeholders for the purpose of discussing issues relevant to agricultural research and setting agricultural research priorities.

In addition to above functions, NARO performs other functions such as:

- Advise the Minister of Agriculture, Animal Industry and Fisheries on research, development and technology transfer in the field of agriculture, Animal Industry and Fisheries;
- Co-ordinate, collect, collate and analyse data and information on agricultural research and ensure their publication and dissemination, and take inventory of all agricultural research in Uganda;
- Inspect facilities and any area where agricultural research is being carried out or intended to be carried out in Uganda;
- Register potential agricultural research service providers in the public and private sectors in Uganda; and
- Maintain a central register of agricultural research and development in Uganda.

NARO comprises of the Council as its governing body, committees of the council as its specialized organs, a secretariat for its day-to-day operations, with the fifteen (15) semi-autonomous **public agricultural research institutes** (PARI) under policy guidance of the secretariat. The Research capacity and reputations of the Public Agricultural Research institutes has been built over several decades, since 1898. In the governance of NARO, the Council is responsible for carrying-out the following:

- Formulate the policies and strategies of the organization;
- Ensure that the objects and functions of the organization are carried out;
- Manage the property, business, income, funds and other affairs of the organization;
- Set targets and approve work plans and budgets for the organization;
- Establish with the approval of the Minister the terms and conditions of service and approve rules and procedures for appointment, termination and discipline of staff of the organization's secretariat and employees of public agricultural research institutes;
- Appoint and discipline members of staff of the organization's secretariat;
- Appoint the directors and research scientists of the public agricultural research institutes, but in exercising this function, the council shall ensure full participation of the management committee of the respective public agricultural research institute in the entire process and the interviewing panel for this purpose shall be constituted in accordance with the fifth schedule; and
- Perform any other functions relating to the above as the Minister may direct.

Public Agricultural Research Institutes (PARIs)

PARIs are semi-autonomous research management entities under the policy guidance of the NARO for the purpose of providing agricultural research services. PARIs are autonomous in their operations relating to the implementation of its programs, allocation and management of its resources in accordance with its approved annual programs and budget as approved by the council. The public agricultural research institutes are of two categories:

- National Agricultural Research Institutes, which manage and carry out agricultural research of a strategic nature and of national importance; and
- Zonal Agricultural Research and Development Institutes, which manage and carry out agricultural research whether applied or adaptive for a specific agro- ecological zone.

Uganda National Farmers Federation (UNFFE)

UNFFE is the largest non-governmental farmers' organization in Uganda. Farmers from all over Uganda founded this organization in 1992 with the objective to mobilize the farming community and voices under one independent umbrella organization. It started as Uganda National Farmers Association (UNFA) and changed to a Federation in 2002 to embrace various commodity associations and service providers. It comprises of seven departments namely, the Administration; Agribusiness Development; Training and Agricultural Advisory Services; Lobby and Advocacy; Information and Communication; Monitoring and Evaluation; and Finance and Accounting.

The UNFFE mandate is to**:**

- Deliver Agricultural Advisory services,
- Influence agricultural policy through lobbying and Advocacy,
- Distribute farm inputs/implements and market members produce through our trading and business arm - Uganda Farmers Agribusiness Ltd (UFAL),
- Mainstreaming Gender, HIV/AIDS, TB, Malaria and Natural Resource management in the federation's programs and farming sector in general,
- Promote agricultural shows and trade fairs,
- Promote commercialization and industrialization of agriculture,

- Organize farmers exchange program (Study Tours) both local and international Young graduate support,
- Promote radio listening groups including production of subject matter cassettes,
- Provision of marketing information and
- Provide agricultural-related and other information to the farming fraternity and the public through the farmers' voice newspaper.

UNFFE envisions empowered farmers through strong farmers' organizations. Its mission is to promote favorable policies for farmer empowerment and strengthen farmer organizations. The objectives of the organization are:

- To lobby and advocate for farmer friendly agricultural policies,
- To build and develop capacity of farmer organizations to render effective services and
- To increase farmers accessibility to income opportunities and agricultural information.

Affiliates of the program include:

- Uganda Commercial Farmers Association (UCFA),
- Uganda Floricultural Association (UFA),
- Uganda Honey Beekeepers Association (UHBKA),
- Uganda Midland Multipurpose Foundation,
- Universal Apostolic Fellowship Farmers Organization,
- Concerned Women of Rakai, Ssembabule (COWORASE),
- East African seeds,
- Horticultural Exporters Association (HORTEXA),
- Masaka and Kalangala Farmers Organization,
- Ngenge Development Foundation and
- Sukura Farm suppliers.

HEIFER International-Uganda

HEIFER International-Uganda was established with gifts from generous donors, including David and Marianne Hogg of Raleigh, North Carolina and Ursula Bartel of La Verne, California. In Uganda, Heifer is providing livestock including dairy cattle, goats, poultry, pigs and bees. The focus of the projects is improving nutrition and income status for small-scale farmers, particularly women, as the male population has been so significantly diminished due to AIDS.

McKnight Foundation

The McKnight Foundation supports programs that provide community and family services for those in need; preserve the environment; support the arts; and promote scientific research in selected areas. The Africa Grants Program's goal is to foster women's social and economic empowerment in Tanzania and Uganda. It seeks to increase women's access to skills and economic opportunities that will help them gain greater control over their lives and participate more fully in their households and communities as equal decision-makers. The Africa program awards a total of approximately US $1.4 million per year to projects that support its overall goal. The Africa program seeks to support efforts that:

- Foster women's ability to start, develop and manage their own small and micro businesses. Funded programs provide financial services as well as access to new skills or technologies that will improve productivity.
- Enhance the ability of rural women to grow crops and raise livestock to achieve food security and increased income. Farm-based programs promote sustainable organic agriculture, building household assets through animal husbandry, and women's entry to commercial farming through high value crops and access to new markets.
- Build women's ability to actively manage natural resources in order to conserve or increase income, or save time or labor. This category of programs supports business development as an alternative to encroaching on protected areas; well-managed commercial responses to market demand for natural resources; and technologies that conserve both scarce resources and women's time.

Global Water Partnership (GWP)

The Global Water Partnership (GWP) with regional headquarters in Uganda is a working partnership among all those involved in water management: government agencies, public institutions, private companies, professional organizations, multilateral development agencies and others committed to the Dublin-Rio principles. "Support countries in the sustainable management of their water resources" as its mission. Within East Africa, it is helps in getting solutions for the specific water related challenges in the particular countries. Among its linkages is: Eritrea Water Partnership, Ethiopia Water Partnership, Kenya Water Partnership, Sudan Water Partnership, Uganda Water Partnership and Burundi Water Partnership.

Boundary/Extension Organizations

There are several organizations and institutions in the Eastern Africa that use climate data and information to develop products for agriculture and food security thus playing a double role as a user and producer. These include the boundary institutions/extension organizations and support institutions and initiatives some which are as listed, but not limited to the following:

- Crop Protection Association of Uganda – Kampala,
- Eastern Africa Root Research Network (EARRNET) – Kampala,
- Eastern African Fine Coffees Association (EAFCA) – Kampala,
- Eastern and Central Africa Program for Agricultural Policy Analysis (ECAPAPA) – Entebbe,
- Environmental Alert – Kampala,
- Faculty of Agriculture, Makerere University – Kampala,
- Fisheries Resources Research Institute of Uganda (FIRRI) – Jinja,
- Food Science and Technology Research Institute (FOSRI) – Kampala,
- Forestry Research Institute of Uganda (FORI) – Kampala,
- Gulu University of Agriculture and Environmental Sciences – Kampala,
- International Institute of Tropical Agriculture, Uganda (IITA) – Kampala,
- International Network for the Improvement of Banana and Plantain, Uganda – Kampala,
- Jaksons Farms Limited – Kampala,
- Kawanda Agricultural Research Institute (KARI) – Kampala,
- Kyoga Foundation – Kampala,
- Lake Victoria Fisheries Organization (LVFO) – Jinja,
- Makerere University Agric. Research Inst. Kabanyolo (MUARIK) - Kampala

- Marketing and Postharvest Research in Eastern and Central Africa (FOODNET) – Kampala,
- Ministry of Energy and Mineral Development - Kampala
- Namulonge Agricultural and Animal Production Research Institute (NAARI) – Kampala,
- National Agricultural Advisory Development Service (NAADS) – Kampala,
- National Agricultural Research Organization – Kampala,
- National Agricultural Research Organization (NARO) – Entebbe,
- National Agricultural Research Organization (NACRRI) - Kampala
- National Animal Genetic Resources Centre and Databank (NAGRC&DB) (NAGRC&DB) - Entebbe
- National Animal Genetic Resources Centre & Databank (NAGRC&DB) (NAGRC&DB) – Entebbe,
- National Forestry Authority, Uganda – Kampala,
- Nkoola Institutional Development Associates Ltd – Kampala,
- Nyabyeya Forestry College - Masindi
- Participatory Ecological Land Use Management Association (PELUM) - Kampala
- PRAPACE – Kampala,
- Regional Agricultural Information Network (RAIN) - P.O Box 765, Entebbe
- Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) – Kampala,
- Rural Empowerment Network (REN) – Kampala,
- Serere Agricultural and Animal Production Research Institute (SAARI) - Soroti
- Uganda Martyrs University - Kampala
- Agricultural Engineering and Appropriate Technology Research Institute - Kampala
- Agricultural Production and Extension Project. Agribusiness Development Centre – Kampala,
- Amfri Farms Limited – Kampala,
- Department of Agricultural Extension/Education – Kampala,
- Department of Animal Science - Kampala
- Department of Continuing Agricultural Extension Education (CAEC) – Kampala,
- Department of crop science – Kampala,
- Department of Food Science & Technology – Kampala,
- Department of soil science - Kampala
- Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) – Entebbe,
- AT (Appropriate Technology) Uganda Ltd – Kampala,
- Bukalasa Agricultural College – Wobulenzi,
- CIAT, Kwanada Agricultural Research Institute, Uganda (CIAT) – Kampala,
- Uganda National Farmers Association (UNFA) – Kampala,
- Ugandan National Banana Research Program (UNBRP) – Kampala, and
- Volunteer Efforts for Development Concerns (VEDECO) - Kampala
- University of Nairobi (Department of Meteorology, Department of Geology)
- Kenya Agricultural Research Institute (KARI),
- Kenya Sugar Authority (KSA),
- Kenya Maritime Authority (KMA),
- Kenya Marine and Fisheries Research Institute (KMFRI),
- Lake Victoria Environmental Program (LVEP),
- Jomo Kenyatta University of Agriculture and Technology (JKUAT),
- National Environment Management Authority (NEMA),

- Kenya Wildlife Services (KWS),
- Ministry of Agriculture,
- Ministry of Water and Irrigation,
- KENGEN - (Electricity Generating Company),
- Ministry of Forestry,
- Department of Resource Surveys and Remote sensing (DRSRS),
- Department of Mines and Geology,
- Regional Center for Mapping of Resources for Development (RCMRD),
- Kenya Bureau of Standards (KEBS),
- Water Resources Management Authority (WRMA),
- Kenya Water Institute (KEWI).
- Ethiopian Institute of Agricultural Research (EIAR**)**
- World Food Program (WFP)
- Food Agricultural Organization (FAO)
- World Food Program (WFP)
- College of Biological and Physical Sciences (Chiromo Campus)
- University of Nairobi, Kabete Campus or College of Agriculture and Veterinary Sciences (Upper Kabete Campus)
- Kenyatta University, Kitui Campus

Some of the boundary/extensions organizations and support institutions and initiatives in the pilot countries are presented country by country in the following subsections.

Ethiopia

Ethiopian Institute of Agricultural Research (EIAR)

EIAR is a government research institution. Its parent ministry is the Ministry of Agriculture and Rural Development. EIAR' s vision is to see that all Ethiopians engaged in agriculture, agro-pastoralism, pastoralism and all agriculture-related business become beneficiaries of improved and appropriate agricultural technologies. Its mission is to conduct research that will provide improved and appropriate agricultural technologies that will contribute to increased agricultural productivity, food security and environmental sustainability. Its major research thematic areas are: Crops, Livestock, Soil and Water, Forestry and Pastoral and Agro-Pastoral. The Agricultural Research System is comprised of Federal Research Institutes and Canters, Regional Agricultural Research Institutes and Higher Learning institutes.

World Food Program (WFP)

WFP is the world's biggest humanitarian agency fighting hunger worldwide and is the food aid arm of the United Nations system. Food aid is one of the many instruments that can help to promote food security, which is defined as access of all people at all times to the food needed for an active and healthy life. Towards that vision, WFP works with sister UN agencies such as the Food and Agriculture Organization **(**FAO**),** the International Fund for Agricultural Development **(**IFAD**),** the United Nations Department of Humanitarian Affairs, UNHCR, the non-governmental organizations (NGOs) and other relevant agencies in the response to emergencies and humanitarian crises.

The policies governing the use of WFP food aid is oriented towards the objective of eradicating hunger and poverty with ultimate objective of the elimination of the need for food aid. WFP also

provides food assistance to Somali, Eritrean and Sudanese refugees, people affected by HIV/AIDS, pregnant and nursing mothers, and children suffering from malnutrition. A number of WFP global pilot projects, such as Purchase for Progress (P4P) and the Risk Insurance project, have been launched in Ethiopia. The activities outlined in 2011, WFP plans to assist 5.7 million people spanning every part of Ethiopia. These activities are intended to contribute towards the Government of Ethiopia's five-year development agenda, the Growth and Transformation Plan (GTP), through which the Government continues to address food security. The main intervention in 2011 will focus on emergency food assistance to some 1.9 million people most affected by temporary food insecurity. As a major partner in Ethiopia's Productive Safety Net Program (PSNP), WFP will assist 1.3 million rural dwellers in generating community assets. Launched in 2005, PSNP provides transfers of food or cash, or a combination of both, to help bridge food deficit periods and to ensure people do not sell off their assets in order to meet their basic food needs.

WFP Ethiopia's Development Program consists of two core components: Children in Local Development (CHILD)/School Meals and MERET (Managing Environmental Resources to Enable Transition), a program supporting sustainable land and water management and increased productivity in food-insecure communities. MERET was recognized at the Cancun Climate Conference at the end of 2010 as a model for confronting climate change. It has great potential for countries that are vulnerable to climactic shocks and it shows that community-based land and water management can reverse environmental degradation and improve long-term food security. CHILD/School Meals focuses on supporting formal education and enhancing schools by developing them into community resource centers that promote good nutrition and environmental awareness.

Protracted Relief and Recovery Operation (PRRO) Ethiopia was designed to provide food assistance from 2009 to 2011 for refugees hosted in camps or communities in Ethiopia. It was based on the 2008 joint assessment mission, the 2008 nutrition mission, the 2007 nutrition survey, the 2008 WFP regional bureau mission, the 2008 evaluation of milling projects, and on-going monitoring and evaluation. The refugees receive monthly general food rations; malnourished children and pregnant women also receive supplementary foods with refugee children benefiting from on-site or take-home school feeding rations. Income-generating activities and environmental rehabilitation are e supported with technical assistance and non-food items to improve livelihood opportunities in selected camps. The operation is in line with Strategic Objectives 1 and 4 of the WFP Strategic Plan (2008−2011). It supports joint Humanitarian Response, Recovery and Food Security, in particular "enhanced multi-sectorial response to displaced people, refugees and other vulnerable populations in emergencies" while work related to HIV and AIDS, gender, environmental rehabilitation and nutrition are coordinated in a common framework agreed by partners.

FAO in Ethiopia

Ethiopia joined the FAO as a member country in November 1948 and the Representation office was established in November 1981 with the arrival of the first FAO Representative. Prior to this date however, FAO's activities in the country were handled by a Senior Agricultural Advisor assigned to the UNDP office. The FAO Representation in Ethiopia to AU and ECA is currently hosting the FAO Representation in Djibouti. The Office also indirectly assists in the implementation of the NEPAD and some activities in the Greater Horn of Africa. FAO's support to Ethiopia is channeled through technical assistance, TCP, Trust Fund, UNDP, and TeleFood Projects.

At the FAO Conference, the Organization's supreme governing body at its 33rd Session held in Rome on 19th – 26th November, 2005 approved further decentralization within the framework of the reform agenda. The Government of the Republic of Ethiopia-FAO Agreement to establish the Sub-regional Office for Eastern Africa (SFE) in Addis Ababa was signed on 31 January 2007 and the office established in February 2007. SFE covers the following eight countries: Burundi, Djibouti, Ethiopia, Kenya, Rwanda, Somalia, Sudan and Uganda. FAO's main objective of decentralization is to establish sub-regional centers to become more responsive in delivering service to member countries.

The FAO Ethiopia Special Program for Food Security (SPFS) helps governments replicate successful food security practices on a national scale. The SPFS also encourages investment in rural infrastructure, off-farm income generation, urban agriculture and safety nets.

FAO Technical Cooperation Department Field Program Activities on Operationally Active projects for all Organizational Units in Ethiopia, Federal Democratic Republic are:

- Technical support to input supply chain response to soaring food prices for 2009-2011,
- Enforcement of post registration regulations for better pesticide management 2010-2011,
- Technical Assistance to Investment Support Directorate 2010-2011, and
- Project for bridging two phases of the project "Support to Agriculture Information Systems" 2010-2011.

Key Partners include African Union, Common Market for Eastern and Southern Africa (COMESA), European Commission on Agriculture, The International Livestock Research Institute (ILRI), EAC and United Nations in Ethiopia.

Kenya

National Irrigation Board (NIB)

Irrigation in Kenya has a long history spanning over 400 years. Historical records show that irrigation in Kenya has existed for many years along the lower reaches of River Tana and in the then Elgeyo-Marakwet, West Pokot and Baringo districts. Rice irrigation activities also existed along the river valleys around Kipini, Malindi, Shimoni and Vanga where slaves were used to construct the rice schemes in the early nineteenth century. Asian workers building the Mombasa–Nairobi Railway line also started some irrigation activities around Makindu and Kibwezi.

In 1946, the African Land Development Unit (ALDEV) for the first time focused on irrigation as part of a broad agricultural rehabilitation program. The Unit, in pursuing its objectives, initiated a number of irrigation schemes including Mwea, Hola, Perkerra, Ishiara and Yatta. Cheap labor supplied by Mau-Mau detainees was used to establish these schemes. Most of the detainees were eventually settled in the schemes.

The National Irrigation Board was established in 1966 through an Act of Parliament (Cap 347) to take over the activities of ALDEV. The Board took over the running of Mwea, Hola and Perkerra. Later, the Board developed Ahero, West Kano, Bunyala and Bura schemes. The first three schemes were developed as pilot schemes in the 1960s and early 1970s and remain so even today. The NIB later expanded the Hola and the Mwea schemes and transferred the control of the Bura Irrigation Scheme to the Ministry of Agriculture. The Board has also facilitated research leading to the development of some public assisted irrigation schemes, such as the Yala Swamp and the South West Kano Schemes, which have been implemented by other agencies.

The original mandate of the NIB as spelt out in the Irrigation Act (Cap 347) was to promote irrigation development and to settle the landless in public irrigation schemes in Kenya. On being established, the NIB took over the Mwea, Hola and Perkerra irrigation schemes that were initiated by the colonial government. Thereafter, the NIB developed Ahero, West Kano, Bunyala and Bura irrigation schemes and also expanded Mwea and Hola schemes. Presently, the Board is in charge of six (6) national irrigation schemes. The following is the original mandate of NIB as derived from the Irrigation Act:

- Controlling and improving national irrigation schemes in the country;
- Conducting research and investigation into the establishment of national irrigation schemes;
- Designing, constructing, supervising and administering irrigation schemes;
- Coordinating and planning settlement on national irrigation schemes;
- Determining the number of settlers to be accommodated in national irrigation schemes;
- Promoting marketing of crops and produce grown or produced in national irrigation schemes in liaison with organizations responsible for marketing of agricultural produce; and
- Formulating and executing policy regarding national irrigation schemes in conjunction with the Water Resource Authority.

The vision of NIB is to be a leading institution in the development of effective and efficient irrigation and drainage projects and schemes in Kenya. Sustaining this vision requires a unique combination of a number of key values: Quality service, Leadership, Care and respect, Accountability, Value for money, Partnerships, and Learning. At its inception, the mission of NIB was to develop, control and improve irrigation schemes. This has changed to with current developments and now is: To develop, promote, and improve irrigated agriculture through sustainable exploitation of available irrigation and drainage potential in Kenya in order to ensure food security and create wealth and employment, therefore improving the living standards of the rural populations.

From the foregoing mandate NIB has a number of weather stations in the all schemes mentioned above. Some like Mwea Irrigation Scheme has a weather station with all instruments that measure parameters that are in put in the Penman-Monteith PET formula. These include temperature (maximum and minimum), radiation, sunshine hours, wind and relative humidity. All other schemes mentioned in their mandate have rainfall and temperature information. On the basis of this basic infrastructure, KMD has been working with NIB by operating these stations as GRADE B agro-met stations mentioned earlier (manned by non-KMD staff), which may later be upgrading to GRADE A (A full synoptic/agro-met station manned by KMD staff).

As a user, NIB receives and uses KMD seasonal forecast for programming it cropping calendar. Advisories given by KMD give NIB officers opportunity to issue out alerts in case of expected outbreak of blast in wheat crop and also to carry out irrigation scheduling. Essentially apart from the contact made by field officers with local communities, NIB does not have a formal bulletin for information dissemination but are being planned for in the organization's next strategic plan.

The strengths and weaknesses of NIB include:

- Strength in the provision of climate information to NIB was demonstrated by the fact that they use the same to control water and put up dykes.
- Most of the items raised indicated weaknesses in the climate information service to the board. Some of these include;
- All the weather stations in the schemes had collapsed and needed rehabilitation

- Regarding pre-paid cards used by KMD to collect rainfall data the officer felt that there could be an element of cheating and end up with false data.
- NIB informed that as the authority charged with irrigation matters the zones used by KMD to give its prediction seem to have changed climatologically, hence need for review.

Famine Early Warning Systems Network (FEWSNET)

FEWSNET is a USAID-funded activity that collaborates with international, regional and national partners to provide timely and rigorous early warning and vulnerability information on emerging and evolving food security issues. FEWSNET professionals in the Africa, Central America, Haiti, Afghanistan and the United States monitor and analyze relevant data and information in terms of its impacts on livelihoods and markets to identify potential threats to food security. The food security framework provides a broad understanding of food insecurity and related factors. It summarizes the key factors, entities, and relationships that affect food insecurity including, key population affected by food insecurity, underlying factors affecting food security, natural and other hazards and gaps in knowledge.

Once these issues are identified, FEWSNET uses a suite of communications and decision support products to help decision makers act to mitigate food insecurity. These products include monthly food security updates for 25 countries, regular food security outlooks, and alerts, as well as briefings and support to contingency and response planning efforts. More in-depth studies in areas such as livelihoods and markets provide additional information to support analysis as well as program and policy development. FEWSNET also focuses its efforts on strengthening early warning and food security networks. Activities in this area include developing capacity, building and strengthening networks, developing policy-useful information, and building consensus around food security problems and solutions.

FEWSNET offers a range of information products, tools and services to provide decision-makers with the up-to-date information necessary to avert or mitigate the impact of a food security hazard. It is to be noted that FEWSNET is a boundary institution as it does not produce raw data, but it produce derived information for use in early warning.

Vulnerability and food security assessments: FEWSNET undertakes livelihoods and food security assessments using a livelihoods approach. These assessments provide an improved context to understand the effects on particular groups and households of current and potential hazards such as drought, floods, crop and livestock disease or changes in food and other commodity prices.

Food security alerts, updates and briefings: Regular and ad hoc alerts, updates and briefings provide in-country decision-makers, USAID, United Nations, NGOs and other donors with the latest information on potential food security threats. Products monitoring are done on dekadal and basis while for early warning seasonal forecast is used.

To promote sustainability, FEWSNET provides technical assistance to national and regional early warning systems. Areas of assistance include early warning techniques and tools, food security and vulnerability assessment methods, and contingency and response planning. In particular these include Remote sensing and Geographical Information system application to Food Security issue with emphasis on what they referred to as FEWSNET APPROACH.

Remotely sensed and ground-based early warning data are collected, analyzed and disseminated on an on-going basis. The data involve rainfall estimates (RFE) that are used in RunCrop model and Flood Model. FEWSNET web site is the activity's primary global vehicle for disseminating information. Regional and national monthly food security updates appear on the site along with other information and technical materials.

FEWSNET collaborates with agencies at the international (FAO, WFP, and EU), regional (SADC, CILSS, IGAD, Drought Monitoring Center), and national levels to improve early warning and vulnerability analysis methodologies.

The main weakness noted by FEWSNET regarding climate forecasts issued by the NMHSs included:

- Accuracy of the forecast should be ascertained and attached to the forecast, thus need to give skill
- Spatial distribution given to the forecast is rather course for effective usage where specific activities have to be undertaken.
- There is need for user workshops to build capacity on understanding of the forecast

International Livestock Research Institute (ILRI)

ILRI began operations in 1995 with the consolidation of two Consultative Group on International Agricultural Research (CGIAR)-sponsored livestock research centers: the International Laboratory for Research on Animal Diseases (ILRAD), in Kenya, and the International Livestock Centre for Africa (ILCA), in Ethiopia. Integration of the laboratory-based strategic research of the former with the field-based production system research of the latter created the first international research institute to address the severe problems of tropical animal agriculture in a holistic way.

ILRI's mandate is global. Its research products are designed to raise livestock productivity without depleting the natural resources on which farming depends. ILRI's mission is to enhance the wellbeing of present and future generations in developing countries through research that improves sustainable livestock production. Consistent with the above mission, ILRI has the following vision:

- To serve the priorities for development-oriented livestock research,
- To deliver livestock research outputs that improve the wellbeing of poor people,
- To develop and sustain full partnerships for international livestock research,
- To assist in the identification of priorities and mobilization of resources for international livestock research.

ILRI's research products include maps of bovine and protozoan genomes, improved vaccines and diagnostics, integrated disease-control strategies, economic and systems models, policy analyses, GIS-based decision-support systems, a tropical forage gene bank, technologies for incorporating forages onto smallholder farms, systems that improve feed supplies for smallholder dairy producers, feeding strategies for multiple purpose livestock (dairy–draft cows), and animal traction technologies that improve the productivity of heavy clay soils.

ILRI's research products and related outputs are disseminated through an outreach program that works to strengthen collaborations with and capacities within the national agricultural research systems of developing countries. As part of its outreach capability one hundred and ten internationally recruited scientific and administrative staff work at ILRI headquarters in Kenya and Ethiopia and with interdisciplinary teams of scientists based in Nigeria (International Institute of Tropical Agriculture

(IITA) headquarters), Niger (ICRISAT's Sahelian Center), Burkina Faso (*Centre International de Recherche-Développement sur l'Elévage en zone Sub-humide* (CIRDES) center) and India (ICRISAT headquarters). Another 769 supervisory and support staff are recruited from Kenya and Ethiopia, ILRI's co-hosting countries, in about equal numbers.

ILRI research and research-related activities during the medium term will be conducted through partnerships that leverage ILRI's limited human and financial resource. These partnerships involve:

***Scientific networks*:** ILRI scientists are contributing in world-wide networks of advanced research institutes, which collaboration strategic research in genome mapping, tick-borne disease, helminthic resistance, rumen ecology, GIS, conservation of genetic resources, improving utilization of crop residues, *inter alia.*

***Eco-regional consortia convened by CGIAR centers*.** Currently, ILRI interdisciplinary research teams are contributing to the Desert Margins Program, the Eco-regional Program for the Humid and Sub-humid Tropics of SSA (EPTHA) and the East African Highlands Program. Through the medium term, ILRI will contribute to the Tropileche consortium and the Consortium for the Sustainable Development of the Andean Eco-region (CONDESAN) in Latin America and to sub-regional consortia in Asia and in the Western and Northern African region. The ILRI-led SLP will support livestock-related research by eco-regional consortia.

***Multi-institutional initiatives*.** These include collaborative research on market-oriented smallholder dairy in East Africa and characterization of indigenous animal genetic resources and involvement in the Confederation of Research Institutes Supporting Livestock Development in Tsetse Affected Areas of Africa.

***System-wide programs*:** ILRI convenes the SLP and the Inter-Centre Training Program for sub-Saharan Africa and contributes to the System-wide Genetic Resources Program, the System-wide Program on Integrated Pest Management, the Property Rights and Collective Action Initiative, and the System-wide Soil Water Nutrient Program.

***Outsourcing*:** ILRI prefers outsourcing when another institute has capacity and comparative advantage to undertake research for which ILRI is responsible. ILRI will also contract research to private and public institutions in developed and developing regions. ILRI will contract with commercial companies to develop and market biotechnological products on condition that products remain affordable for resource-poor livestock owners.

In addition, ILRI's **Index Based Livestock Insurance Project (ILBI)** is the one routinely using weather and climate information including satellite-based information. ILRI leads Index-based Livestock Insurance project in northern Kenya, which provides livestock insurance to over 2000 households in Marsabit district to help livestock herders sustain their livestock-dependent livelihoods during drought.

ILRI in collaboration with partners from Cornell University, the BASIS I4 project at the University of California – Davis, and Syracuse University, have designed and developed the insurance program and is being implemented by commercial partners as a market-led index-based insurance product that is protecting livestock keepers from drought-related animal losses particularly in the drought-prone arid and semi arid areas of Kenya. Satellite based normalized vegetation index (NDVI) is used to

determine and predict potential losses of livestock forage and issue insurance payouts to anticipating members when incidences of drought occur. This employs products including:

- The main parameter used is the NDVI and satellite rainfall based estimates. The rainfall network in the county is not adequate, and the meteorological stations in the county are located in areas that are not representative of the rest of the county.
- 2 Regime Switching Regression Model is the one being used and as of now validation is being undertaken.
- Livestock mortality data provided by the Ministry of Northern and arid areas and livestock development used for injection into the model.

The project is expected to bring economic and social benefits to livestock keepers and protect households against drought-induced livestock losses thereby reducing their likelihood of descending into poverty. By insuring the assets of pastoralists against catastrophic losses, members will be able to come out of poverty, be protected from the risk of falling into poverty and at the same time will have opportunity to explore other activities for household economic development.

The impact of the project is currently under assessment to find out its benefits before it can be scaled up to other districts in the country. In order to scale up the project ILRI is endeavoring to bring on board national institution such as Ministry of Livestock, Kenya Meteorological Department (KMD) and Department of Resource Surveys and Remote Sensing (DRSRS) so that they can take it up. The project constitutes of 2 partnering entities that include:

- Technical Partners who are working with model including improvement and validation and are Cornell University, Wisconsin, Syracuse University, University of California – Davis, KMD and DRSRS, and
- Commercial partners from the insurance fraternity who are composed of Equity Insurance Agency of Equity Bank, UAP Insurance, SWISS-Re.

The project is showing good indications success and will buffer the farmer through payback. Main weakness noted is luck of adequate observation network in the project pilot area and other semi-arid areas where it may be up-scaled; as such data will go along way in ensuring a well-validated model.

Kenya Marine and Fisheries Research Institute (KMFRI)

KMFRI is a state corporation in the Ministry of Livestock and Fisheries Development of the Government of Kenya. It is mandated to conduct aquatic research covering all the Kenyan waters and the corresponding riparian areas including the Kenya's Exclusive Economic Zones in the Indian Ocean waters. Its vision is to be a center of excellence in aquatic research and promotion of sustainable utilization of marine and freshwater resources. Its mission is to contribute to the management and sustainable exploitation of aquatic resources and thus alleviate poverty, enhance employment creation and food security through multidisciplinary and collaborative research in both marine and fresh-water aquatic systems. The research programs it is involved in are: Aquaculture, Environment & ecology, Fisheries, Information and data management, Natural products and Socio-economics.

Tanzania

World Food Program (WFP)

WFP is the food aid arm of the United Nations system fighting hunger worldwide. Food aid is one of the many instruments that can help to promote food security, which is defined as access of all people at all times to the food needed for an active and healthy life. The vision of the WFP is the food aid arm of the United Nations. It is moving from a food aid to a food assistance program. It pursues a vision of the world in which every man, woman and child has access at all times to the food needed for an active and healthy life. The WFP mission is to promote food security using many instruments and most importantly food aid. The organization's five objectives are:

- Save lives and protect livelihoods in emergencies;
- Prepare for emergencies;
- Restore and rebuild lives after emergencies;
- Reduce chronic hunger and under nutrition everywhere;
- Strengthen the capacity of countries to reduce hunger

WFP is working to connect farmers in Tanzania to markets through the Purchase for Progress initiative, development and relief programs. The purchase for progress initiative combines demand for staple crops and technical expertise of supply partners to build capacity of farmers helping them access credit and improving their ability to deliver a quality product to profitable markets. The main interventions in Tanzania centered on development with school meals representing the largest activity covering 350 schools in food insecure areas and refugee camps in northwestern Tanzania.

WFP Country Program was launched in 2007. In addition to school meals, it includes food-for-asset activities that enable vulnerable households to enhance their food security; targeted supplementary feeding mainly for children, pregnant and nursing women; and support to people living with HIV/AIDS. WFP Tanzania has pushed hard to increase the national focus on nutrition and particularly on fortified foods in order to improve the nutritional status of the poor.

WFP Tanzania is also collaborating with the government on the establishment of a national school meals program. The discussions are at an early stage, but seek to harvest the experiences and knowledge of both parties in order to develop a sustainable program.

WFP Tanzania supports vulnerable and destitute families and school feeding for complementary basic education institutions that enroll children. It has in recent years actively participated in new initiatives to improve access to markets for smallholder farmers. This initiative will further enhance WFP's move towards more local procurement and simultaneously address the root causes of hunger. WFP Tanzania provides logistical support services to its neighboring countries. Through the port of Dar es Salaam, WFP Tanzania receives cargo bound not only for Tanzania, but also for DRC, Rwanda, Burundi, Uganda and Somalia and organizes the onward transport, thus playing a crucial role in the food supply line for these countries.

The achievements of this project include:

- Food Aid Information System providing everyone with world food data and information.
- In 2010, WFP was able to provide life-saving food and nutrition assistance for 101.8 million people affected by conflict, storms, droughts, displacement, financial crises and other shocks that left them without food. 84 million of beneficiaries were women and children.

- Irrigation canals were dug in pilot countries including Tanzania;
- In some pilot villages each acre of farmland now yields 10 to 15 bags of maize, up from 1 to 2 bags before the canal;
- Capacity was built in post harvest handling, standards of quality and organizational management, access to credit, delivery of quality products to markets, farming techniques, warehouses and others.

Mikocheni Agricultural Research Institute (MARI)

MARI is one of the research institutes under the Division of Research and Training (DRT) of the Ministry of Agriculture and Food Security in Tanzania. Its mandate is to conduct and promote research for the development of the coconut sub-sector and tree crops-based farming systems along the coastal belt of Tanzania. The Institute is also responsible for the promotion and coordination of agricultural biotechnology activities in the country.

Uganda

Famine Early Warning Systems Network (FEWSNET)

FEWSNET (Uganda Office visited), is a USAID-funded activity that collaborates with international, regional and national partners to provide timely and rigorous early warning and vulnerability information on emerging and evolving food security issues. Its professionals monitor and analyze relevant data and information in terms of its impacts on livelihoods and markets to identify potential threats to food security. Once these issues are identified, FEWSNET uses a suite of communications and decision support products to help decision-makers act to mitigate food insecurity. FEWSNET also focuses its efforts on strengthening early warning and food security networks. Activities in this area include developing capacity, building and strengthening networks, developing policy-useful information, and building consensus around food security problems and solutions. Its approach is guided by several main pillars that support its core objectives. These include: continued production of high quality targeted early warning information, emphasis on developing sustainable networks, emphasis on policy-useful information and continued innovation in analytical tools and methods. The FEWSNET implementing partners are: Chemonics International, Inc., United States Geological Survey (USGS), National Aeronautics and Space Administration (NASA), National Oceanographic and Atmospheric Administration (NOAA) and United States Department of Agriculture (USDA).

National Crops Resources Research Institute (NACRRI)

NACRRI is one of the public agricultural research institutes in Uganda under the policy guidance of the National Agricultural Research Organization (NARO). NACRRI has a national mandate to generate and disseminate improved technologies of crops that include beans, cassava, cereals (maize and rice), sweet potato and animal production. It carries out research in biological control of crop pests and weeds; and on agro-meteorology. Research activities in the Institute are carried out under commodity programs and units. Presently, there are five programs according to the mandate: beans, cassava, cereals, potato Bananas and Horticultural crops. All programs have multidisciplinary teams. The institute emphasizes participatory research that involves farmers (and other clients) at all levels of technology generation and development as well as bodies at national, regional and international levels in various research activities. So far the improved varieties released are Beans (11), Cassava (9), Maize (3), Rice (3), Solanum potato (8) and Sweet potato (11). All the varieties released are higher yielding and more disease and pest resistant than the traditional varieties.

National Agricultural Research Laboratories (NARLI)

NARLI, Uganda (also a NARO constituent) hosts' agricultural research for development and a new biotechnology facility, which has a capacity for tissue culture, molecular biology and plant transformation in Uganda. Presently, the facility is referred to as the National Agricultural Biotechnology Centre (NABC). It is using biotechnology to address various agronomic problems in bananas, beans and coffee. Its goal is to ensure that people of the Uganda benefit from the revolution in biotechnology that is transforming agricultural research and development around the world. Areas of agricultural biotechnology currently being employed at NABC include: plant tissue culture used for mass generation of pest and disease and free planting material of improved crop varieties for banana and coffee. NABC has achieved very significant scientific and technological progress in banana (*matooke*) transformation. It is sourcing and using genes to improve banana crop to resist pests and diseases that are currently affecting productivity. The other productivity factors in *matooke* that are being targeted for improvement through biotechnology are: maturity period, shorter plants and delayed ripening. NABC performs research and development in biotechnologies not only for sustainable agriculture but nutrition improvement.

Support Institutions and Initiatives

Ethiopia

Association for Strengthening Agricultural Research in Eastern and Southern Africa (ASARECA)

ASARECA is a non-political organization of the National Agricultural Research Institutes (NARIs) of ten (10) countries in Eastern and Central Africa: Burundi, D. R. Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania and Uganda. It aims at increasing the efficiency of agricultural research in the region so as to facilitate economic growth, food security and export competitiveness through productive and sustainable agriculture. Its mission is to enhance regional collective action in agricultural research for development, extension and agricultural training and education to promote economic growth, fight poverty, eradicate hunger and enhance sustainable use of resources. ASARECA mission is dependent on effective partnerships with her partner national agricultural research systems (NARS) for enhanced regional collective action in agricultural research for development, extension and agricultural training.

Among the sub-regional research organizations (SROs), ASARECA and FARA have experiences that could be shared with other SROs for added value at regional level. ASARECA's stakeholders include international research centers such as the international Food Policy Research Institute (IFPRI) which assist with prioritization process where the major challenge is to respond to Africa's agriculture and food security situation, that is low productivity, risk and disaster among others posed by climate change, with the aim of achieving the first Millennium Development Goal of halving the number of people in hunger by 2015. In it's new strategy, ASARECA consolidated 17 networks into five commodity programs:

- Staple crops,
- Non-staple priority crops,
- Livestock and fisheries,
- Agro-biodiversity and biotechnology, and
- Natural Resource Management

ASARECA has two other programs for:

- Policy and advocacy, and
- Capacity development, institutional strengthening and technology uptake and up-scaling.

East African Agricultural Productivity Project (EAAPP)

EAAPP was conceived in 2009 by the governments of four participating countries namely Ethiopia, Kenya, Tanzania and Uganda through signed agreements to implement EAAPP at national and sub-regional levels. Ethiopia, Kenya and Tanzania have already launched the project and are implementing it. Uganda will launch soon following its recent endorsement by Cabinet and Parliament. Under EAAPP, the four countries undertake to establish Regional Centers of Excellence (RCoEs) for agricultural research by investing in commodities identified by ASARECA as being of sub-regional importance to mitigate food insecurity. Kenya will be the center of excellence for dairy, Uganda for cassava, Ethiopia wheat and Tanzania for rice. The countries have pledged to manage investment in these commodities to benefit the sub-region (ASARECA, 2011).

The RCoEs are an excellent opportunity for transforming the sub-region's agriculture from subsistence to an innovative, productive, commercially oriented and competitive agriculture through the agricultural value chain approach. The second ASARECA-EAAPP planning meeting was held on 8th to 10th November, 2010 at the Imperial Resort Beach Hotel, Entebbe, Uganda and was attended by a total of 68 participants drawn from the four EAAPP countries, representatives of the World Bank from Washington, Ethiopia, Kenya, Tanzania and Uganda regional offices and ASARECA Secretariat. The meeting was designed to take the participants through a participatory step-by-step process of reviewing, discussing and consensus building towards the finalization of the RCoEs operational plans and regional projects implementation plans

ASARECA and EAAPP seek to enhance collaboration of the National Agricultural Research Systems (NARS) to contribute to the AU/NEPAD's CAADP Pillar IV, which focuses on revitalizing, reforming and expanding Africa's agricultural research, technology dissemination and adoption.

ASARECA has offered to use its expertise in coordinating regional research for development, extension, training and education to facilitate spill overs of technologies and innovations that will be generated through EAAPP. Specifically, ASARECA plays the following roles in EAAPP:

Convening role: ASARECA has already convened two planning workshops for these participating countries to agree on roles and responsibilities of each RCoE and the mode of operation of the RCoEs.

Networking: ASARECA will facilitate information sharing platforms to enable sharing of benefits and spill over of technologies and innovations developed by individual RCoEs to other participating countries.

Technical backstopping: ASARECA has over the years developed in-house expertise for out-scaling agricultural technologies, innovations and best practices; and so would like to put this expertise at the disposal of the RCoEs.

Monitoring and evaluation: Regional M&E activities will primarily focus on tracking the extent to which EAAPP is making spill overs happen across the sub-region.

Policy harmonization: ASARECA pledges to facilitate the rationalization and harmonization of policies, procedures and regulations aimed at creating common standards in the participating countries. This will be attained by establishing the status of policies and procedures affecting the four commodities; analyzing and developing policy options and advocating for and supporting implementation of the options.

Capacity building: ASARECA will organize and facilitate regional training workshops for managers of RCoEs to equip them with the tools and skills that will make them more effective research institutions.

Training role: ASARECA will collaborate with institutions and organizations that have expertise for training agricultural extension workers in undertaking the training.

Management and coordination: ASARECA has pledged to ensure the highest level of professionalism in managing EAAPP affairs and resources. EAAPP is like a new baby in the house. ASARECA is paying deserving attention to this new-born. We will do all it takes in collaboration with the RCoEs to see the baby grow and live a complete lifespan.

Sustainable Land Use Forum (SLUF)

SLUF, formerly called NOVIB Partners Forum on Sustainable Land Use in Ethiopia and Eritrea, is an outgrowth of the December 1994 workshop that was organized by NOVIB in Addis Ababa. Its vision is that "It envisages seeing a secured livelihood in a sustainable natural environment in Ethiopia". Its mission is that "It would like to promote Sustainable Land Use and improve Natural Resource Base and People's Livelihood". This would be achieved by enabling stakeholders: Member organizations, Government organizations; Communities related to SLUF in rural and urban areas, Community Based Organizations and Civil Society Organizations; the private sector and individuals build their capacities through: Training, Information Exchange, Studies and Research, Advisory Services, Advocacy and Lobbying and Networking. Its objective is to support and strengthen local organizations that work to improve natural resource management and sustainable land use practices. It is a network association of organizations that are engaged in public policy advocacy, research and environmental protection work. SLUF has sub grantees with different intervention areas, including promotion of participatory natural resources conservation, forest and land use management, environmental improvement and combating water pollution and other environmental problems through different environmental friendly processes.

Climate Change Research Group, Addis Ababa University

The Climate Change Research Group is a new initiative within the Environmental Science Department at Addis Ababa University. It was established to monitor long term patterns of extreme events. Currently, the research group has researchers from Environmental Science, Earth Science, Physics and Statistics Departments. They will be integrating graduate students in their research. They will be open to establish collaboration with other research institutions. Their aim is to have regional integration. They want be aligning their research to international research agenda apart form considering the national one. They are currently funded by SIDA on a project that will entail observing termite behavior in response to extreme events. They are currently developing a governance structure to enable it become an independent climate change research center.

Horn of Africa Regional Environment Centre and Network (HOARECN)

HOARECN is an initiative of the Science Faculty of the Addis Ababa University. HOAREC's mission statement is to improve environmental governance and management in the Horn of Africa Region by focusing on several critical environmental management areas as well as enhancing the development of environmental support sectors to relieve pressure on natural resources by stimulating new value chains for sustainable products and services and promoting renewable/sustainable energy. *Horn of Africa Regional Centre* acts as a major resource center for the region. It promotes environmental awareness and deploying educational activities and pilot projects to test and disseminate innovations.

The center has focused on management of lakes and wetlands, management of parks and buffer zones, management of erosion prone highlands and dry lowlands. Demand Driven Action Research is one of the center's programs, which is designed to bring academic research capacity closer to the reality "on the ground". The Partnership program is aimed at stimulating and facilitating partnerships between academia and the private sector and/or civil society organizations in order to implement environment related projects. The center also has a capacity building program for environmental management in the region whether through experience exchange within the Horn countries or through training and education from other areas and distance learning programs on environment management modules using practical case studies from the field. *Horn of Africa Regional Environment Network (HoA-REN)* is a network of member and partners consisting of environmental community based organizations, non-governmental and higher learning institutes from six countries in the Horn of Africa.

International Maize and Wheat Improvement Center (CIMMYT)

CIMMYT (Spanish acronym for *Centro Internacional de Mejoramiento de Maíz y Trigo*) is a non-profit research and training institution dedicated to both the development of improved varieties of wheat and maize, and introducing improved agricultural practices to farmers, thereby improving their livelihoods. CIMMYT has direct links to about 100 developing countries with offices in Asia, Africa and Latin America. The first steps toward the creation of CIMMYT were taken in 1943 when cooperative efforts of the Mexican government and the Rockefeller Foundation led to the founding of the Office of Special Studies, an organization within the Mexican Secretariat of Agriculture. The office's goal was to ensure food security in Mexico and abroad through selective plant breeding and crop improvement. CIMMYT became one of the first international research centers to be supported through the CGIAR and currently, the CGIAR comprises 15 such centers, all dedicated to sustainable food security through scientific research.

CIMMYT activities focus on:

- The conservation and utilization of maize and wheat genetic resources,
- Developing and promoting improved maize and wheat varieties,
- Testing and sharing sustainable farming systems, and
- Analyzing the impact of its work and researching ways for further improvement.

Through strong science and effective partnerships, CIMMYT creates, shares, and uses knowledge and technology to increase food security, improve the productivity and profitability of farming systems and sustain natural resources. It participates in an extensive global network of people and organizations that share similar development goals, including the public and private sector, non-governmental and civil society organizations, relief and health agencies, farmers and the development

assistance community. The expected applications of research of Global Wheat Program is that it will provide farm households with new options to diversify crop and livestock production systems, improve their productivity, and conserve scarce water and soil resources in large areas of Asia, Northern, Southern and Eastern Africa and Latin America.

The Global Maize Program uses maize genetic resources to provide diverse, high-yielding varieties that withstand infertile soils, drought, insect, pests, and diseases. Conducts crop and natural resource management research to help farmers exploit the full potential of improved seed and to preserve and enhance soil and water resources. Among its partners and donors it has*:* International Maize Improvement Network, International Wheat Improvement Network (IWIN), Borlaug Global Rust Initiative, The Drought Tolerant Maize for Africa Initiative, Insect Resistant Maize for Africa (IRMA), Water Efficient Maize for Africa (WEMA), national agricultural research institutions, non-government and community-based organizations, seed sector organizations, regional research networks, other CGIAR centers, private companies, and advanced research institutions world-wide.

CIMMYT partners with national agriculture research institutions across the globe. Thought its headquarters are in Mexico, the center supports 13 regional offices (Afghanistan, Bangladesh, China, Colombia, Ethiopia, Georgia, India, Iran, Kazakhstan, Kenya, Nepal, Turkey, and Zimbabwe).

International Livestock Research Institute (ILRI)

ILRI's vision is a "world made better for poor people in developing countries by improving agricultural systems in which livestock are important". Its mission is to work at the crossroads of livestock and poverty, bringing high-quality science and capacity building to bear on poverty reduction and sustainable development for poor livestock keepers and their communities. Its research themes are: Targeting and innovation, improving 16 marketing opportunities, using biotechnology to secure livestock assets and people, livestock and the environment. ILRI's strategy is to place poverty at the center of an output-oriented agenda. ILRI's strategy focuses on three livestock-mediated pathways out of poverty: (1) securing the assets of the poor, (2) improving the productivity of their livestock systems and (3) improving their market opportunities. ILRI also coordinates the System wide Livestock Program of the Consultative Group on International Agricultural Research (CGIAR). Its other linkages are drawn from Donor Agencies, National Agricultural Research Institutes, Non-Governmental Organizations, Farmer Organizations and Private sector. Past experience at ILRI Ethiopia include advisory service on emergency relief for livestock or livestock insurance for the Ethiopian Government.

International Water Management Institute (IWMI)

IWMI is one of international research centers supported by CGIAR. It is a non-profit organization. IWMI established its sub-regional office for Nile Basin and Eastern Africa (NBEA) towards the end of year 2003. Before the establishment of the sub-regional office, IWMI had been operating in the sub-region on a project basis such as in Kenya, Tanzania and Ethiopia and also had history of working in the Sudan in late 1980's and early 1990s.

The Nile Basin and Eastern Africa (NBEA) sub-region comprises 13 countries – 10 countries that share the Nile waters (Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Eritrea, Kenya, Rwanda, Sudan, Tanzania and Uganda) and Djibouti, Somalia and Madagascar (See Figure 1). Currently, IWMI is mainly active in Ethiopia, Kenya, Tanzania and Uganda. In addition, through some basin wide research projects IWMI is covering all the Nile Basin countries.

The NBEA sub-region has an estimated population of 330 million with around 175 million people living in the Nile basin. The vision of the NBEA is to be a world-class knowledge center on water, food, and environment. Its mission is to improve the management of land and water resources for food, livelihood, and nature. It engages in activities include:

- Basin Water Management;
- Land, Water and Livelihoods;
- Agriculture, Water and Cities; and
- Water Management and Environment

The cross cutting activities in all themes include, assessment of land and water productivity and their relationship to poverty, identification of interventions that improve productivity as well as access to and sustainability of natural resources, assessment of the impacts of interventions on productivity, livelihoods, health and environmental sustainability. IWMI strives for excellence in research by building an organizational culture of impact, performance and service through collaborative research with many partners and targets policy makers, development agencies, individual farmers and private sector organizations.

Ethiopian Institute of Agricultural Research (EIAR)

EIAR has evolved through several stages since its first initiation during the late 1940s, following the establishment of agricultural and technical school of Ambo and Jimma. Until the mid 1960's the Imperial College of Agricultural and Mechanical Arts—now Haramaya University with its Agricultural Experiment Station at Debre Zeit namely Debre Zeit Research Center became the major research entity. The establishment of the Ethiopian Institute of Agricultural Research (EIAR) in 1966 saw the first nationally coordinated agricultural research system in the country.

The Ethiopian Agricultural Research System (EARS) comprises of EIAR, Regional Agricultural Research Institutes/centers (RARIs), and Higher Learning Institutions (HLIs). EIAR is responsible for the running of federal research centers, and RARIs are administered by the regional state governments.

The core mandate of this system includes:

- Supply of improved agricultural technologies,
- Popularization of improved technologies,
- Coordination the national agricultural Researches, and
- Capacity building of Researchers.

EIAR's vision is to see improved livelihood of all Ethiopians engaged in agriculture, agro-pastoralism and pastoralism through market competitive agricultural technologies. EIAR's mission is to conduct research that will provide market competitive agricultural technologies that will contribute to increased agricultural productivity and nutrition quality, sustainable food security, economic development, and conservation of the natural resources and environment. As an apex body, EIAR provides strong leadership in coordinating research within the EARS, by taking a leading role in influencing agricultural policy development.

The federal research centres are: Ambo Plant Protection Research Center, Assosa Agricultural Research Center, Bako National maize research project, Debrezeit Agricultural Research Center,

Forestry Agricultural Research Center, Hawassa Research Centre, Holetta Agricultural Research Center, Jimma Agricultural Research Center, Kulumssa Agricultural Center, Melkassa Agricutural Research Center, National Fish and Other Aquatic Lives Research Center, Pawe Agricutural Research Center, Tepi Research Center, Werer Agricultural Research Center, and WondoGenet Agricultural Research Center.

The regional research centers include Adet Agricultural Research Center, Amhara Regional Agricultural Research Institute (ARARI), Andassa Livestock Research centre, Bahir Dar Agricultural Mechanization, Bahir Dar Fishery and Aquatic Life Research Center (BFALRC), Bako Agricultral Mechanization Research Center, Debre Berhan Agricultural Research Center, Gonder Agricultural Research Institute, Sekota Dray land Agricultural Center, and Sirinka Agricultural Research Center. In addition to conducting research at its federal and regional centers, EIAR is charged with the responsibility for providing the overall coordination of agricultural research countrywide, and advising Government on agricultural research policy formulation. Currently the EIAR has 55 research centers and sites located across various agro-ecological zones. The research centers vary in their experience, human capacity, facility, and other resources capacities. Some of the research centers and sites have one or more sub-centers and testing sites.

Jinka Agricultural Research Center (JARC)

JARC is one of the EIAR centers established some years ago on the southwestern corner of Ethiopia. The Center is situated in Southern Nations Nationalities and Peoples Regional State (SNNPR). To streamline research for development activities of the Center, EIAR through loan-based funds from IFAD and from the national treasury made a colossal commitment to establish this modern research center in South Omo Zone at Jinka. Based on this pledge, EIAR spent over 40 million Birr to build the center and made it ready for research.

Its establishment is meant to address the production and productivity problems of farmers and agro-pastoralists of South Omo Zone of SNNPR. The majority of the people of the Zone are engaged in pastoral mode of life. The focus of the Center is to change such mode of life through improved type of livestock production, crop production and natural resources management, which involves bringing adaptable technologies and knowledge to the area, replace tradition-based ancient modes of activities, and making the people be part of the growing economy of the country.

On 23 January 2011, the newly constructed Jinka Agricultural Research Center was inaugurated by H.E Ato Shiferaw Shigute, President of SNNRS and Dr Solomon Asefa, Director General of EIAR. Dignitaries from Federal Government and SNNPR also attended in the ceremony. Research and support staff of the Center, delegates from EIAR and Southern Agricultural Research Institute (SARI), representatives from South Omo Zone, and building contractors also attended the inaugural ceremony. During the ceremony, the portfolio of present activities of JARC was presented by the Center Director.

The Director General of SARI also presented an overview of research in the Region and specific needs of agricultural research services for South Omo Zone and encouraged commitments of every researcher to bring about a positive change in the lives of the people. The Director of EIAR on his part appreciated the immense contribution of the stakeholders who made the establishment of JARC in its present form and promised to assist the Center in every aspect of its intended undertakings. In his address the President of SNNPR also reiterated the commitment of his government to make every

effort on strengthening JARC for it to bring about the required change in the Zone. He also acknowledged everyone who individually and collectively dedicated himself or herself in materializing the Center in all aspects. As part of the inaugural ceremony, there was a sidekick exhibition arranged by the Center. The exhibit showcased the overall activities of the Center and promising outputs recently realized and ready for scaling out.

Kenya

Africa Harvest Biotech Foundation International (AHBFI)

AHBFI is a non-profit foundation in Kenya. It has contributed biotech expertise to the New Economic Partnership for African Development (NEPAD) and to the Forum for Agricultural Research in Africa (FARA). FARA is the technical arm of the African Union Commission (AUC) on rural economy and agricultural development and the lead agency of AU's New Partnership for Africa's Development (NEPAD) to implement the fourth pillar of Comprehensive African Agricultural Development Program (CAADP), involving agricultural research, technology dissemination and uptake. AHBFI vision is "*A*n Africa free of hunger, poverty and malnutrition" while its mission is to use science and technology – especially biotechnology – to help the poor in Africa achieve food security, economic well-being and sustainable rural development. One of its projects is the Africa Biofortified Sorghum (ABS), which seeks to modify the sorghum protein constituents and enhance its palatability. Its linkages: are: Biotechnology, Breeding and Seed Systems for African Crops, the African Agricultural Technology Foundation, West and Central African Council for Agricultural and Research Foundation (CORAF), The Association for Strengthening Agricultural Research in Eastern and Central Africa, US Agency for International Development, African Centre for Technology Studies (ACTS), Forum for Agricultural Research in Africa (FARA), Biotechnology Trust Africa (BTA), AfricaBio, Bio-Earn, the International Service for the Acquisition of Agribiotech Applications, African Biotechnology Stakeholders Forum (ABSF), World Business Council For Sustainable Development and GMO Blog.

Department of Meteorology, University of Nairobi

The Department of Meteorology provides academic and research environment to examine the climate systems and the dynamic, physical, and chemical processes that occur in the atmosphere generating rainfall variability. A major theme is the establishment of a physical basis for understanding, observing, and modeling climate and global change. Graduate students, research staff, and faculty work together on a wide range of research topics. It has on-going consultancies from UNESCO's FRIEND/Nile Project, the Government of Kenya - Nile Basin Initiative, UNDP/GEF and Government of Kenya-Ministry of Energy/KMD. Some of its on-going projects are Formulating Disaster risk reduction strategy for Kenya., The onset and cessation of the long rains in the eastern Africa and their inter-annual variability, Improvement of our understanding of rainfall mechanisms, prediction and verifications, Calibration, use of climate indices to Predict Droughts and Floods and Validation of Satellite-Derived Data and Products for improved environmental monitoring for sustainable development. These projects are being managed by individuals and/or in collaboration with other institutions.

Masinde Muliro University of Science and Technology (MMUST)

MMUST's vision is to be a center of excellence in science and technology responding to development needs of society through engagement in dynamic knowledge creation and application. The university is already responding to socio-economic needs of the locals and the country at large. It is fulfilling

this through the various capital development projects. The university has two faculties: Faculty of Science and Engineering (FSE) and Faculty of Education and Social Sciences. They also have a Centre for Disaster Management and Humanitarian Assistance (CDMHA), Institute of Graduate Studies, Research and Extension (IGSRE) and Science and Technology Park and Industrial Linkages (STPIL).

KAINet

In 2006 the Kenya Agricultural Information and Communication stakeholders led by the Kenya Agricultural Research Institute (KARI) together with ASARECA, FAO, and the Centre for Agricultural Bioscience International, created the Kenya agricultural information network (KAINet). KAINET was a project had the following objectives:

- Facilitate the development of institutional policies and strategies on Information and Communication Management (ICM) in agricultural sciences and technology in Kenya,
- Develop the basis for a national network, including selected resource centers and mechanism for fostering institutional collaboration,
- Strengthen human capacities in the key centers,
- Document the process and develop as a case study for development of a national AGRIS Network.

KAINet worked with five institutions in Kenya to implement the project in three phases. Phase one was preparatory where stakeholders were consulted to create a consensus on what was required, followed by planning of activities and capacity building. The phase two involved strategy implementation of the KAINet and the third phase mainly scaling –up and –out of KAINet activities across the country. The KAINet e-repository access to a large collection of world literature covering all aspects of agricultural sciences and technology, including grey literature that is not available through normal publication and distribution channels.

KAINet has a web portal with links to other national and international agricultural databases such as Access to Global Online Research in Agriculture; Online Access to Research on the Environment; and Ask FAO, among others. The portal, which is user friendly and easily accessible, provides visibility to institutional agricultural repositories. KAINet provides technical backstopping on agricultural information management to member institutions. With the support of partners, we have developed a critical mass of professionals trained on the management of electronic documents; digitization; web development; promotion of agricultural information services; open access; and the monitoring and evaluation of information projects. We are committed to agricultural information sharing and exchange. KAINet also promotes and implements international standards in agricultural information management.

Coastal Oceans Research and Development in the Indian Ocean (CORDIO) East Africa

CORDIO is a Kenyan-based program created to respond to the degradation of coral reefs throughout the Indian Ocean. The program was initiated by the extensive bleaching and mortality of corals that occurred during 1998. CORDIO is supported by SIDA (Swedish International Development Cooperation Agency), the World Bank, FRN (Swedish Council for Planning and Coordination of Research), MISTRA (Foundation for Strategic Environmental Research) and WWF (Worldwide Fund for Nature). Activities within the program are conducted in Kenya, Tanzania, Mozambique, Madagascar, Seychelles, Reunion, Comoros, Mauritius, Maldives, India and Sri Lanka and

coordinated from sub-regional secretariats in Kenya, Sri Lanka and Reunion. Projects within CORDIO focus on determining a) the bio-physical impacts of coral degradation as a result of bleaching and other disturbances, and the long term prospects for recovery, b) the socioeconomic impacts of coral mortality and options for mitigating these through management and development of alternative livelihoods and c) the prospects of restoration and rehabilitation of reefs to accelerate the ecological and economic recovery.

Advocates Coalition for Development and Environment (ACODE)

ACODE is an independent public policy research and advocacy think tank. ACODE is one of the regional leaders in cutting-age public policy research and analysis in a range of areas including governance, trade, environment, and science and technology. Its research team is a unique blend of multi-disciplinary professionals with specialized expertise in cutting age policy research, advocacy and monitoring of public policy. Its aim is to influence development and governance policies for the promotion of social justice in Eastern Africa through independent policy research and advocacy. Through research, it helps governments and international development organizations expand the range of policy options available to confront challenging and controversial public policy problems. Through advocacy, ACODE contributes to formulation of policies that support sustainable development thereby expanding livelihood and income options for poor people. Through representation, it empowers communities to demand for justice and promote public participation is decisions making processes that affect rural livelihoods and the environment.

Kenya Agricultural Research Institute (KARI)

KARI was established in 1979 as a semi-autonomous government institution through the amendment of the Science and Technology Act Cap 250, following the collapse of the East African Community (EAC) in 1977. The new institute took over research activities from the East African Agricultural and Forestry Research Organization (EAAFRO), East African Veterinary Research Organization (EAAVRO) and later the Ministries of Agriculture and Livestock Development. Further, in 1986 the Kenyan government recognized the challenge to meet long-term food production constraints in the country as recognized in Sessional Paper No. 1 of 1986 entitled "Economic management for renewed growth." More recently, the Kenya Veterinary Vaccines Production Institute (KEVEVAPI) and the Kenya Tripanosomiasis Research Institute (KETRI) have been integrated into KARI. The government has recognized the need to further strengthen its agricultural research system by placing these research centers under KARI to create an institutional framework to effectively manage, reorganize and consolidate agricultural research within the country.

KARI is a premier national institution bringing together research programs in food crops, horticultural and industrial crops, livestock and range management, land and water management, and socio-economics. KARI promotes sound agricultural research, technology generation and dissemination to ensure food security through improved productivity and environmental conservation.

KARI envisions a vibrant commercially oriented agricultural sector, propelled by innovative technologies, knowledge and approaches that respond to demands and opportunities. Its mission is to contribute, together with its partners, agricultural innovations and knowledge towards improved livelihoods and commercialization of agriculture through increasing productivity and fostering value-chains while conserving the environment. Its core values and strategic goals include:

- Creativity and innovation for development in a proactive manner,

- Whole value-chain encompassing the research-to-development continuum,
- Commitment to impact, particularly at farm level,
- Quick responsiveness to clients, including policy makers, partners and collaborators, staff and particularly the farming community and producers,
- Client-driven technology development to enhance appropriateness and adoption,
- Partnerships and team work in research for development,
- Cost-effectiveness and efficiency in application of human, physical and financial resources,
- Transparency and accountability in application of all resources and implementation of research activities, and
- Developing and nurturing professionalism at work
- Integrated crop value chains 2 fostering commercialization of agricultural enterprises,
- Integrated livestock value chains fostering commercialization of agricultural enterprises,
- Sustainable and integrated management of natural resources for agricultural production,
- Institutional arrangements for enhancing concerted action for development and uptake of technologies and innovations,
- Capacity and competence building for integrated agricultural research for development

Its research programs focus on:

- Food crops research on cereals, root and tuber crops, legumes and pulses,
- Horticultural and industrial crops research on flowers, vegetables, fruits, fiber crops, herbs and spices,
- Animal production and range research on dairy, beef, small ruminants, poultry, pigs, pastures and fodder crops, and range,
- Animal health research on livestock diseases,
- Socioeconomics and biometrics for crop, livestock and natural resources including impact assessment, priority setting, market and policy research,
- Land and water management which includes soil fertility, survey and conservation; vegetation survey; agroforestry, irrigation and drainage Biotechnology research for crops and livestock improvement including development of livestock vaccines and diagnostic kits, and
- The Kenya Arid and Semi-Arid Lands Program (KASAL) focusing on developing site specific agricultural technologies for farmers and livestock keepers in the Arid and Semi-Arid Lands.

Cross-cutting non-research programs focus on:

- Foundations Seed and Germplasm conservation,
- Agricultural Research and Investment Services (ARIS),
- Agricultural Technology and Information Response Initiative (ATIRI), and
- Information and documentation services focusing on information technology and content delivery, organization, repackaging, marketing, maintenance and archiving.

KARI Centers Network is widespread covering the entire country as shown in Figure 13 below.

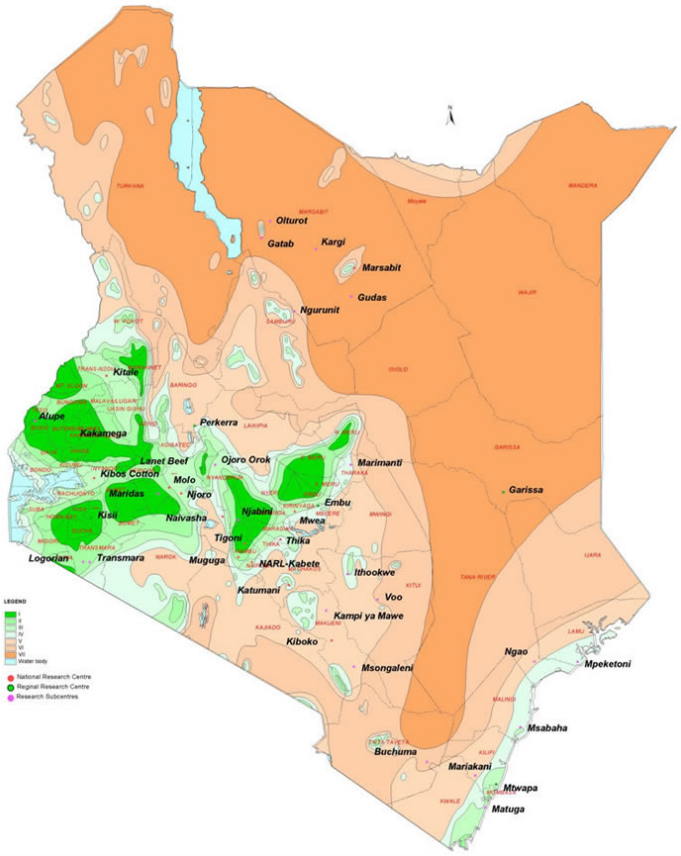


Figure 13: Spatial Distribution of KARI Centres Network

Coffee Research Foundation (CRF)

CRF promotes research into by investigating all issues relating to coffee and other agricultural and commercial systems as are associated with coffee and on matters ancillary thereto. Climate change has affected Kenyan coffee production through unpredictable rainfall patterns and excessive droughts, making crop management and disease control a nightmare, a researcher said on Thursday. Intermittent rainfall in the 2007/08 crop year, for example, caused a terrible bout of the Coffee Berry Disease that cut Kenyan output 23 percent to 42,000 metric tons as farmers were caught out by rains and did not protect their crop in time. "We have seen climate change in intermittent rainfall patterns, extended drought and very high temperatures," said Joseph Kimemia, director of research at Kenya's Coffee Research Foundation (CRF).

International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT)

ICRISAT is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa. The mandate of ICRISAT research is to primarily produce International Public Goods that are relevant and can be used across regions of the world. This is interpreted often to mainly mean publishing scholarly papers in peer-reviewed journals.

ICRISAT conducts its research under four themes: Agro-ecosystems development, harnessing biotechnology (bioinformatics), Crop improvement and management, and Institutions, Markets, policy and Impacts.

ICRISAT adopts Integrated genetic and natural resources management as its overarching research strategy. The aim is to combine tested methods of crop commodity research with well-established practices in research in natural resources management. The original goal was to use crop improvement research as the basis to improve food availability in drought-prone areas of the tropics.

International Livestock Research Institute (ILRI)

Over the past year, ILRI in collaboration with various partners has pursued a comprehensive research agenda aimed at designing, developing and implementing market mediated index-based insurance products to protect livestock keepers from drought related asset losses they face, particularly those in the drought prone Arid and Semi Arid Lands (ASAL). For pastoralists whose livelihoods rely solely or partly on livestock, the resulting high livestock mortality rate has devastating effects on asset levels, rendering them amongst vulnerable populations in Kenya.

Index-based insurance products represent a promising and exciting innovation that could allow the benefits of insurance to protect the climate-related risks that vulnerable rural smallholder farmers and livestock keepers face. Because index insurance is based on the realization of an outcome that cannot be influenced by insurers or policy holders (such as the amount and distribution of rainfall over a season), it has relatively simple and transparent structure. This makes such products easier to administer and consequently more cost-effective to develop, and trade. Indeed the success of pilot programs conducted in few countries in Africa, have proven the feasibility and affordability of such products.

Weather Information for All (WIFA)

Evaluating the impact of new weather and climate services for fishers and farmers in the Lake Victoria region of Kenya, Tanzania and Uganda.**"** The Project is led, under the patronage of the Kofi Annan Foundation by HCF in collaboration with ACMAD and the Aga Khan University, Nairobi, Kenya. HCF will be responsible for the management, implementation and execution of the project and will be reporting through the Kofi Annan Foundation to the Svenska Postkod Stiftelsen (the donor); ACMAD is overall responsible for the WIFA initiative and will coordinate activities with the National Meteorological Services (NMSs) and WMO. Kenya Meteorological Department (KMD) has a crucial role in making WIFA successful and there is evidently expressed need for information from the private sectors. The Aga Khan University will be responsible for the fieldwork in the area of Lake Victoria in collaboration with ACMAD, HCF and other entities in the region.

WIFA aims to assist NMHSs in Africa enhance their surface observing networks, for the delivery of reliable weather information for the safety of lives, livelihoods and property to enable "communities" to reduce or eliminate the impact of adverse weather and climate-related disasters and allow farmers, fishermen and other economic groups to maximize productivity.

Work conducted under the AfriClimServ agreement will enable WIFA to set up:

- Regional Implementation Offices in several locations, and
- Support the completion of the enhancement of the NMS observing network in one country.

Specifically the WIFA planned activities are:

- Establish within ACMAD a program office responsible for
    - the implementation of WIFA throughout Africa,

- ensuring the financial integrity of the project,
- assisting in the assessment of the project outcomes,
- coordinating regional and national activities,
- facilitating the country installation of observing networks, and
- ensuring that reporting requirements are met.

- In addition to the program office, focal points will be established at each of the AfriClimServ partner organizations to facilitate regional implementation of WIFA and interaction with other complementary projects and programs with Africa.
- The ACMAD program office will be assisted by GHF WIFA secretariat office in Geneva, which will be primarily responsible for fundraising, communication, and any additional functions necessary to support the ACMAD-based WIFA program office

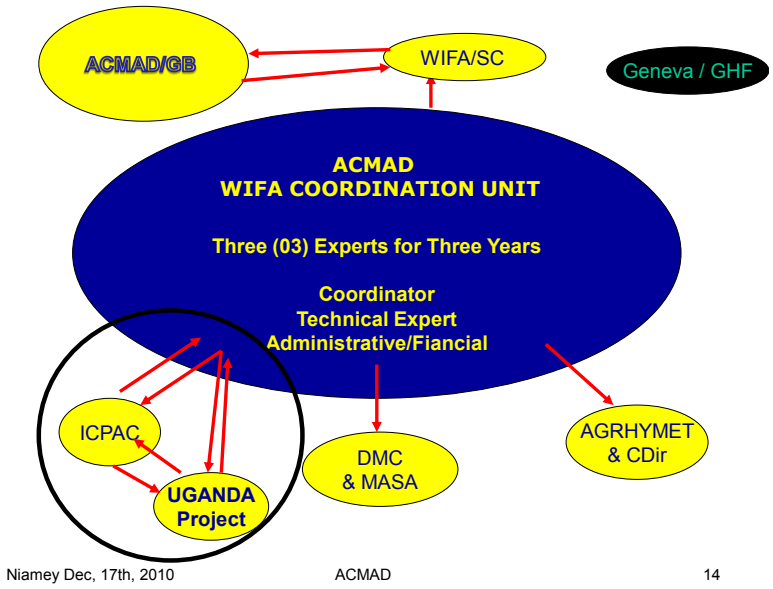


Figure 14: ACMAD WIFA coordination structure (Source: ACMAD).

Tanzania

Institute of Marine Sciences (IMS), University of Dar es Salaam

IMS is based in Zanzibar. It does its research in marine science and coastal research on a theoretical laboratory and field basis. Its research priorities fall into in four domains: Living Resources and Ecology; includes Fisheries, Ecology and Marine Botany, Chemical and Environmental Marine Sciences; includes Chemical Oceanography and Marine Pollution, Physical and Applied Marine Sciences; includes Physical Oceanography, Marine Geology and Ocean Engineering, Marine Education Extension and Development. Its objectives are: (a) to undertake research in all aspects of marine science including socio-economics and resource management, (b) to provide postgraduate training and, in the future, establish undergraduate training in accordance with the country's manpower requirements and (c) to provide advisory and consultancy services in marine affairs.

The research program of the Institute is mainly on projects undertaken by its staff as well as collaborative research programs with different departments in the university, various institutions in

the country, overseas universities and international research, education and development organizations. The collaborative research programs are supported under bilateral and multilateral agreements. IMS research activities are funded by the Government of Tanzania, as well as international organizations such as ASARECA, UNESCO's Intergovernmental Oceanographic Commission, the Canadian International Development Agency, and consultancies. In addition to this, support has been provided through various collaborative research programs, which have been, or are, supported by the EU, UNESCO, UNEP, IUCN, WWF, the World Bank and other international organization.

AGENDA

AGENDA is a Tanzanian non-governmental, non profit sharing organization that was reconstituted as an autonomous NGO and officially registered in July 1997. It was established by the Danish Development Agency (DANIDA) as a project to contribute to the development of the business sector in Tanzania by promoting environmentally responsible, transparent and accountable business practices in the country. On concluding the its vision is "Socio-economic development is attained equitably to all members of the society without causing adverse effects to human health and the environment". Its mission is to promote a culture of responsibility to the environment and sustainable development among the general public in Tanzania.

In Chemicals and Chemical Waste Management, it conducts studies on health and environmental impacts of chemicals. The studies focus on the entire life cycle of the chemicals. AGENDA has also been involved in the training of the Community Based Organizations (CBOs) involved in Solid Waste Management (SWM) in Tanzania. In collaboration with government and other interest groups it has contributed to initiatives for the conservation of biological resources by promoting the production of biodiversity education materials to support the Biodiversity convention in Tanzania.

In 1998, AGENDA established a Desktop Publishing Unit for biodiversity conservation in collaboration with the International Centre for Conservation Education (ICCE) under the Darwin Initiative. AGENDA has been involved in capacity building for environmental conservation and economic uplifting of coastal communities. In addition, AGENDA facilitated the integration of environmental responsibility into decision- making. Working with the National Environment Management Council. One of the AGENDA's strategies is to influence tertiary institutions to incorporate Environmental Education in their syllabi.

Sokoine University of Agriculture (SUA)

The history of SUA dates back to 1965 when it started as an Agricultural College offering diploma training in the discipline of agriculture. With the dissolution of the University of East Africa and the consequent establishment of the University of Dar es Salaam (UDSM) in July 1970, the College was transformed into a Faculty of Agriculture of UDSM and thereby started offering Bachelor of Science in Agriculture. In 1974, the Division of Forestry was established and hence the faculty was named Faculty of Agriculture and Forestry. The introduction of Bachelor of Veterinary Science in 1976 and the establishment of the Division of Veterinary Science, the Faculty was re-named "Faculty of Agriculture, Forestry and Veterinary Sciences". The Faculty was on the 1st of July 1984 transformed, through Parliamentary Act No. 6 of 1984, into a full-fledged University and became known as Sokoine University of Agriculture (SUA) with the Faculty of Agriculture, Faculty of Forestry and Faculty of Veterinary Medicine

Currently SUA has four faculties namely: the faculties of agriculture; forestry and nature conservation; veterinary medicine; and science, the latter of which was established in 2001. Other academic units include the Directorate of Research and Postgraduate Studies, the Institute of Continuing Education, the Development Studies Institute, the Computer Centre, the Pest Management Centre, the SUA Centre for Sustainable Rural Development and the Sokoine National Agriculture Library. SUA also hosts the African Seed Health Centre and Virtual Centre known as "Southern African Centre for Infectious Disease Surveillance."

SUA is located in Morogoro Municipality has 3,350 ha of land for training, research and production in Morogoro municipality; 840 ha of forest land in Arusha; 320 ha of virgin forest for research in Usambara Mountains in Tanga and 500 ha of miombo woodlands in Kitulanghalo in Morogoro region. The university has for campuses namely, the Main Campus within Morogoro municipality; Solomon Mashlangu Campus (SMC) in Morogoro municipality; SUA Training Forest (SUATF) Olmotonyi in Arusha region and Mazumbai Forestry Reserve in Tanga region. The University also has one Constituent College, the Moshi University College of Cooperatives and Business Studies (MUCCoBS), which is located at the foot of Mount Kilimanjaro in Moshi Municipality.

SUA's academic business is guided by the university's vision and missions as well as the Corporate Strategic plan (2005-2010), the latter that spells out plans in keeping with university's core missions and functions as well as the need to remain competitive.

Vision of SUA is "To become a center of excellence and a valued member of the global academic community in agriculture and other related fields with emphasis on implementing practical skills, entrepreneurship, research and integration of basic and applied knowledge in an environmentally friendly manner". The vision is guided through the mission, which is "To promote development through training, research, extension, provision of services to the public and private sector in an environmentally friendly manner."

SUA is currently offering 24 undergraduate and 39 postgraduate programs in agriculture, forestry and veterinary medicine, environmental sciences and allied disciplines. To date, SUA is the only university, amongst 34 universities and university colleges in Tanzania that offers degree programs in the broad field of agriculture. In addition, SUA offers degree programs in Information Technology (i.e. B.Sc. Informatics) and Education. On the other hand, MUCCoBS offers non-degree, bachelor and postgraduate programs in the disciplines of cooperative and business studies.

SUA's main research objective is to provide leadership in basic and applied research in order to generate science evidence knowledge and innovations that respond to contemporary and emerging needs. SUA thus emphasizes that research becomes linked to development and societal issues. Research, outreach and consultancy services are driven by trained agricultural and natural resource manpower base that comprises 452 academic staff, of whom 50% have PhD qualifications. Research capacity at SUA is further enhanced through collaborative research projects, which are supported by more than 50 memoranda of understanding. Currently, SUA has a number of ongoing research projects.

Uganda

International Union for Conservation of Nature (IUCN)

IUCN helps the world find pragmatic solutions to our most pressing environment and development challenges. Its vision is "a just world that values and conserves nature". The mission is to influence,

encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. In knowledge, IUCN develops and supports cutting edge conservation science, particularly in species, ecosystems, biodiversity, and the impact these have on human livelihoods. IUCN runs thousands of field projects around the world to better manage natural environments. It also helps implement laws, policy and best practice by mobilizing organizations, providing resources, training people and monitoring results. It offers scientific research, brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, laws and best practice.

Assessment of Climate Services

Good climate services rely on a series of important climatic elements. Institutions involved should be open to clients, flexible enough to adjust or develop requirement based new services and adopt advanced quality management systems including new procedures, standards and best practices. The information delivered should be prepared with tools using the latest advances in science and technology. The communication and dissemination of the information should use Internet communication technologies very efficiently.

The scoping study found various applications of climate information and services as follows: Seasonal climate forecasts for informing stakeholders in agriculture and food security about potential risks, monthly climate watch for crop monitoring and food situation assessments, special alert bulletins for informing stakeholders on potential €disaster risks and outputs from climate projection models for formulating adaptation to climate change in the agriculture and food security sector.

For better operational agricultural practices, it was found that Daily and weekly weather forecast and 10-day climate outlooks were considered as important while Monthly Climate Outlook, Agro-met Forecasts, Seasonal Climate Forecast, Climate Change Projections, Climate Change vulnerability assessment maps, Advisories/Alerts (Extreme Climate Events), Early Warnings (outbreaks of pests and diseases), Frost occurrence forecast and Seasonal rainfall onset and cessation dates were found to be very important.

There was a consensus that the 10-day climate information provided by NMHSs is very useful. However, the users requested for timely dissemination of climate information for effective planning. It was noted that the rainfall onset dates forecasts provided are sometimes not accurate calling for some effort for improved skill in predicting seasonal rainfall onset dates.

Meteorological observing network is poor and there is need for rehabilitation of surface and upper-air stations, installation of Automatic Weather Stations and Radar to improve weather and climate forecasting and severe storm tracking in the sub-region. Agricultural institutions consider seasonal climate forecast as an early warning tool for agriculture, food security and water resources management sectors.

Institutions

The National Meteorological Services of 3 pilot countries were visited as the major climate services providers. The agro meteorology divisions in these services are the main supplier of climate products

and services for agriculture and food security. The detailed institutional visits have been articulated under foregoing institutional profiles.

Institutional Arrangements

At national level, multidisciplinary working groups involving providers and users have been operating in most of the countries of the Greater Horn of Africa. Climate and relevant non-climate information are exchanged, discussed and a report published every ten-day in countries mostly during the wet season. National Climate services providers in the sub-region were mostly national meteorological services under an appropriate Ministry but in recent times emergence of meteorological agencies or authorities with some degree of administrative, financial and staffing is giving more flexibility and opportunities for networking and partnerships for sustainable development.

Institutional Capacities in Provision and Dissemination

Technological advances have improved strategies in the dissemination of climate information and prediction products to various user sectors and stakeholders. The NMHSs are able to access the climate data and processed products to meet various sectors demands due to optic fiber cable high-speed Internet connectivity.

Inadequacies in Institutional Capacities in Provision and Dissemination

The crop yield forecasting tools are currently being developed and require rainfall forecasts made at the start of the season for each 10-day period of the cropping season. Most of the countries do not have sufficient instruments to help assess crop water requirements. This has been an impediment to the private sector players who are using Index insurance to pay off farmers in some selected districts. The livestock sector has not fully made use of satellite-based information (NDVI) for pasture monitoring. There is need to relate NDVI and climate information with a view to developing pasture yield models.

It is expected that the food security sector in the region would substantially benefit from more accurate food production estimates to better assess food risks well in advance and implement required contingency plans and measures. In most cases today in the region, food crisis are not anticipated well in advance and costly response measures are applied including tax-free imports of commodities and mobilization of national and international emergency food aid.

Inadequate observational network is an impediment to provision of climate information products and services especially where some localized information is needed. The potential solutions are expected from the ACMAD coordinated ClimDevAfrica Framework program and the possibility to formulate integrated project proposals for Climate services using the ClimDev Special Funding mechanisms (AfDB) and ACPC/UNECA Planning Process. However, there are some institutions that need improved Internet facilities in the dissemination and accessing of the climate information products and services in the region. It is discernable from questionnaire analysis shown on Table 1 that, the dissemination and accessing of the climate information through Internet and telephone are modes frequently used modes followed by workshops and postal mailing. The use of mobile phones in information dissemination is playing a crucial role.

Table 1: Modes of climate information dissemination by providers and accessing by users (communities, boundary/extensions organizations, Support institutions and initiatives) starting with 1 as the most frequently used to 10 as the least-used mode.

	Providers			Users			Boundary/ Extension		Support/ Initiatives	Total
Internet	4	1	1	1	3	2	1	1	1	
Telephone	2	2	4	5	1			1	8	
Postal mail	3	5	7		2				2	
Fax	6	3	8		2				10	
Media	1	4	2	6					4	
Workshops	5	6	3	7			2	2	7	
Field days	8	7	5	8					9	
Traditional methods	9	9	9		9				5	
Personal communication	7	8	6		1				6	
Other		10	10		10		3	1	3	
RESPONSES	3			3			2		1	9

Networking, Partnership and Knowledge Sharing

One of the major functions of NMHSs is to strengthen networking, partnerships and knowledge sharing at all levels. The performance of meteorology depends on the collaboration with national, regional and international organizations to facilitate data exchange, Research and Development and also share meteorological prediction products and lessons learnt from various users of climate data and information. The networking, partnerships have promoted and strengthened cooperation at international and regional level have been achieve through agreements, Memorandum of Understanding and protocols. Some of national organizations that network well with DoM include Secondary schools and Universities, National Agricultural Research System (NARS); Autonomous Government bodies and Parastatals; Community Based Organizations (CBOs); Media Houses; Telecommunication Companies; Commercial Farmers; and Insurance Companies. Others include UN and International bodies like World Food Program (WFP); CARE International, OXFARM, Germany Development Agency, World Vision and Red Cross among others. For example KMD has signed a Memorandum an MoU with Meteo France International (MFI) to assist KMD to successfully realize the Implementation of WIGOS and WIS within the implementation timeframe.

Partnerships have become an important strategy for research program implementation where two or more organizations with complementary areas of expertise commit resources and work together to achieve a mutually beneficial outcome. Partnership brings together complementary skills and institutional synergy in addressing the complex challenges in agricultural research for development. Different kinds of institutions, including those from outside the formal research community need to come together, in order to create significant development impact.

A wide range of institutional partnerships and networks exists within on-going projects. From institutions' web site visits, different institutional arrangements were observed. Some of these were established through applied research collaboration. There are also knowledge networks formed by research institutions and development institutions including universities and development NGOs with

strong community links. The institutions are bound together by a common course through research, knowledge sharing and dissemination for applications. Some of these jointly develop and implemented projects fall within areas of common interest. Some of such projects include those initiated by the stronger partners such as international research institutes. These are commonly between the CGIAR Centers (IWMI, ILRI, CIMMYT, and IITA), FARA, AGRA and national agricultural research institutes.

To realize their objectives and mandate in the countries and sub-region of interest, the CGIAR Centers work with local institutions, giving a leading role in initiating such strategic partnerships with regional, national local agricultural institutes or universities. The scenario is similar with respect to RRNGOs. Being mainly private organizations, they require partnerships with public institutions to realize policymakers' buy-in and achieve their overall goals. Similarly, they easily partner with other regional-level organizations to synergize expertise by bringing on board multi-disciplinarily.

They also tend to rely heavily on associates (part-time researchers) in local universities to cut on costs of hiring full-time researchers. At national level research, the institutions are also known to have local research partnerships and knowledge networks e.g. local agricultural research institutes working with relevant departments at state universities, Parastatals, private seed companies and community based organizations. Another typical example is that of KEMRI, University of Nairobi, COHESU (NGO in western Kenya) and local referral hospitals on its malaria project. In general these are not limited by the type and number of institutions.

Collaboration between research institutions and development agencies as well as NGOs/CBOs is largely in the unpacking and dissemination of outputs. For example, CIMMYT works with World Vision and Catholic Relief Services (CRS) on demonstration and dissemination of improved maize technologies in Kenya. CIMMYT has similar arrangements with CBOs in Tanzania and Uganda. In Ethiopia, IWMI has worked with NGOs such as WaterAid, CARE, CRS and local communities to translate research outcomes into consumable forms before dissemination. For instance, this partnership supported the Godino Irrigation Scheme to develop by-laws for water use. In Uganda, NARLI works with Caritas International and World Vision in a symbiotic relationship where these development agencies receive critical field data required in operationalizing relief programs, for which they in turn unpack research outputs into appropriate forms for dissemination to end users. The NACRRI also Uganda works with World Vision and Action Aid to disseminate cassava stems, beans and rice varieties in resettlement areas. In Kenya, KMFRI works with NGOs such as Kwetu, who translate research findings into training and sensitization programs on mangrove conservation to Coastal communities. MMUST in Kenya supports field programs of Action Aid and Red Cross based on findings from its disaster management research.

The other collaboration is through participatory action research, where communities are also engaged directly on research project activities. Examples include COHESU's involvement in the implementation of KEMRI's climate change/malaria program, EIAR's Promotion of Local Innovation by Farmers (POLINOVA) Project in Ethiopia, and the University of Nairobi-Department of Meteorology engagement of Red Cross Society and CBOs in Nakuru town to integrate meteorological considerations in their programs. The Great Lakes University in Kisumu also works with community through health centers to collect data on a wide range of rural development parameters. Other examples include a case in Uganda where ACODE collaborates with CARE, Action Aid and Oxfam to translate its research results into policies for the benefit of "animal-challenged" communities, and Uganda Wildlife Authority (UWA) engages research assistants from local communities around the

parks where they participate in development activities that concurrently contribute to UWA's data gathering efforts.

Through strategic partnerships with government agencies, ILRI has relied on communities for the identification of animal epidemics such as bird-flu, while in Zanzibar, WIOMSA is working with communities on mariculture projects involving pearl fish and milk farming funded by USAID and EU. NACRRI and MARI are very popular for translating research by results into the field during *farmer field schools*.

The Ethiopian universities are leading discussions with relevant government entities to build development partnerships. Most research institutions have as a policy, engagement of interns, graduate students and post-docs to undertake certain tasks under supervision of senior research staff. To some institutions, this is free manpower to undertake some tasks that would ordinarily be undertaken by consultants. Yet to others, it is a key duty and also viewed as social responsibility and have a continuous admission program all year round.

Key program of Research Partnerships and Networks exist in the region For instance, WIOMSA has several scientific research grants from SIDA on marine issues. It also supports MSc and PhD students from overseas, who spend short periods of time at WIOMSA-member institutions where candidates sponsored by WIOMSA are based at IMS. Through HoARECN's demand-driven action research (DDAR) program, 50 proposals by MSc students in member institutions are funded each year—proposals whose design requires clear roles for CBOs in the implementation of the proposed activities. ILRI, IWMI and CIMMYT all have MSc (from host-country universities) and PhD students (globally selected). RRNGOs tend to host mainly post-doc fellows. All national research institutes, except EIAR17, admit graduate students as part of their capacity building policy. The **"**duals**"** admit interns-undergraduate students in continuing degree programs at local universities.

In general, institutions tend to hire consultants under various circumstances. First, whenever expertise required is urgent but deficient in-house or among its network membership. Examples include CIMMYT that hires consultants from local universities to support its socio-economic components or for project evaluations. Practical Action has occasionally hired University of Nairobi Chemistry lecturers to undertake indoor air pollution and Kenyatta University ones for climate change adaptation studies. The second model is popular among regional research NGOs, which maintains roasters of research associates in local universities and other think-tanks, and whom they engage on short notice to undertake certain tasks.

Multi-disciplinarily is recognized and embraced by almost all research institutions. This is achieved through (i) hiring consultants on needs-basis (ii) harnessing capabilities in partner institutions, and (iii) employing qualified persons into full-time positions. Among the international research institutes, socio-economics seems to be the prime discipline to which consultants are hired. RRNGOs exploit multi-disciplinary expertise among their research associates (mainly private consultants and university lecturers in specific fields). WIOMSA members have challenges getting social scientists with interests in marine studies. The demand for the few trained ones has been so high that many have been lost to western institutions. Capacity building is needed to create a critical mass of social scientists around environmental issues.

All national research institutes have established positions for needed areas of specialization and into which they have employed researchers. For example, KEMRI has on board entomologists,

climatologist, GIS specialists, parasitologists, statisticians and hydrologists. When it comes to universities, the departments have problems seeking specialists, something Institutes of the universities do not encounter. Examples include MMUST which has about 15 researchers with PhDs in various fields relevant to disaster management studies while the IMS-University of Dar es Salaam in Zanzibar has employed staff including sociologists, economists, engineers and oceanographers. The clear message emerging from this study is that, the strategic partnering and networking and contract research may be important sources of project financing if well planned.

Climate Information Products

There are several climate information products. These include the following:

- Daily Weather Forecasts;
- Dekadal Agro-meteorological Bulletins;
- Monthly Climate Outlooks;
- Seasonal Climate Outlooks;
- Observed Climate change signals;
- Climate Change Vulnerability Assessment Maps;
- Advisories/Alerts on Extreme Climate Events such as droughts and floods;
- Climatological maps;
- Agro-ecological maps;
- Seasonal distribution maps of onset and cessation of rains;
- Length of growing period maps;
- Maps on chances of dry and wet spell of given lengths;
- Maps on rainfall variability during different seasons; and
- Climate atlases

In addition, there are various communication and dissemination strategies:

- Websites
- Emails
- Meetings/Workshops
- Courier Services
- Electronic Media
- Print Media
- Cell phone text messages

Existing Strengths and Gaps

There are numerous gaps that still exist in our understanding of the nature of Africa's vulnerability to climate change and the existing opportunities for adaptation. In many of these countries, there is a need for improved scientific and technical capacity to conduct the integrated, multi-disciplinary regional investigations necessary to fill these gaps.

Strengths

Eastern Africa has good regional meteorological services network within NMHSs and ICPAC as a specialized sub-regional institution is well co-funded by member states. The institutions websites are regularly updated. The Internet high-speed availability in the region facilitates easy accessibility of climate information and products.

Gaps

Some countries have poor data observation network, including Eritrea and Somalia. There are insufficient funds to continuously disseminate climate information and prediction products for instance holding workshops or through print media. There is no early warning budget line allocated by governments. The early warning sector that is responsible for disseminating climate forecast products and information is located in the ministry of Agriculture in some countries.

Recommendations and the Way Forward

Climate analyses and outlooks are being progressively considered among advanced climate change adaptation tools. Current Climate change assessments have fallen short in better informing science and development debates, shaping climate sensitive sectors strategies and policies and fostering appropriate advocacy. The program for modernization of Agriculture in the sub-region recognizes the threat posed by climate change, however, the level of resources and capital needed to address climate risk management in the agriculture sector is therefore hampering significantly.

Even though there is increased awareness on climate change and the need for adaptation, more than half of farmers in countries are not yet exposed to research and extension services. Where available, these services do not usually address effectively the demands of farmers. As a way forward there is a pressing demand to improve farmer's capacity to articulate demands for agricultural advisory services, build partnerships between farmers and information service providers and build capacity of service providers to respond to expressed demands. Efforts are therefore required to make future outlooks and assessments more relevant and adequate to inform strategies, policies, plans and practices in the agriculture and food sector.

Recommendation 1: Drawing on the findings of consultations, discussions and interviews a number of actions are proposed worthy of consideration for the development of future climate products and services for better adaptation of agriculture and food security sector. To adequately engage the full range of actors and issues needed to comprehensively undertake research and development on better climate products and services for agriculture and food security, participatory approach in the design and implementation of joint projects involving experts in relevant sectors (agronomy, trade, retailing, harvesting, climate, agriculture extension services, agriculture development, farming techniques, nutrition, sociology and ecology) appears to be decisive.

Recommendation 2: In collaboration with agriculture community, climate experts should continue to improve content, format and relevance of climate information.

Recommendation 3: It is essential to go beyond concepts and methodological approaches moving towards feasible and cost effective adaptation options using the next generation of climate products and services by:

- Better documenting types of agriculture practices and food security concerns in the region;
- Inventorying pathways of climate impacts on agriculture and food security;
- Inventorying indicators of impacts pathways; and
- Inventorying and scaling up best practices on climate information production and use in agriculture and food security

Recommendation 4: There is increasing recognition of the climate change impacts on the frequency and magnitude of extreme events. Current climate products and services still fall short in providing relevant climate information for agriculture advisory services and food security. Mostly response and recovery are recorded in cases of extreme climate in much of the sub-region. Future efforts should shed some lights on balance intervention including prevention, preparation in addition to response and recovery by adjusting policies, plans, regulations, decisions and practices in the agriculture and food sector.

Recommendation 5: A standard feedback mechanism should be developed to improve weather forecasts needed in the agriculture and food security sector.

Recommendation 6: It was found from the study that there are several users of climate data and information. It is recommended that the provider of this climate information should improve on the quality and accuracy of these products in order to increase the usage of the products.

Recommendation 7: It was noted that due to the lack of sufficient cooperation and collaboration of various food security outlooks and early warning systems, the systems seem to compete for the same information sources and meet the needs of similar user groups resulting in unnecessary duplication. It is recommended that the institutional arrangements of existing monitoring systems should be strengthened and coordinated by the Governments.

Recommendation 8: Early warning systems should be evaluated on the accuracy of the data they produce as well as their capacity for data processing, analysis and interpretation. It is important that the information produced arrives in a timely fashion, giving decision makers enough lead way to produce the necessary policy responses.

Recommendation 9: In countries for example Kenya, the farmers get climate information from extension services, daily radio, television, newspapers and through community interactions. Experience has shown that majority of the farmers prefer indigenous forecasting knowledge over contemporary forecasting. Their reasons are that indigenous information is more compatible with local culture and it has been tested, tried and trusted. In addition, it is more specific and is in a language that can be understood better by communities passing clear message that integration of indigenous forecasting knowledge into science based climate forecasting will promote effective use and create ownership by communities.

Recommendation 10: In some countries there is need for paradigm shift and attitude change in order to expand services and seek partners to demonstrate relevance in socio economic development, for NMHSs to become semi autonomous by; 1) Setting standards to maintain quality, 2) Control mechanism to avoid contradictory weather products and services, 3) Monitoring compliance and 4) Establishment of regulatory bodies.

Recommendation 11: Better ways of integrating users and providers of NMHSs services include interaction with users in Regional Climate Outlook forums and National Climate Outlook forums, making agreements, building collaboration and partnership with NGOs through training as part of community engagement. Other ways of integrating user would through joint research with universities, participation in national programs and organizing local level-climate users groups and forums.

Recommendation 12: In order to develop strategy for better ways of delivering services, there is a need for branding, exploiting faster modes of delivery at low cost using appropriate Media (mobile phone technology, TV, social media, radio, SMS services, Updated websites). There has been a disconnect in disseminating services to users hence need to translate the products into local languages. The services should be timely with continuous evaluation and feedback from users.

Recommendation 13: It is imperative to improve quality of information and services given to users and this can be achieved through understanding customer needs and the added value of integrated climate information in the growth of national economy. In order to further improve the quality of services, need for benchmaking against established NMHSs and carrying out socio-economic sector pilot projects is highly recommended. As part of benchmaking NMHSs need to carry out institutional mapping to identify threats and opportunities within the country and the region.

Recommendation 14: The important aspect needed in assessment of climate information and services, is evaluation of impacts and measurement of benefits. Demonstrated impacts on decision-making and uptake of information by user may be through evident strengthened collaborations with customers and stakeholders, especially in vulnerable risk areas and sectors. The benefits accruing from use of climate information and services are indicated through increased demands of pilot project demonstrations and contigency plans made to mitigate losses or maximise profits. For all the above to be achieved in the Regions, the need to establish baseline information for impact assessment is very crucial.

Recommendation 15: Mobile phones could be an effective tool for communicating messages to poor small-scale farmers in developing countries. "You would find at least one person with a mobile phone in a village; this person can be made the focal point and convey messages on actions to be taken through that person within the area.

Recommendation 16: In many instances the installation of weather stations does not take into account, the quality of data generated, hence the WMO recommendation be observed during instruments installations.

Recommendation 17: Majority of the stakeholders interviewed in this scoping study indicated that rainfall and temperature data are very important if disseminated in time with good spatial distribution.

Appendices

Appendix 1: Survey Questionnaire

Survey study for review of existing climate information products and services in the agriculture and food security Sector

CGIAR Climate Change, Agriculture and Food Security (CCAFS)

The CGIAR Challenge Program on Climate Change, Agriculture and Food Security (CCAFS) new research theme, "Adaptation Pathways Based on Managing Current Climate Risk" has requested ACMAD to carry out scoping study on review of existing climate information products and services targeting agriculture and food security. ACMAD in collaboration with CGIAR, CCAFS have launched this survey questionnaire on existing climate information products and services.

The questionnaire is divided in three major parts:

Part A	Common to both providers & users or information & services	Questions 1
Part B	For providers of information such Weather & Climate Centres at International, regional and national level, Agro meteorological & climatic extension service, Organisation from UN System and NGO, Organisation dealing with early warning systems (Fewsnet)	Questions 2.1 to 2.6
Part C	For users of the climate information, products and services at different stages (Users of raw data & information, extension services, final users in the Agricultural sector.	Questions 3.1 to 3.12

Your contribution will be acknowledged in the survey report. We kindly request you to send back the filled questionnaire by the Deadline 22nd February 2011 at the latest by email to the following addresses

dgacmad@acmad.org

with copy to kadi_metdz@yahoo.com , njogunjau2006@yahoo.com , johnmwicha@yahoo.com

1. PART A: INSTITUTION PROFILE	
Basic information of Organization/Institution	
Country	
Name of organization/entity	
Type of organization[1] Date it was created	
Mission	
Relationship to Agriculture and Food Security	
Address	
Telephone number	
Fax number	
Email address	
Web site	
Size of organization (number of staff)	
Contact person (name, mail,…)	
Add any other relevant information	

PART B: PROVIDER OF CLIMATE INFORMATION PRODUCTS AND SERVICES

Please answer the following questions about climate information products and services you provide for agriculture and food security

2.1 What kind of climate information products and services do you provide and to who?

No.	Type	Equivalent title of your product	Name of user
1	Daily Weather Forecasts		
2	Weekly Weather Forecasts		
3	Agro-met Forecasts		
4	Dekadal Climate Outlook		
5	Monthly Climate Outlook		
6	Seasonal Climate Forecast		
7	Climate Change Projections		
8	Climate Change vulnerability assessment maps		
9	Advisories/Alerts (Extreme Climate Events)		
10	Early Warnings (outbreaks of pests and diseases)		
11	Alerts		
12	Frost occurrence forecast		
13	Rainfall onset and cessation dates		
14	Climate atlases		
15	Others		

[1] Governmental, intergovernmental, local, non-government, private, association, educational, international, etc.)

2.2 Please rank the modes of dissemination of your climate information products and services to users starting with 1 as the most frequently used to 10 the least used mode.

No.	Mode of dissemination	Rank and observations
1	Internet	
2	Telephone	
3	Portal mail	
4	Fax	
5	Media	
6	Workshops	
7	Field days/Open days	
8	Traditional Methods	
9	Personal contact/Communication	
10	Others	

2.3 Please give details in the space below on how information on your products, services to potentials users is provided.

2.4 Are there any institutional arrangements for cooperation (or any relationship) with users/user sectors of the climate information you provide? If yes, please list them in order of priority

No.	Users/User sectors	Bilateral/MoU	Type of products and services
1			
2			
3			

2.5 Can you describe you service delivery strategy

2.6 What strategies are needed to improve your service delivery (delivery of products)?

2. USER OF CLIMATE INFORMATION PRODUCTS AND SERVICES

Please answer the following questions about use of climate information products and services.

2.1. As a user, which is your area of utilization of climate information products and services? Just put (X) as appropriate.

Agriculture		Water management		Disaster prevention	
Energy		Health and welfare		Transportation	
If other, please specify:					

2.2. Type and source of climate information products and services you receive and its source (Source A) and those you wish to receive and use (B)?

No.	Category and Type	Source A (provider, web site ..)	B (put a X)
1	Daily Weather Forecasts		
2	Weekly Weather Forecasts		
3	Agro-met Forecasts		
4	Dekadal Climate Outlook		
5	Monthly Climate Outlook		
6	Seasonal Climate Forecast		
7	Climate Change Projections		
8	Climate Change vulnerability assessment maps		
9	Advisories/Alerts (Extreme events)		
10	Early Warnings (outbreaks of pests and diseases)		
11	Frost occurrence forecast		
12	Rainfall onset and cessation dates		
13	Climate atlases		
14	Statistics		
15	Others (please specify)		

3.3 Which of the modes do you use to access the climate information products and services for your operational activities? Starting with 1 as the most frequently used to 10 the least used mode.

No.	Mode of dissemination	Rank	Observations
1	Internet		
2	Telephone		
3	Portal mail		
4	Fax		
5	Media		
6	Workshops		
7	Field days/Open days		
8	Traditional Methods		
9	Personal contact/Communication		
10	Others		

3.4 How important do you consider the following category and types climate information products and services for your activity? Rank as 1 Very Important, 2 Important, 3 Not important.

Category and Type	Rank	Category and Type	Rank
Daily Weather Forecasts		Climate Change Projections	
Weekly Weather Forecasts		Climate Change vulnerability maps	
Dekadal Climate Outlook		Advisories/Alerts (Extreme Events)	
Monthly Climate Outlook		Early Warnings (pest & disease outbreaks)	
Agro-met Forecasts		Frost occurrence forecast	
Seasonal Climate Forecast		Seasonal rainfall onset and cessation dates	

3.5 Explain how products are tailored to meet your needs or suggest how they could be tailored to meet your needs.

3.6 **For the 3 main type of information used, can you please, briefly indicate how you apply the information in your operational activities or planning?**[2]

No.	**Type & Source**	**How do you apply it in your activities**
1		
2		
3		

Use more space if necessary

3.7 As a user, do you have any framework of cooperation / collaboration (i.e.. MoU or others) with providers of climate information products and services?
If yes, please describe fill the table below.
If No: do you expect any?

No.	**Provider Institution**	**Bilateral/MoU/Other**	**Type of products and services**
1			
2			
3			

3.8 In general, how easy do you feel it is for the different groups of end users to access and understand the climate information in the format that are currently provided? Just put a tick (√) as appropriate.

Group	**Very difficult**	**Difficult**	**Moderate**	**Easy**	**Very easy**
National government					
Local government					
NGOs					
Community leaders					
Rural populations					

3.9 In your opinion which of groups do you feel best placed to disseminate climate information to <u>rural communities</u> for enhanced agricultural production and food security?

Group	Give organization name if possible	Mean of Dissemination?
United Nations affiliated Organization		
International Climate/Weather Centres		
National meteorological and Hydrological Services		
Agricultural Extension Services		
Community leaders/Village elders		
NGOS		
CBOs		
National Media		
Agro-based institutions/agencies		
Research Institutions		
Others		

.

If any other than the above please specify in the space provided below.

3.10 Please provide any recommendations and strategy for better dissemination, production and presentation of the climate information for agriculture and food security.

Your contribution will be acknowledged in the survey report. We kindly request you to send back the filled questionnaire by the 15th of February 2011 at the latest by email to the following addresses : dgacmad@acmad.org with copy to kadi_metdz@yahoo.com & njogunjau2006@yahoo.com & johnmwicha@yahoo.com

ACMAD thanks you for this contribution!!!!

Appendix 2: Institutions Interviewed and their Products

No.	INSTITUTION	PRODUCTS
	KENYA	
1	Kenya Meteorological Department (KMD)	Daily weather forecast, 4-day Forecast, 7-Day Forecast, Monthly Forecast, Seasonal Forecast, Agro-meteorological services (10-Day Bulletin) Special Reports
2	IGAD Climate Prediction Application Centre (ICPAC)	Consensus outlooks for a dekad, monthly and seasonal.
3	Ministry of Agriculture (MOA)	Early Warning bulletin for food security to extension farmers and seminars during farmers field days
4	Ministry of Livestock Development (MOLD)	Early Warning bulletin for food security and marginal pastoralists
5	National Irrigation Board (NIB)	
6	International Livestock Research Institute (ILRI)	Index Based Livestock Insurance
7	The Tea Board of Kenya (TBK)	Research findings by TRF
8	World Vision	Vulnerability Assessments Status like disaster risk mapping
9	Brookside Dairy	Dairy Products as influenced by pasture and temperature conditions
10	Food Early Warning System Network (FEWSNET)	Livelihood zone maps
11	ICRISAT	Research Findings in selected crops
12	KARI	Research findings in Kenya Agriculture
13	WFP	Food Aid Information System
14	NALEP	
15	CRF	Research Findings on coffee
16	KFSSG	EWS bulletins
17	KILIMO SALAMA	Both the premiums to UAP Insurance and the pay-outs to farmers
18	Western Kenya Community Driven development & Flood Mitigation Project	Daily weather and monthly climate broadcast
	UGANDA	
1	Department of Meteorology, Ministry of Water and Environment	Daily weather forecast, 4-day Forecast, 7-Day Forecast, Monthly Forecast, Seasonal Forecast, Agro-meteorological services (10-Day Bulletin) Special Reports
2	Famine Early Warning Systems Network	Food Security Outlooks
3	Ministry of Agriculture	Early Warning bulletin for food security to extension farmers and seminars during farmers field days
4	National Agricultural Research Organizations	Research Findings in selected crops
5	World Food Program	Food Aid Information System
6	Uganda National Farmers Federation	
7	Food and Agriculture Organization http://www.fao.org	

Appendix 3: Institutions and Officers Interviewed

No.	Acronym	Name of Institution & Website	Name /Designation/Contact
		KENYA	
1	ICPAC	IGAD Climate Prediction Application Centre	Zackary Atheru, Program Officer, e-mail: zatheru@icpac.net
2	FEWSNET	Famine Early Warning System Network www.fews.net	Gideon Galu, e-mail: ggalu@fews.net
3	KMD	Kenya Meteorological Department http://www.meteo.go.tz/wfo/index.php	Peter Ambenje, Deputy Director, Forecasting and Regional Services, e-mail: ambenje@meteo.go.ke
4	NIB	National Irrigation Board	G. M. Ndirangu, Senior Irrigation Officer, e-mail : gmndirangu@gmail.com, ndirangu@nib.or.ke
5	ILRI	International Livestock Research Institute	Brenda Wandera, Project Development Manager, Index Based Livestock Insurance Project, Poverty and Gender Group, e-mail: b.wandera@cgiar.org
6	KFSSP	Kenya Food Security Steering Group	Samuel Mwangi – Group Member e-mail : mwangi@meteo,go.ke
7	TBK	Tea Board of Kenya	SAMUEL O. OGOLA, Technical Services Manager, e-mail: ogolas@teaboard.or.ke
8		Brookside Dairy Limited	Beatrice Otieno, Administration, Procurement and Extension Manager, e-mail: beatrice.otieno@brookside.co.ke
9	FSD	financial sector deepening	Michael Mbaka, Project Manager, Index-Based Weather Insurance, e-mail: michaelm@fsdkenya.org
10	WV	World Vision	Mary Njeri, Livelihood and Resilience coordinator, e-mail: mary_njeri@wvi.org
		UGANDA	
1	DoM	Department of Meteorology, Ministry of Water and Environment WWW.meteo-uganda.net	Mr. M.S.Z.NKALUBO, Commissioner P.O. Box 7025 Kampala Tel.+ 256 414 251 798 Fax: +256 414 251 797 nkalubo_m@yahoo.com Michael.nkalubo_m@yahoo.com com.met@meteo-uganda.net Deus Bamuanya Sekunda Samuel Kalid Wuembe Lubega N. Fortunata lubegf@yahoo.com
2	FWES NET	Famine Early Warning Systems Network	Agnes Atyang
3	MoA	Ministry of Agriculture	Ms A. Hakuza
4	NARO	National Agricultural Research Organizations	Ms Evelyn Komutunga
5	WFP	World Food Program	Mr Zacharias Ndirima
6	UNFFE	Uganda National Farmers Federation	Katungisha Kenneth katungishakenneth@yahoo.co.uk kkatungisha@unffe.org
7	FAO	Food and Agriculture Organization http://www.fao.org	Stella Sengendo Program Officer Food Security Stella.Sengendo@fao.org

Appendix 4: Contact Officers for Future Collaboration

No.	Acronym	Name of Institution/Web site	Phone/Address	Contact/Email
		ETHIOPIA		
1	CIMMYT	International Maize and Wheat Improvement Center www.Cimmyt.org	Tel: +251 116462324	Denis Friesen Principal scientist d.friesen@cgiar.org
2	ILRI	International Livestock Research Institute www.telecom.net.et	Tel: +251 116172221 Fax : +251 1 461-253, 611-892	Shirley Tarawali, Director-People, Livestock and Environment ilri-ethiopia@cgiar.org
3	HoARECN	Horn of Africa Regional Environment Centre and Network	Tel: +251 111239472	Dr Mekuria Argaw Coordinator mekuriaa@hoarec.org
4	NMA	National Meteorological Agency	P.O Box 1090 Addis Ababa Tel: +251 116625292 Fax: +251 16625292/5517066	Babu Amare Amare2002@yahoo.com nmsa@telecom.net.et
5	SLUF	Sustainable Land Use Forum	Tel: +251 115157656	Habtemariam Abate Executive Director executivedirector@sluf.org.et
6	AATF	African Agricultural Technology Foundation www.aatf-africa.org/		
7	AAU	Addis Ababa University	P.O. Box 1176, Addis Ababa Tel: +251 1 564 745	Chemistry.aau@telecom.net.et
8	EIAR	Ethiopian Institute of Agricultural Research http://www.eiar.gov.et/about-eiar	Tel: +251 116454430	Teklu Tesfaye Head Research, Extension Farmer Link Department teklenet@yahoo.com
9	CCRG	Climate Change Research Group, Addis Ababa, University	Tel: +251 911405950	Mohamed Umer Group Coordinator Moha_umero@yahoo.com
10	IWMI	International Water Management Institute www.IWMI.org	C/o ILRI-Ethiopia Campus, Wereda 17, Kebele 21, P.O.Box 5689, Addis Ababa Tel: +251 116463215 +251-11 6172000 Ext: 2190 or 2200 Fax: +251-11 6172001	Seleshi Bekele s.bekele@cgiar.org iwmi-ethiopia@cgiar.org
11	MOA	Ministry of Agriculture WWW.dppc.gov.et	Tel: +251 911246267	Dejere Abesha dejereabesha@yahoo.com Tamrat Tsegaye Tamratt @dppc.gov.et.
12	AU	African Union Commission	PO Box 3243, Addis-Ababa Tel: +251 115517700	Dr Ahamed Hamdy, Head of Science Technology and ICT Division hamdya@africa-union.com
13	PPRC	Plant Protection Center	Tel: +251 1 360094	
14		TREE AID www.treeaid.org.uk/grants.htm	Square; Bristol BS2 8PE, UK Tel: 00 44 (0)117 909 6363. Fax: 00 44 (0)117 909 6617	Caroline Robottom programs@treeaid.org.uk.
15	CRS	Catholic Relief Services www.crs.org/ethiopia/		
16		CARE Ethiopia www.care.org.et/		
17		FAO www.fao.org/world/ethiopia/index.htm		
18	WFP	World Food Program WWW.wfp.org	Kirkos Sub City, Kebele 17/18, River Side Hotel PLC, Off Olompya/Haile Gebreselassie Road, Addis Ababa	Ahmad Shah Shahi ahmadshah.shahi@wfp.org
19		Ministry of Water and Energy	Tel: 00 44 (0)011-6-611111 Fax: 00 44 (0)011-6-610885	

No.	Acronym	Name of Institution/Web site	Phone/Address	Contact/Email
20	FEWS NET	Famine Early Warning Systems Network WWW.fews.net	Bole Road, behind Boston Partners building, Addis Ababa 11 662 02 17/18 Tel: 00 44 (0) 11662 02 30	Emebet Kebede G/Hanna Ekebede@fews.net
		UGANDA		
1		National Agricultural Research Organization – Fisheries Resources Research Institute NARO- FIRRI	P.O Box 343, Jinja	
2	ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) – Entebbe www.asareca.org	P.O.Box 765, Entebbe Tel:+ 256 41 4320212 Fax:+ 256 41 4321126	
3	DoM	Department of Meteorology, Ministry of Water and Environment WWW.meteo-uganda.net	P.O. Box 7025 Kampala Tel.+ 256 414 251 798 Fax: +256 414 251 797	Mr. M.S.Z.NKALUBO nkalubo_m@yahoo.com cm.met@meteo-uganda.net
4	LVFO	Lake Victoria Fisheries Organization	P.O Box 1626,Jinja Tel: +256 43 120205/6	Senior Scientist, omkumba@yahoo.co.uk
5		Global Water Partnership www.gwp.org		
6		National Agricultural Research Laboratories Institute		
7		HEIFER Project International Uganda		
8	FAO	Food and Agriculture Organization www.fao.org	P.O. Box 521, Kampala Tel:+256-414-340324/2 +256-414-349916/7 Fax:+256-414-230605 Mob. +256-772-419649	Stella Sengendo Program Officer Food Security and Agricultural Livelihoods Stella.Sengendo@fao.org
9		Directorate of Environment, MoWE		
10	FEWSNET	Food Early Warning System Network www.fewsnet,net	P.O. Box 7856 Kampala Tel:+256-414-530. Mob. +256-772 608696	Agnes Atyang FEWSNET Representative Uganda aatyang@fews.net Uganda@fews.net
11	IUCN			
12	NACRRI	Cassava mosaic project		
13		McKnight Foundation Program www.mcknight.org/international/africa.aspx	710 South 2nd St., Suite 400; Minneapolis, MN, USA 55401 USA. Tel: 612-333-4220 Fax 612-332-3833	Kathleen Rysted, Director, Research Programs Email: krysted@mcknight.org
14	UNFFE	Uganda National Farmers Federation www.unffe.org	P.O. Box 6213, Kampala Tel:+256-414-230705. Fax: +256-414-230748 Mob. +256-312-103345	Katungisha Kenneth katungishakenneth@yahoo.co.uk kkatungisha@unffe.org unfa@starcom.co.ug
	NARO	National Agricultural Research Organization		Ms Evelyn Komutunga
		TANZANIA		
1		Institute of Marine Sciences, UDSM		
2	WIOMSA			
3	ARM	Agricultural Research Institute	Mikocheni	
4	TATEDO			
5	IUCN			
6	CEEST			
7		AGENDA for Environment		
8		IRA University of Dar es Salaam		Amos Majule amajule@ira.udsm.ac.tz
9		University of Dar Es Salaam, Faculty of Aquatic Sciences and Technology	Mlimani Campus P.O. Box 60091 Tel: 255 222 410 480 Fax:255 222 410 480	Prof. Yunus Mgaya ymgaya@udsm.ac.tz yunusmmgaya@yahoo.com
10		EA University-lake Victoria projects www.lvrlac.net/database/subjects.htm		
11	MARI			
12	SUA	Sokoine University of Agriculture	P.O. Box 3000 CHUO KIKUU, Morogoro Tel. +256 23 2603511-4, Fax +255 23 2604573	Jacob Ayub Churi churij@gmail.com Henry Mahoo mahoohenry@yahoo.com

No.	Acronym	Name of Institution/Web site	Phone/Address	Contact/Email
13	SUA	Sokoine University of Agriculture WWW.suanet.ac.tz	Sokoine University of Agriculture, PO.box 3000, Chuo Kikuu, Morogoro, Tel. +255 23 260 3511-4 Fax .+255 23 260 4651 vc@suanet.ac.tz	The Vice-Chancellor vc@suanet.ac.tz vc@suanet.ac.tz
14	EPMS	Community Based Adaptation to climate change in Africa (CBAA) project		
15	TMA	Tanzania Meteorological Agency WWW.meteo.go.tz	Along Morogoro Road, Ubungo Plaza Building Third and Fourth Floor P.O Box 3056 DAR ES SALAAM Tel.+255 784251301 Fax .+255 22 2460735	Director General Dr. Agnes Kijazi kijazi@meteo.go.tz, Augustine Kanemba kanemba@meteo.go.tz akanemba@yahoo.com
KENYA				
1	KMD	Kenya Meteorological Department	P.O Box 30259, Nairobi	Stanslus Muthaka Gachara gachara@meteo.go.ke gachara05@yahoo.co.uk
2	IGAD (ICPAC)	Climate Prediction Application		Prof. Laban Ogallo Centre, E-mail: director@icpac.net
3	(MOA)	Ministry of Agriculture		Permanent Secretary c/0 Directorcrops@yahoo.com, Samuel Waigwa samuelwaigwa@gmail.com
4	(MOLFD)	Ministry of Livestock and Fisheries Development		Hele Bushel, Permanent Secretary hbushell@oxfam.org.uk
5	NALEP	National Agriculture and Livestock Extension Program		Program co-ordinator mulagoli@nalep.co.ke Mary Njeri Mary_njeri@wvi.org
6	ILRI	International Livestock Research Institute http://www.livestock.go.ke/	P.O. Box 30709 Nairobi 00100, Kenya Tel : + 254-20 422 3000 ILRI-Kenya@cgiar.org	Project Development Manager – Brenda Wandera b.wndera@cgiar.org Davi Aura Okoko okoko.davies@kenyaredcross.org
7	(TBK)	Tea Board of Kenya	P.O. Box 20064 City Square 00200 Nairobi	Technical service Manager – Pgola O. Samuel info@teaboard.or.ke, Cynthia B. Awour cynthia@care.or.ke
8	WV	World Vision Nairobiweb: wvafrica.org	East Africa office, P.O.Box 133 - 00502 Karen	Mary Mwale Mary.mwale@aridland.go.ke
9	FEWSNET	Famine Early Warning System Network www.fews.net		Gideon Galu ggalu@fews.net Nancy Mutunga nmutunga@fews.net
10	A-AARNET	ASARECA Animal Agricultural Research Network (A-AARNET)	A-AARNET, ILRI, Old Naivasha Road, Kabete, P.O.Box 30709 00100 GPO Nairobi Tel: 25420-422 3401 Fax:25420-422 3001	Ndikumana Jean j.ndikumana@cgiar.org
11	AGRA	Alliance for a Green Revolution in Africa		Joan Kagwanja jkagwanja@agra-alliance.org
12	LVBC	Lake Victoria Basin Commission www.lvbcom.org		Owora Richard Othieno, Head of Department, Corporate Communication and Public Affairs othieno@eachq.org Charles-Martin Jjuuko, Communications and Development Awareness Officer, jjuuko@lvbsec.org
13	AU-IBAR	African Union International Bureau for Animal Resources	P.O. Box 30786 00100 Nairobi Tel: 254 367 4000 Fax:254 367 4341	Hameed.nur@au-ibar.org drnuru@yahoo.com
14	KARI	Kenya Agricultural Research Institute	P.O.Box 57811, City Square, 00200 Nairobi Tel:+254-020-4183720, 4183301-20 Fax:+254-020-4183344	Resource.center@kari.org

No.	Acronym	Name of Institution/Web site	Phone/Address	Contact/Email
15	WEMA	Water Efficient Maize for Africa project www.aatf-africa.org/projects/aatf_pro		
16	NARL	National Agricutural Research Laboratories Kabete	P.O. Box 14733, Nairobi	
17	KMD	Kenya Meteorological Department	P.O Box 30259, Nairobi	Stanslus Muthaka Gachara gachara@meteo.go.ke gachara05@yahoo.co.uk
18	KWS	Kenya Wildlife Services http://www.kws.org	P.O. Box 40241 - 00100 Nairobi Kenya Tel: +254 (20) 6000800, +254 (20) 6002345 Fax: +254 (20) 6003792	kws@kws.go.ke
20	PA	Practical Action	**Tel**:+44 (0) 1926 634400 **Fax**:+44 (0) 1926 634401	Eric Kisiangani eric.kisiangani@practicalaction.or.ke
21		Composite Loss Assessors & Adjusters	P.O Box 64501-00620 Nairobi Tel: 020 2320680 Tax: 0203740719	Victor K. Kagwe composite@jambo.co.ke
22	IUCN	International Union for Conservation of Nature	IUCN Eastern and Southern Africa Regional Office, P.O. Box 68200 - 00200 Nairobi Tel: ++254 (020) 890605/12.	Email: earohr @ iucn.org
23	KEFRI	Kitui Regional Research Centre www.kefri.org	P.O. Box 892 Kitui Tel : +254-44-22311/22626	director@kefri.org
24	UoN	Department of Meteorology University of Nairobi	P.O. Box 30917 Nairobi,	John Muthama jmuthama@uonbi.ac.ke Cromwel B. Lukorito mailto:cbusolo@uonbi.ac.ke
25	SEUCO	South Eastern University College University of Nairobi http://www.seuco.ac.ke/		Prof. Eliud M. Mathu, Ag. Dean, School of Earth Sciences, SEUCO emathu@seuco.ac.ke
26	ADP	Kenya Accenture Development Partnerships and NetHope WWW.accenture.com, www.nethope.com		Vicky Easterbrook vicky.easterbrook@accenture.com Chungli Tsai chungli.tsai@hethope.com
27		AGRISOKO EL www.agrisokoel.co.ke	P.O Box 15956 Nakuru 20100 Tel: +254 722734468	Paul Muthangya Paul.muthangya@agrisokoel.co.ke

Appendix 5: List of Users, Including Community Groups

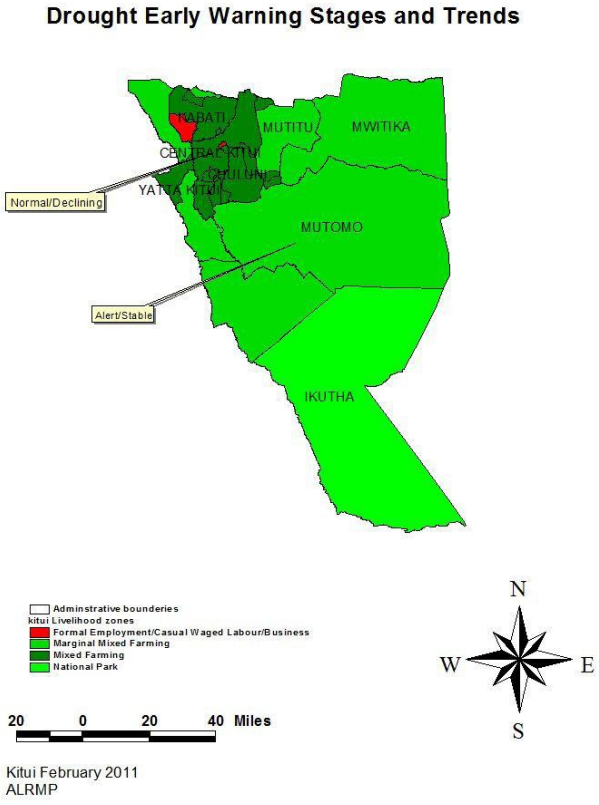
Country	No.	Institution /Organization
ETHIOPIA	1	Ministry of Agriculture and Rural Development
	2	Tree Aid
	3	Catholic Relief Services (CRS)
	4	OXFAM
	5	CARE
	6	World Vision Ethiopia
KENYA	1	Arid Lands Information Network (ALIN) is a network of community development workers
	2	Lake Basin Development Authority (LBDA)
	3	Practical Action (formerly known as Intermediate Technology Development Group-ITDG)
	4	Alliance for a Green Revolution in Africa (AGRA)
	5	Tea Board of Kenya (TBK)
	6	World Vision (WV)
	7	Ministry of Agriculture and the Ministry of Livestock Development (MOA/MOLD)
	8	Kenya Food Security Steering Group (KFSSG)
	9	Kilimo Salama
	10	Brookside Dairy Limited
	11	Financial Sector Deepening (FSD) Trust
TANZANIA	1	Lake Victoria Basin Commission (LVBC)
	2	Agricultural Council of Tanzania
	3	Southern Agricultural Growth Corridor of Tanzania
UGANDA	1	National Agricultural Research System (NARS)
	2	Uganda National Farmers Federation (UNFFE)
	3	Public Agricultural Research Institutes (PARIs)
	4	HEIFER International-Uganda
		Global Water Partnership (GWP)
	5	National Agricultural Research System (NARS)
	6	McKnight Foundation
	7	Uganda Commercial Farmers Association (UCFA),
	8	Uganda Floricultural Association (UFA),
	9	Uganda Honey Beekeepers Association (UHBKA),
	10	Uganda Midland Multipurpose Foundation,
	11	Universal Apostolic Fellowship Farmers Organisation,
	12	Concerned Women of Rakai, Ssembabule (COWORASE),
	13	East African seeds,
	14	Horticultural Exporters Association (HORTEXA),
	15	Masaka and Kalangala Farmers Organization,
	16	Ngenge Development Foundation and
	17	Sukura Farm suppliers

Appendix 6: Inventory of Programs and Projects using Climate Information for Agriculture and Food Security in the Region

No.	PROGRAMS/PROJECTS
1.	Nile Basin Initiative - Protecting Africa's Common Future From Impacts of Climate Change
2.	University of Nairobi – Climate Change Impacts, Vulnerability and Adaptation Assessment in East Africa.
3.	IWMI-International Water Management Institute (Research in East Africa) -Agricultural Water Management(AWM) Solutions Project, Rethinking Water Storage for Climate change adaptation in Sub-Saharan Africa, Improving Water Productivity of Crop-Livestock Systems of Sub-Saharan Africa, **Water Management and Environment: balancing water for food and nature, Increasing water-use efficiency for food production through better livestock management – The Nile River Basin, Agricultural Water Management Technologies,** CGIAR-NBI Synergies.
4.	International Development Research Centre (IDRC), African Centre for Technological Studies (ACTS) - Community Based Adaptation to Climate Change in Africa.
5.	ASARECA - Association for Strengthening Agricultural Research in Eastern and Central Africa, (International Potato Center) - Predicting climate change induced vulnerability of African agricultural systems to major insect pests through advanced insect phenology modelling, and decision aid development for adaptation planning , Participatory development and testing of strategies to reduce climate vulnerability of poor farm households in East Africa through innovations in potato and sweet potato technologies and enabling policies, (ILRI) - Mapping climate vulnerability and poverty in Africa
6.	CIESIN (Centre for International Earth Science Information Network) -**Climate, Health and Land Cover/Land Use Interactions in Kenya,** Hydrology and Social Interactions: A Focus on Conflict in Africa.
7.	KMD - WIGOS Demonstration Project in Kenya
8.	RANET-Kenya Project
9.	The CGIAR Challenge Program - Climate Change, Agriculture and Food Security
10.	OP (Office of the President) - Western Kenya Community Driven development & Flood Mitigation Project
11	WIFA
12	Cassava mosaic project
13	McKnight Foundation Program
14	EA University-lake Victoria projects http://www.lvrlac.net/database/subjects.htm
15	Community Based Adaptation to climate change in Africa (CBAA) project
16	Water Efficient Maize for Africa project www.aatf-africa.org/projects/aatf_pro

Appendix 7: Climate Products

Kitui Drought EWS Bulletin, February 2011



Districts covered by Arid Lands Resource Management Project (ALRMP II)

Situation overview

- During the month of February the district received off- season rains that were well spatially spread across the district. These rains triggered the regeneration of pastures and sprouting of shrubs.

- The quality and quantity of pastures was good. The situation is further expected to improve if the rains continue.

- The water situation in the district was improved by the run-off produced by the rains. The rains also facilitated the recharge of roof catchment water facilities, rock catchments and springs. However, water stress continued to be felt in Malalani location and Mutha division where surface water facilities are few and communities relied on boreholes, which were experiencing stress due to long pumping hours. More time was spent on these sources queuing for water.

- Pastoralists who had started retreating to their districts migrated back to Twambui in Malalani Location of Mutitu District in search of water. This situation is creating tension among the communities.

- No major livestock disease outbreaks were reported. Isolated cases of goats' deaths were reported due to suspected cases of contagious caprine pleuropneumonia (CCPP) while deaths of poultry were reported across the district due to New Castle Disease.

- The price of a kilo of maize retailed at Ksh17 per kilo in the mixed farming livelihood zone while in the marginal mixed farming likelihood zone the same retailed at between Ksh17 and Ksh22 depending on the location of the market. The price is expected to go-up with the onset of the dry planting season.

- The price of beans went-up and a kilo of this commodity retailed at Ksh70 in the marginal mixed farming livelihood zone, while the same traded at Ksh60 in a few locations in the Mixed Farming Livelihood Zone. The other pulses available in the markets include pigeon peas at Ksh50 per kilo and green grams at Ksh75 per kilo. Mangoes were available in Kitui Central and Zombe Location of Mutitu Division.

- The month saw a decline in the price of both cattle and goats. Bulls traded at an average of Ksh16,000 while goats traded at Ksh2,000 per head. This price drop was attributed to the anticipated severe drought. Many families turned into sale of livestock to meet food and other household budgets such as school fees.

- The nutrition status of children below five years remained stable**.** Communities got food supplementation for the under fives and both pregnant and lactating mothers in the district spearheaded by the Catholic Diocese of Kitui and AMREF1.

- The main source of income in the district was casual labour. Charcoal burning was on the increase and a certain portion of the population was relying on remittances for food supplies.

FEWSNET Report

ETHIOPIA Food Security Outlook January to June 2010

An estimated 5.23 million people will require emergency food assistance up to December 2010 with the net food requirement including TSF needs being 290,271 MT estimated to cost around USD. 231.3 million according to the Joint Government and Humanitarian Partners' Humanitarian Requirement Document released on 2 February 2010

- Performance of the *kiremt* rains (June to September) was below normal, particularly in Gambella, the eastern half of the country and southern lowlands of SNNPR. As a result, main season *meher* crop harvests are poor in these areas.
- Poor main season *karma/karan* rainfall in the pastoral region of Afar and northern zones of Somali region have led to poorer than usual pasture and water availability. Further deterioration is expected until the rains begin in March.
- Availability of pasture and water in the southern zones of Somali region, neighbouring lowlands of Oromia and South Omo Zone of SNNP region has marginally improved following the *deyr* (October December) rains. However, the respite will likely be short lived and households will continue to depend heavily on external assistance.
- Several areas in the eastern parts of Amhara, Tigray, Afar, Oromia and Somali regions are facing water shortages at the start of the dry season following the poor *kiremt* rains. For more information on FEWS NET's Food Insecurity Severity Scale, please see: **www.fews.net/FoodInsecurityScale Source: FEWS NET and WFP**

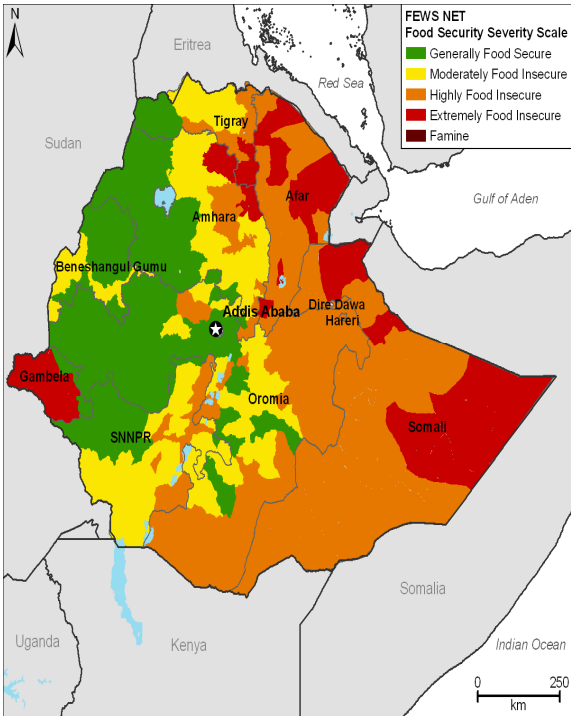
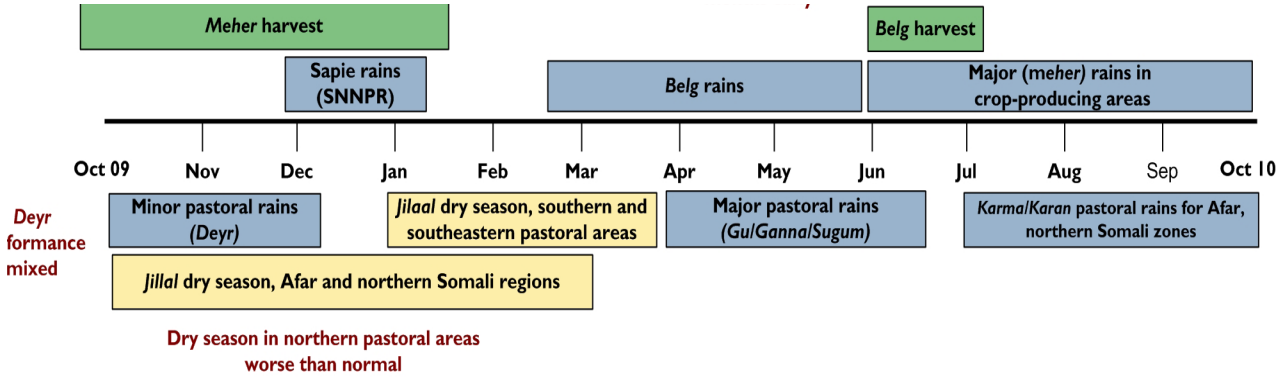


Figure 1. Current estimated food security conditions, January 2010

Seasonal calendar and critical events



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