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

Working Paper No. 4

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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Correct citation:

Kadi, M., Njau, L.N., Mwikya, J., Kamga, A. 2011. The State of Climate Information Services for Agriculture and Food Security in West African Countries. CCAFS Working Paper No. 4. Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org

Titles in this Working Paper series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

Published by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). CCAFS Coordinating Unit - Department of Agriculture and Ecology, Faculty of Life Sciences, University of Copenhagen, Rolighedsvej 21, DK-1958 Frederiksberg C, Denmark. Tel: +45 35331046; Email: ccafs@cgiar.org

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of the CGIAR and the Earth System Science Partnership (ESSP). CGIAR is a global research partnership for a food secure future.

The program is supported by the Canadian International Development Agency (CIDA), the Danish International Development Agency (DANIDA), the European Union (EU), and the CGIAR Fund, with technical support from the International Fund for Agricultural Development (IFAD).

The views expressed in this document cannot be taken to reflect the official opinions of these agencies, nor the official position of the CGIAR or ESSP.

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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 favourable 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 West 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 West Africa.

Keywords

Food security; Climate services; West Africa

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Acknowledgements

Thanks to international, regional and national institutions/organizations for availing themselves for consultations and interviews conducted in the pilot countries. Our thanks are extended to the professionals from various institutions that were interviewed by the experts conducting the study. Special thanks to the Director and Permanent Representative with WMO of Ghana Meteorological Agency (GMet), the Director and Permanent Representative of Burkina Faso with WMO and the Director and Permanent Representative of Mali with WMO for all the support provided during countries visits. We also express our sincere gratitude to experts and institutions that made contributions to the study through completion of the survey questionnaire and comments on the draft report; to Bonaventure Some (AGRHYMET Regional Centre) for material contributed; and to Mohamed Boulahya (ClimDevAfrica Programme) and Benoît Sarr (AGRHYMET Regional Centre) for their reviews of an earlier version of this report.

The study was facilitated by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) as "Host Institution" and ACMAD as the "Collaborating Institution." This work was done with the support of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) with the financial assistance of the European Union, Canadian International Development Agency, World Bank, New Zealand Ministry of Foreign Affairs and Trade and Danida and with the technical support of IFAD.

Contents

Acronyms

2iE	Education Centre of Excellence
ACCC	Adaptation to Climate and Coastal Change in West Africa
ACF	Australian Conservation Fund
ACMAD	African Centre of Meteorological Applications for Development
ACPC	African Climate Policy Centre
AESC	Architectural and Engineering Services Corporation
AEWACS	African Early Warning and Advisory Climate Services
AFD	Agence Française de Development
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
AGRHYMET	Agro-Meteorology and Hydrology Regional Centre
ARC	AGRHYMET Regional Centre
AMMA	African Monsoon Multidisciplinary Analysis
ARD	Agriculture and Rural Development
AUC	African Union Commission
BIOTA	Biodiversity Observatories West Africa
BIRD	Bureau of Integrated Rural Development
BMBF	German Federal Ministry of Education and Research
CAADP	Comprehensive Africa Agriculture Development Program
CANR	College of Agriculture and Natural Resources
CBA	community-based adaptation
CBUD	Centre for Biodiversity Utilisation and Development
CCADP	Comprehensive African Agricultural Development Programme
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CCRES	Centres for Agricultural and Environmental Research
CGIAR	Consortium of International Agricultural Research Centers
CIDA	Canadian International Development Agency
CILSS	Interstate Committee for Drought Control in the Sahel
CIMMS	Cooperative Institute for Mesoscale Meteorological Studies
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour développement
CLISS	Permanent Inter-State Committee for Drought Control in the Sahel
CMB-SE	Cattle Breeding Centres and Livestock Stations
COASem	West African Seeds Committee

CORAF	Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricole
CRM	climate risk management
CSIR	Council for Scientific and Industrial Research
CRI	Crops Research Institute
DMN, Niger	Direction Nationale de la Météorologie, Niger
DMN, Burkina Faso	Direction Nationale de la Météorologie, Burkina Faso
DNM, Mali	Direction National de la Météorologie, Mali
DONATA	Disseminating New Agricultural Technologies in Africa
DRR	disaster risk reduction
DVGs	Disaster Volunteer Groups
CAADP	Comprehensive Africa Agriculture Development Programme
ECOWAS	Economic Community in West African States
ENSA	Advanced National School of Agriculture, Senegal
EPA	Environmental Protection Agency
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
EWS	Early Warning Systems
FABS	Food and Agricultural Budgetary Support
FAO	Food and Agriculture Organization
FARA	Forum for Agricultural Research in Africa
FASDEP	Food and Agriculture Sector Development Policy
FEWSNET	Famine Early Warning System Network
GAABIC	Ghana Agricultural Associations Business Information Centre
GAPTO	Ghana Agricultural Producers and Traders Organization
GCOS	Global Climate Observing Systems
GFCS	Global Framework for Climate Services
GHF	Global Humanitarian Forum
GIEWS	Global Information Early Warning System
GIS	Geographic Information Systems
GLOWA	Global Change and Hydrological Cycle
Gmet	Ghana Meteorological Agency
GPRS	Ghana Poverty Reduction Strategy
GIZ	German Development Assistance Agency
GVP	GLOWA Volta Project
HSD	Hydrological Services Department
HYOCS	Hydrological Cycle Observing System
IAV	Veterinary Institute Hassan II, Morocco

ICPAC	IGAD Climate Prediction and Applications Centre (ICPAC)
ICRAF	World Agroforestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	information and communication technologies
IDRC	International Development Research Centre
IER	Institut d'Economie Rurale
IFAD	International Fund for Agriculture Development
IFDC	International Centre for Soil Fertility and Agriculture Development
IFPRI	International Food Policy Research Institute
IFRC	International Federation of the Red Cross and Red Crescent Societies
IFRP	International Food Relief Partnership
IGNRM	Integrated Genetic and Natural Resource Management
ILRI	International Livestock Research Institute
IMK-IFU	Institute for Meteorology and Climate Research Atmospheric Environmental Research
IMWI	International Water Management Institute
INERA	Institut de l'Environnent et de Recherches Agricoles
INRA	National Agricultural Research Institute, Ghana
INRAN	National Agricultural Research Institute of Niger
INSAH	Institute du Sahel
INTSORMIL	International Sorghum and Millet Collaborative Research Support Program
IPCC	Intergovernmental Panel on Climate Change
IPTA	innovation platform for technology adoption
IRD	Institute of Research for Development
IRI	Radio-Isotopes Institute
IRSH	Human Sciences Research Institute
ISRA	Senegal: Institut Sénégalais de Recherches Agricoles
IWMI	International Water Management Institute
KIT	Karlsruhe Institute of Technology
KNUST	Kwame Nkrumah University of Science & Technology
MCA	Millennium Challenge Cooperation
MDG	Millennium Development Goals
MESSRT	Ministry of Secondary and Higher Education, Research, and Technology
MOAP	Market Orientated Agriculture Programme
MOFA	Ministry of Food and Agriculture
MOFEP	Ministry of Finance and Economic Planning
MoU	memorandum of understanding
MRA	Ministry of Animal Resources

MSEs	micro and small-scale enterprises
NADMO	National Disaster Management Organization
NBA	Niger Basin Authority
NDVI	normalized difference vegetation index
NEPAD	New Partnership for Africa's Development
CAADP	Comprehensive Africa Agriculture Development Programme
NGOs	non-governmental organizations
NMHS	National Meteorological Services and Hydrological Services
NOAA	National Oceanic and Atmospheric Administration
NORPREP	Northern Region Poverty Reduction Program
NRGP	Northern Rural Growth Programme
ORTM	Public Radio and Television Office, Mali
PRESAO	Prévisions Saisonnières en Afrique de l'Ouest
PRONAF	Cowpea Project for Africa
PRRO	Protracted Relief and Recovery Operation
PRRO	Protracted Relief and Rehabilitation Operation
RAFiP	Rural and Agricultural Finance Programme
RANET	Radio & Internet for the Communication of Hydro-Meteorological Information for Rural Development
RCOF	Regional Climate Outlook Forum
REP II	Rural Enterprise Project Phase II
ROCAFREMI	West and Central African Millet Research Network
RRAC	Regional Centres of environmental and agricultural research
RTIMP	Root and Tuber Improvement and Marketing Programme
SADA	Savannah Accelerated Development Authority
DMC	Drought Monitoring Centre
SADC	Southern African Development Community
SARI	Savannah Agricultural Research Institute
SCARDA	Strengthening Capacity of Agricultural Research for Development in Africa
SCF	seasonal climate forecasting
SIM	Serving In Mission
SNV	Netherlands Development Organization
SOFITEX	La Société Burkinabè des Fibres Textiles
SRO	sub-regional organizations
SSA	sub-Saharan Africa
SSA CP	sub-Saharan Africa Challenge Program
TCP	Technical Cooperation Programmes
THORPEX	The Observing System and Predictability Experiment

TLF	Tamale Learning Festival
UAM	Abdou Moumouni University, Niamey, Niger
UEMOA	Union économique et monétaire oust africaine
UN-CECAR	University Network for Climate and Ecosystems Change Adaptation Research
UNCT	United Nations Country Team
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children's Fund
UNU-ISSER	United Nations University Institute of Statistical, Social and Economic Research
UNU-INRA	United Nations University Institute for Natural Resources in Africa
UNU-ISP	United Nations University Institute for Sustainability and Peace
URTEL	Union des Radios et Télévisions Libres
USAID	United States of America Agency for International Development
VBA	Volta Basin Authority
VITO	Flemish Institute for Technological Research
WAMIS	World Agro-meteorological Information Service
WARDA	West Africa Rice Development Association
WASCAL	West African Science Service Centre on Climate Change and Adapted Land Use
WCC-3	World Climate Conference
WECARD	West and Central African Council for Agricultural Research and Development
WFP	United Nations World Food Programme
WHO	World Health Organization
WHYCOS	World Hydrological Cycle Observing System
WIFA	Weather Information For All
WMO	World Meteorological Organization
WMO RA1	World Meteorological Organization Region 1, Africa

Executive summary

The expected increase in extreme events such as droughts and floods associated with climate change will have far-reaching impacts on agricultural production and food security, water resources, energy resources, health, biodiversity, and human settlement especially in Africa. Climate-risks related to crop failures and livestock deaths have caused heavy economic losses undermining food security, and these are expected to increase with climate change. This is especially true in West Africa, where more than 93 per cent of agricultural activity is dependent on erratic rainfall and thus vulnerable to droughts and disaster.

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 West 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 West Africa.

From the analysis of responses to the survey questionnaire and interviews, it was noted that at national level the NMHSs 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 (Appendices 5 and 6),
- 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.

Climate products derived from observations for agriculture and food-security decisions and management actions include: monthly climate reports, 10-day agrometeorlogical and agro-hydro-meteorological bulletins, and hydrological bulletins.

Over the last several decades, food security Early Warning Systems (EWSs) have improved the region's ability to deal with food emergencies and famine. This includes the food security assessments provided at the Regional Climate Outlook Forum, the Famine Early Warning System Network, national-level food-security authorities/commissions, and interdisciplinary working groups. In addition to early warning systems, West Africa has a host of relevant organizations that fall under categories of Climate Services Providers, Climate Service Users, Boundary or Extension Organizations, and Support Institutions. Each of these categories is detailed in the text.

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 and outputs from climate projection models for formulating adaptation 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 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 the interdisciplinary databases and undertake research for adaptation to climate variability and change.

The main gap found has been the limited effort to communicate sector specific climate information in agriculture and food security professional journals. In Mali and Burkina Faso, farmers' federation and associations requested development and dissemination of climate information in their journals that is used to communicate agricultural practices and advices.

From seasonal to multi-decadal timescales, local forecasts and scenarios are required from the climate community. Farming practices, agricultural calendars, food production models, crop

yield estimation and assessment tools, food demand, supply and 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 West Africa.

Moving forward, the following recommendations are offered:

- Capacity building to develop joint climate-agriculture research group to support operational interdisciplinary working groups, expand climate information interpretation and use to all countries of the region, improve understanding, packaging, quality and communication of information is required.
- Scientific development is required to provide local predictions at daily to decadal timescales and to deliver the downscaled climate scenarios needed to adjust agricultural calendars, estimate crop yield, food demand, supply and prices.
- Agriculture and socio-economic modelling communities are encouraged to develop, improve, or adapt existing food-system models so that they can take advantage of climate information as input.
- The climate science community should focus on research to generate climate information required to formulate or suggest actionable adaptation policies, prevent and better manage food crises, improve livelihood of farmers and cope with climate shocks.
- The adaptation science community must develop more anticipatory adaptation measures for agriculture and food security sector.
- Climate, agriculture and socioeconomic science communities are challenged to develop interdisciplinary end-to-end systems, providing climate, crop yield, food production, supply, demand, and price information required to manage climate risks in agriculture and food security.
- Agricultural development planners should further mainstream climate variability and change into agriculture and food security development programmes at national and regional levels.
- Specific climate information for the agriculture and food security sectors should be developed and disseminated via farmers' association journals.

- Regional platforms such as RCOFs for sub-Saharan Africa are keys for capacity building of scientists; service providers of the climate information and agriculture communities and other end users should be enhanced.
- Meteorological services should be better positioned to provide climate services to all climate-sensitive stakeholders and, particularly, to ministries of agriculture and food institutions.
- High-speed Internet connectivity and acquisition of computers is recommended for efficient downloading of data and information as well as for processing and timely dissemination of climate information products and early warning information.

Introduction

An increased in extreme climate events such as floods and droughts will have far-reaching impacts on agricultural production and food security, water resources, energy resources, health, biodiversity, and human settlement especially in Africa. It will impact heavily on the poor, who depend on agriculture for their livelihoods and have a lower capacity to adapt. Climate-risks related to crop failures and livestock deaths have caused heavy economic losses undermining food security, and these are expected to increase with climate change. Feeding the projected increasing population will require a radical transformation of agriculture, growing more food without exacerbating environmental problems and simultaneously coping with climate change.

Since the late 1990s, climate products including statistical parameters from historical data and predictions outputs have been used to inform agriculture policies, plans and practices. Many countries or regions have developed food security outlooks and famine early warning systems based on climate products and services to manage increasing climate risks. Even though some countries, mainly in the developed world, are able to anticipate some climate events along with related food production and price changes several months in advance, most developing countries still face low crop yields and unforeseen fluctuations in food production and prices due to climate variability and change. In an attempt to better define activities to address these problems, an assessment of the current climate information, products and services available to improve agricultural production and increase food security is necessary.

More than 93 per cent of agricultural activity in West Africa is dependent on erratic rainfall and thus vulnerable to droughts and disaster. In guarding against climate shocks, and in order to enhance livelihood resilience, it is imperative that foundations are laid for responsive, adaptive agricultural technologies and policies that help communities reduce their vulnerability to climate variability, while at the same time paving the way for the successful climate risk management (CRM). To inform this action, a new initiative is needed to integrate and apply the best and most promising approaches, tools and technologies emerging from numerous disciplines.

Despite the fact that relatively reliable climate information and products have been available since the late 1990s, farmers seldom use such products for farm-level decision-making

(Hansen, 2002; Hammer et al., 2001). This is mainly due to lack of adaptability of the information to local conditions, and due to difficulties in accessing the information on time and in a format that decision makers can easily understand. To address this, the current study seeks to narrow this gap through inventorying various climate information types, formats, and modes of dissemination from various regional and national actors.

Seasonal climate forecasting (SCF) is one of many risk management tools that play an important role in agriculture and food security decision-making. Agrawala et al. (2001) has decried the fact that only a few examples of SCF are being used successfully by vulnerable groups, despite international efforts to improve societal responses. However, dialogue between producers of information, researchers and different categories of decision makers has been enhanced the use of SCFs through regional climate outlook forums (RCOFs). The dialogue has promoted the development of regional initiatives focusing on agriculture and food security – for example, the "Regional Partnership Compact for the Implementation of the ECOWAS Regional Agricultural Policy and the Comprehensive Africa Agriculture Development Programme" (ECOWAP/CAADP) that was signed on 12 November 2009 at the International Conference on Financing Agricultural Policy in West Africa.

This study makes an inventory of types and formats of climate information; assesses current climate services, including how they 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 West Africa. Apart from bridging the gap between producers and users of climate information and products, the report synthesizes relevant knowledge, identifies promising initiatives, and clarifies areas where CCAFS may be involved in adding value.

Conceptual and Methodological Framework

This chapter articulates a conceptual framework for engaging with organizations and in gathering the data and other information involved in this study. Further information on the sorts of information gathered, and the sources from which this information was gathered, are presented in Appendices 1-6. More information on specific examples of climate products that are currently used in the region is included in Appendix 7a-c.

Climate information useful for 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 communities, 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 subregional 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 Global Framework for Climate Services. 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 can be improved using the multidisciplinary approaches established in the member countries of the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS).

Identification of providers and users

The climate information products and services providers are organization established as regional and 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.

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 that processing 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). Organisations such as AGRHYMET, ACMAD and the NMHSs are considered producers or providers of this climate information products and services while developmental organisations such as FAO, AGRA, WFP, FEWSNET, USAID, ILRI, CGIAR, ICRISAT play a double role as users and producers. A boundary organization is an 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 organisation to reach various user communities in the countries have been documented to some extent.

Methodological Approach

The scoping study began with a literature review and an analysis of organizational web sites to determine issues and organizations involved in the production and use of climate information products and services in agriculture and food security in West Africa. This was followed by visits and interviews that assessed current climate services and identifies needs. To this end, three experts visited four of the five pilot countries (Mali, Burkina Faso, Ghana and Niger) and, in addition, contacts were made with scientists in various fora including WMO RA1 meeting in Morocco.

Questionnaire

ACMAD prepared and circulated a questionnaire (Appendix 1) to carry out the survey on existing climate information products and services. These questionnaires were sent to providers (mostly NMHSs and regional institutions) and different users in the agriculture and food security sector in the pilot countries (Niger, Mali, Burkina Faso, Senegal and Ghana) in West Africa.

The total number of survey questionnaires disseminated to various institutions was 186, with the first response received on 17th October 2010 and more responses submitted to ACMAD by the end of October 2010. ACMAD requested partners to make a contribution by completing and circulating this survey questionnaire as widely as possible to the providers and users of climate information products and services familiar to them.

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 the kind of information that each organization produces, how they use this information, and the limitations and opportunities for improvement that they experience. The responses were analysed, while noting the distinct roles of climate services by provider institutions, climate user communities and boundary/extension organizations including the existing support institutions and initiatives. Because responses were not plentiful, efforts were made to approach individuals at the institutions with view to improving the response numbers.

Analysis of responses to the questionnaire was instrumental in preparing relevant sections of the report. Limitations and opportunities for improvements are captured within recommendations in the report. All partners who contributed by completing the survey questionnaire and others who made this important scoping study successfully completed have been acknowledged in the CCAFS Scoping Study final report.

Consultations, visits, interviews and web sites

Organizations in four pilot countries (Ghana, Burkina Faso, Mali and Niger) were selected. Visits were conducted in these organizations for face-to-face interviews and/or focus group discussions with experts in November and early December 2010. The visits involved the discussions, consultations and interviews with institutions/programs/projects professionals on climate products related to agriculture and food security. Workshops and meetings offered additional

opportunities for discussions and the distribution of the questionnaire. Together, the interviews and visits formed a major part of this study report. Institutions and professional interviewed are as in Appendices 2 and 3. Prior consultations with pilot countries heads of NMHSs were made during the WMO Regional Association meeting in Marrakech (29 to 30th October 2010).

Inventory of Climate Services

Through the conference declaration, 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, established a Global Framework for Climate Services (GFCS) 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 users' 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, climate prediction science must be accorded an important part in organizing beneficial climate services.

The effective implementation of the Global Framework for Climate Services is expected essentially to lead to widespread social, economic and environmental benefits through more effective climate risk management and increased capacity for adaptation to climate variability and change. To improve the delivery of tailored climate information products and services, it is imperative to make an inventory of the existing categories and types of climate information and services as well networking for future collaboration (Appendix 4)**.** The following subsections provide a review and details on climate information and services.

Categories and types of climate information and services

From the analysis of responses to the survey questionnaire and interviews, it was noted that at national level:

- The NMHSs provide climate information which includes observations, analysis and forecasts at short-range, medium-range, and long-range for various sectors decision making.
- The most basic and simple type 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 (Appendices 5 and 6),
    - 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.

In situ observational network is quite sparse in the region; hence satellite information is being used to derive additional estimates of climate parameters particularly in areas without *in situ* observing stations. These observed and estimated data are being used to process derived parameters for use in crop-water balance calculations.

Climate products derived from observations for agriculture and food-security decisions and management actions (Appendix 7) include:

- monthly climate reports;
- 10-day agrometeorlogical and agro-hydro-meteorological bulletins; and
- hydrological bulletins.

It was noted that most NMHSs provide such products, but there was expressed need for further standardization and upgrading of the production process for agriculture and food security.

It was found that:

- Disaster managers require forecasts of frequencies of heavy rainfall, high winds, sand and dust storms, number of consecutive days with very high or low temperatures to draw hazards risk maps, and
- Farmers need to know frequency of extended dry spells, rainfall onset and cessation periods to make decisions.

It was noted that the threshold values of climate parameters for impacts have not been well established and are required to assess vulnerability, develop contingency and operating plans for agriculture and food organizations. Historical rainfall datasets can help to detect areas vulnerable to floods for use by disaster managers, as they have not been fully exploited to establish return periods. Some users would require products derived from a combination of several basic climate and environmental observations such as ENSO indices for seasonal forecasting, water satisfaction index for plants or heat index and animal comfort index. To prevent and get prepared in advance for climate shocks, organizations and individuals need predictions days, weeks and months ahead. These are produced by forecast models, or tools used to process observations from different types of sensors and to generate climate parameters representing an expectation of a future state of the climate. Weather forecasts, along with monthly and seasonal climate forecasts (Figure 1), are examples of such products.

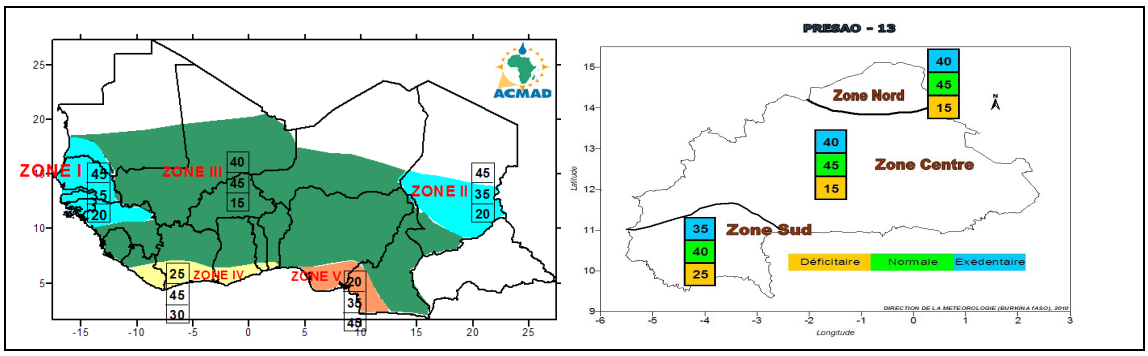

Figure 1: Seasonal forecasts of precipitation for July-August-September (JAS) 2010: (a) over West Africa, Chad and Cameroon and (b) downscaled for Burkina Faso.

These products are becoming important inputs to policy and decision-making in climate-sensitive sectors including agriculture and food security. For example, given the observed

year-to-year variations in monsoon rainfall (Figure 2), seasonal forecasts are becoming useful for adjustment of agricultural calendars, initially developed based on past climate conditions.

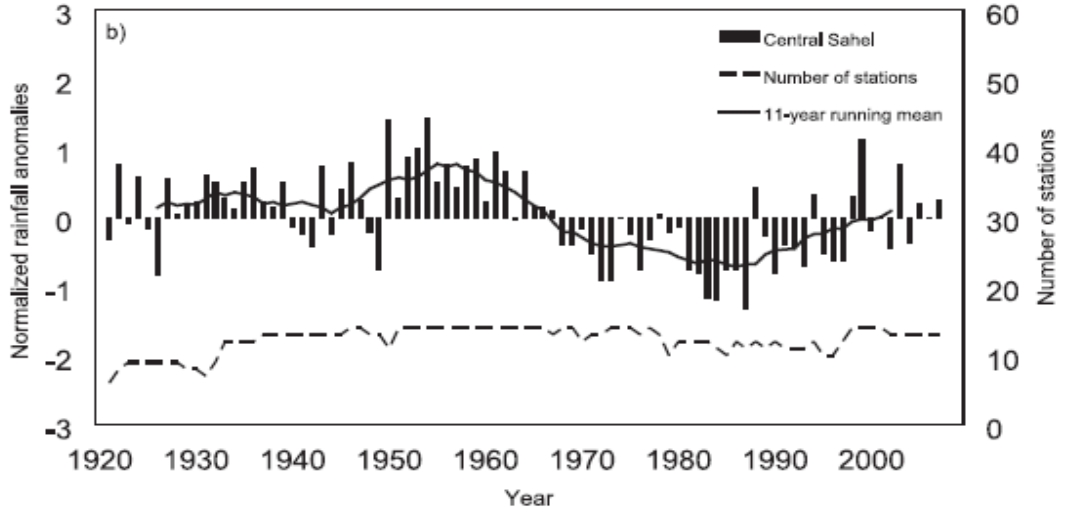

Figure 2: Normalized index of precipitation anomalies over central part of the Sahel in West Africa for June-July-August-September 1921-2007. The solid curve is the 11-year running mean and the dashed curve indicates the number of stations used every year to calculate the index.

With the increased awareness on climate change and its effects on environment, societies and economies, long-term projections are also made to provide scenarios of plausible changes on future climate. Projected climate datasets produced with complex General Circulation Models have started to be used to assess impacts of warming on agriculture. Research on crop varieties that can withstand a shorter or longer rainy season or a 2-to-4 degree increase in temperature, including changes in the frequency and intensity of extreme temperature and rainfall during the coming decades rely heavily on the use of climate projections. Climate observations and related statistics, indicators and indices, predictions and projections, assessments, reports, statements, atlases and bulletins are produced by a network of national, regional and global climate centres and institutes under the overall leadership of the World Meteorological Organization.

Review of Food Security Outlooks and Early Warning Systems

It is widely recognized that the West Africa Early Warning Systems (EWSs) for food security have contributed in the last twenty years to better face famine emergencies (Genesio et al. 2010). The improved understanding of the environmental and socio-economic dynamics of

the region, change in the causes for food insecurity and the evolution of Information and Communication Technologies (ICT) have favoured the introduction of new approaches and the involvement of a network of stakeholders. There are more and better capacity-building workshops in the region for smooth integration of EWSs within sectorial decision-making processes, such as agricultural production, food security, water resource management and disaster risk management.

Farm-system models that incorporate details of soils, crops and management options have been developed for application in crop monitoring (Hammer, 2000). Integrated seasonal climate forecasts into food security assessment are being made at the sub-regional level by *regional climate outlook forums* (RCOFs), particularly PRESAO jointly organised by ACMAD and the food security stakeholders.

The *Famine Early Warning System Network* (FEWSNET) and the *UN Food and Agriculture Organization* (FAO) use seasonal climate forecasts for integrated early warning systems and have played a major role in the food security outlooks in the region.

Some countries (mostly Sahelian countries that are members of the Interstate Committee for Drought Control in the Sahel) provide comprehensive technical reports on the observed climate, water, agriculture, food situation including prices with advices and recommendations to decision makers and farmers through operational *interdisciplinary working groups* or early warning systems.

National-level food-security authorities/commissions were identified in Mali, Ghana and Burkina Faso. In Niger, the national early warning system is attached to the prime minister's office. They organize field surveys and meetings with all national and international stakeholders involved in food security related activities to analyse available information and propose policies and decision options to governments. Focused reports and bulletins are made by agriculture and food sector. These documents present climate conditions, describe natural resources that support agriculture and discuss food security situation at national and regional levels. The Famine Early Warning System (FEWSNET) in West African regional and country offices issue such reports (Appendix 7d).

Institution Profile

Climate Information Providers

The relationship between providers and users of climate information products and services is determined to a great extent by the level of services in the provision of tailored climate information products and services. However, the provision of sector-specific tailored climate information products and services remains a major challenge to the providers in meeting increasing demand for these products.

There is a need to document institutions profiles for networking and partnership. Below, we identify institutions, programs, projects and special groups, organizations and communities actively involved in production and/or utilization of climate information for regional, national and where possible farm level decision making for agriculture and food security in the countries as presented below. However, it is important to note that a country like Ghana has enormous number of institutions, projects and programs. As such, the study lists only the most relevant organizations.

Burkina Faso

DNM – Burkina Faso

The *Direction Nationale de la Météorologie* (DMN) is a government institution under the directorate general of civil aviation.

Activities: agro meteorological monitoring during the cropping season; Preparation and dissemination of agro meteorological bulletins; Development of agro meteorological databases; Cooperation with regional and international institutions in meteorology, agriculture and food security and Contribution to agro meteorological and hydrometeorlogical research studies.

Products: The DMN supports the agriculture and food security through provision of the following climate information products:

- 10-day agrometeorological bulletin,
- Monthly climate watch,
- Climate data and related statistics, and

- Seasonal forecast bulletins.

Ghana

GMet

The Ghana Meteorological Agency (GMet) was created in 1957 to provide national meteorological services and recently became an Agency.

Mission: To provide efficient weather and climate services by collecting, processing, archiving and disseminating meteorological information to end-users.

Activities: Provision of weather and climate information on individual basis to farmers, research institutions, private and public agencies where charges for services provided are levied dependent upon the nature of the information being sought and whether it is required for profit making, giving early warning forecasts of changing weather conditions e.g. imminent storm, wind gust and hurricanes, provision of Agro-meteorological information, provision of advisory services to the general public on environmental issues and offering consultancy services in the field of meteorology.

Products: Weather Reports, Rainfall forecast (daily, monthly, seasonal climate including number of rainy days, rainfall intensities, return periods and patterns), Agrometeorological Bulletin, Eco-Climate, Expert Weather Advice on Bird sanctuaries, Evapotranspiration and data on Evaporation, Humidity, Sunshine Duration, Wind Speed/Direction, Temperature, Cloud Cover and Height, Sea Surface Temperature, Radiation, Thunderstorms/Lightning, Windstorms (Squalls), Soil/Earth Temperatures and Visibilities.

Mali

DNM – Mali

The *Direction National de la Météorologie* (DNM) of Mali or Malian Meteorological Services is a government institution under the ministry of transport.

Mission: Observe, monitor and predict weather and climate in the country.

Activities: Development and management of meteorological observing network; Participation to the world weather watch; Monitoring of international cooperation in meteorology; Contribution to natural disaster prevention and management**;** Development and provision of

weather and climate forecasts for public and private stakeholders; Implementation of applied climatology studies**.**

Products: 10 day agro-meteorological bulletin; Monthly climate watch; climate data and related statistics; Seasonal forecast bulletins from May to October; Forecasts of monsoon onset and withdrawal; Weekly climate outlooks and related weather forecast from April to November; and Guide for agricultural practices.

Niger

AGRHYMET

The AGRHYMET Regional Centre (ARC) is a specialized institute of the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS), created in 1974 as an interstate public body.

Mission: to contribute to food security, desertification control and water management and control in the Sahel by building the capacities of national institutions, producing and disseminating information to policy makers and other users. Specifically, the ARC mandate is**:**

- Data collection, processing and information dissemination on food security, natural resource management, water control and desertification control across the Sahel,
- Development of decision support tools to meet the Sahelian populations' development needs,
- Technical capacity building trough training and transfer of the tools, methods and know-how adapted to the Sahelian countries in the fields of climatology, agrometerology, hydrology, crop protection, geomatics and remote sensing.

Activities: ARC has national AGRHYMET Components (NACs) based in the nine (9) countries of CILSS. The NACs are for services in agriculture, meteorology, water resources, forestry, livestock, plant protection, water engineering, the environment and NGOs. These services constitute intermediaries in the system for collecting, processing, disseminating and using information produced by the ARC.

Products: Monthly bulletin on seasonal crop monitoring and food situation, special decision makers' bulletin, Interpretation of seasonal climate forecast in agriculture, special desert

locust bulletin, map of normalized difference vegetation index (NDVI) and assessment and monitoring of the vegetation, rainfall estimates, successful sowing dates monitoring, crop water requirement satisfaction index, estimated millet grain yields, mapping risk zones, crop, pastoral and phytosanitary monitoring and mapping and an Atlas (*Climat et changements climatiques en Afrique de l'Ouest (2007), Club du Sahel et de l'Afrique de l'Ouest / OCDE, Division de l'Environnement, des Changements Climatiques et de la Bioénergie / FAO Centre Régional AGRHYMET/CILSS CEDEAO*).

ACMAD

The African Centre of Meteorological Applications for Development (ACMAD) serves the Weather and Climate needs of the 53 countries of the African continent. It was created in 1987 by the Conference of Ministers of the United Nations Economic Commission for Africa (UNECA) and the World Meteorological Organisation (WMO). ACMAD has been operational since 1992.

Mission: Provision of meteorological, climate and environment data and products for sustainable socio-economic development in Africa.

Activities: Its primary activities are: data collection and analysis; issuing reliable and timely weather and climate information and predictions products; preparation and dissemination of climate watch bulletins and tailored early warning advisories for agriculture, health, water and energy resources management, including climate disaster risk reduction (DRR) through existing networks; monitoring climate variability and climate change impacts and vulnerability assessments; strengthening the human capacity of the member states; and the coordination of climate information for development projects and community based radio internet (RANET) and Weather Information For All (WIFA).

Products: ACMAD in collaboration with NMHSs, international institutions and development partners organize the regional climate outlook forum (RCOF), the PRESAO for 18 countries (16 West Africa countries, Chad and Cameroon) which is held in May-June before onset of rains to release the season climate consensus forecast for the July-August-September rainfall over the Sahel, annual state of climate in Africa report, bulletins (Monthly Climate Watch, Monthly Climate and Health, 10 day (Dekadal) bulletins, weekly climate outlooks, daily

weather forecasts, high impact weather, IFCR 3 – day Climate Risk, Alerts and bulletin special for disaster risk reduction).

The Centre in collaboration with partner institutions is running the following projects**:**

- **ACMAD-NBA project:** Niger Basin Authority (NBA)-ACMAD Hydrological forecasting and climate projections projects on the Niger River Basin covers nine (9) countries; Guinea Conakry, Mali, Niger, Nigeria, Cote d'Ivoire, Burkina Faso, Benin, Chad and Cameroon. The basin is a shared resource calling for sustainable development through an integrated management of water resources and related eco-systems, for the enhancement of the living conditions and the prosperity of the population. The River Niger is a source of livelihood for the people of these countries, particularly in terms of river transport, energy, fishing, farming, domestic and industrial use. For development and preservation of the eco-system and the socio-economic infrastructure around the basin weekly to seasonal rainfall forecast over the catchment are necessary for the management of water throughout the year. Thus in summary the ultimate beneficiaries are the men and women engaged in activities contributing to development, including those related to water resources management, Agriculture, livestock and fisheries and Relief operations. The target groups are meteorological and hydrological services and national organizations in charge of the management of basin resources and research communities who have their research interest within the basin.
- **ClimDevAfrica:** The Climate for Development in Africa (ClimDevAfrica) is a joint initiative of the African Development Bank, the Commission of the African Union and the United Nations Economic Commission for Africa, 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 not well developed. 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" programme from 2010 to 2012 coordinated by ACMAD as the Executing Agency in close partnership with the Global Humanitarian Forum (GHF) and the Climate Centres specific to each regional economic community such as the CILSS-ECOWAS Agro-meteorology and Hydrology Regional Centre (AGRHYMET), the IGAD Climate Prediction and Applications Centre

(ICPAC), the SADC Drought Monitoring Centre (DMC) and the GHF Weather Information For All initiative (WIFA). The goal of this component is to ensure that reliable, useful and useable climate- related data are generated and made widely available to policy-makers, policy support organizations and the general population in the Continent.

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.

- **AEWACS project:** "African Early Warning and Advisory Climate Services (so called *ViGiRisC* Project)" focus is adaptation of African countries to climate variability and change by delivering Early Warning Systems, on the following thematic areas;
    - Food security: rainfed agriculture and pastoralism, over West Africa,
    - Water resources and risks associated with river flow (Congo, Niger, Volta…),
    - Health: malaria, meningitis or other diseases,
    - Coastal zone civil protection: high tides and sea swell, severe waves, and
    - High impact weather phenomena (drought, floods, high precipitations, strong wind, etc.).
- **RANET-Africa Programme:** The focus of RANET is to bring support in the collection of meteorological data and dissemination of vital information to community in remote areas in Africa by combining modern technologies such Internet, mobile phones, automatic weather observing stations and satellite.
- **WIFA Project:** Is an African-led initiative to improve access to *in situ* weather and climate observations throughout Africa. It focuses on assisting NMHSs by strengthening 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 to

quantify costs and benefits of investment in NMHSs by demonstrating social and economic value of the services provided.

WIFA works through an extensive network of partners and collaborators to achieve its objectives and aims to avoid duplication of effort by working closely with development organizations, in particular the AfDB and World Bank, and with programmes such as Global Climate Observing Systems (GCOS), which have a mandate to improve climate networks, and research activities, such as *THORPEX-Africa*, which aims to demonstrate the benefits of better observations and prediction systems, and *VigiRisC*, which generally aims to prevent the adverse impacts of climate change and variability.

With ACMAD leadership, the cooperation of the sub-regional Climate Centres, WMO, and civil society partners, WIFA will work closely with all of the NMHSs in Africa that need assistance to improve their meteorological observing networks and demonstrate the value of these improvements.

The Niger Basin Authority (NBA)

The Niger Basin Authority (NBA) with 9 member states: Benin, Burkina Faso, Cote d'Ivoire, Guinea, Mali, Niger, Nigeria, Chad and Cameroon, located in Niger was created on 21st November, 1980 by Faranah (Guinea) convention.

Objectives: To promote cooperation among the 9 member states: Benin, Burkina Faso, Cote d'Ivoire, Guinea, Mali, Niger, Nigeria, Chad and Cameroon and to ensure an integrated development of Niger Basin in areas of hydropower generation, agriculture, animal rearing, fisheries and fish farming, forest exploitation and sylviculture, transports and communication and industry.

Activities: Conducting studies and projects aimed at developing integrated development plan of the Basin, Provision of information to improve efficient management of the water resources in line World Hydrological Cycle Observing System (WHYCOS) and Building capacity through provision of technology and training to monitor hydrological parameters (rainfall, river flow and evaporation) in the Niger River basin.

Products: Long time series of rainfall, river flow and evaporation data and Niger HYCOS Monthly bulletin.

DMN-Niger

The *Direction Nationale de la Météorologie* (DMN), Niger was created in 1961, under the Ministry of Transport.

Mission: To Facilitate Accessible Meteorological Information and Services, to Ensure the Safety of Persons and Properties and Infusion of Scientific Knowledge to Spur Socio-economic Growth and Development.

Activities: Implement a system for collecting, concentrating, processing, preparation, archiving and dissemination of data enabling it to perform its duties; ensure the management and operation of networks of meteorological observations and telecommunications, to promote research and meteorological applications, especially in the areas of global climate change and environmental protection; monitor regional and international institutions dealing with weather issues, located in Niger and contribute to food security in the management of natural resources and environment. The DMN-Niger RANET program initiated by ACMAD is to transmit the weather and environmental information to rural community. The DMN Niger is managing an observational network of stations consisting of 15 synoptic stations; 3 agro-meteorological stations; 45 climatological stations and 650 rainfall stations.

Products: The Directorate provides weather and climate information products and services for agriculture and food security, health, water and energy resources management including climate disaster risk reduction (DRR). Its main products and services are**:**

- a daily weather forecast,
- a TV weather (rainy season),
- 10-day climate bulletin,
- seasonal rainfall forecast,
- agro-hydro-meteorological dekadal bulletin, and
- special bulletin for policymakers (twice during the crop year)

Senegal

DMN - Senegal

The *Direction Nationale de la Météorologie* (DMN) of Senegal is a government institution, which became a National Meteorological Agency (*Agence Nationale de la Météorologie du-Sénégal (ANAM))* in 2008.

Mission: monitoring the atmosphere, the ocean surface, predict trends and disseminate relevant information.

Activities: Data processing, forecasting, archiving and dissemination ensuring management and maintenance of the meteorological observation network; coordinate and harmonize meteorological observation made by other agencies, parastatal or private sector; participation in research and development activities in the national, regional and international programs for improved understanding and knowledge of atmosphere interactions with environmental and human activities, Contribution to natural disaster prevention and management; development and provision of weather and climate forecasts for public and private stakeholders; Maritime and aviation services; and applied climatology studies.

Products: Dekadal (10-day) agro meteorological bulletin; monthly climate watch; climate data and related statistics; seasonal climate forecast bulletins; forecasts of monsoon onset and withdrawal; weekly climate outlooks, weather forecast and maritime forecasts.

Climate Services User Community

Agriculture is the economic mainstay and major employment sector in West Africa**.** The occurrence of extreme climate events such as floods and droughts has severe impacts on the agricultural yield, survival of livestock and marine ecosystems. This in turn impacts heavily on food security often resulting to hunger, malnutrition, diseases and loss of life. 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 programmes for sustainable agricultural development. There are some examples integration of climate information in development as being practised by agricultural communities in Mali. Groups and communities in the sub-region are evidently working hard with various institutions' financial and technical support for 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 as demonstrated in this scoping study is extremely encouraging.

Burkina Faso

SOFITEX

The SOFITEX is a semi-private partnership of the Burkina Faso government and the French textile industry that purchases, processes, and exports cotton. The export agriculture has enabled Southwest farmers to have far greater access to technology, inputs and credit, which are channelled through SOFITEX. Because of the importance of cotton to international trade, farmers of the Southwest have been better served by agricultural extension than have other areas. The climate variability is one of the factors affecting the farmers' crop yield. However, farmers in Burkina Faso have broad perception of climate variability, including more frequent water-deficit-years, late onset of the rainy season, premature cessation of rains and anomalous rainfall distribution and their interest has been demonstrated by active participation at the annual regional climate outlook forum (RCOF), the Prévisions Saisonnières en Afrique de l'Ouest (PRESAO) for 18 countries (16 West African countries, Chad and Cameroon).

OXFAM - Burkina Faso

OXFAM is among the leading aid and charity organizations. It is a confederation of nongovernmental organization working in 99 countries including Burkina Faso. Among issues addressed by OXFAM are: prevention of damages to the environment, gender inequality, capacity building on management of natural resources to improve livelihood of the poor.

In Burkina Faso, OXFAM works with farmer associations to combat famine by developing and implementing education, advocacy, livelihoods and vulnerable livelihood programmes. Partnerships are established with local communities to support smallholder farmers with information on rainfall, floods and droughts. OXFAM helps to respond to crisis by building relief infrastructure, providing cash for work, rehabilitation work, seeds distribution, training for risk reduction. Seasonal forecasts are a major input into OXFAM Burkina's strategy to empower community by increasing their resilience to climate shocks.

CIRAD

Centre de Coopération Internationale en Recherche Agronomique pour développement (CIRAD), is the French Agricultural Research Centre for International Development working with developing countries to tackle international agricultural and development issues in

partnership with other institutions such as 2iE which uses climate data for hydrological scenarios generation for various horizons.

INERA

Institut de l'Environnent et de Recherches Agricoles (INERA) is an organization whose functioning is based on Department, with its central support services having Regional Centres of environmental and agricultural research (RRAC). These structures are the venues for operational research activities for main users: producers, extension structures, NGOs, projects and programs. A total of five regional centres for agricultural and environmental research (CRRES) were created and distributed according to agro-ecological zones of the in Burkina Faso. These centres include:

- CRRES Centre, headquarters Saria (Koudougou),
- CRRES East, seat Kouaré (Fada-N'gourma)
- CRRES Northwest, seat Di (Tugan)
- CRRES West seat Farako-Ba (Bobo-Dioulasso) and
- CRRES Sahel (North), seat Katchari (Dori)

Ghana

FARA

The Forum for Agricultural Research in Africa (FARA) is an organization bringing together and forming coalitions of major stakeholders in agricultural research and development in Africa. The vision of FARA is for African agriculture to become vibrant and competitive in the international market, growing at a rate of at least 6% per annum by the year 2020 (FARA, 2007). FARA aims to enhance and add value to the effectiveness and efficiency of agriculture research systems in Africa that will contribute to agricultural development, economic growth and sustainable use of natural resources. It also complements the innovative activities of national, international and sub-regional research institutions to deliver more responsive and effective services to its stakeholders.

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 Programme (CAADP), involving agricultural research, technology

dissemination and uptake. FARA (2007) identified five (5) programs to enhance continental impact on livelihoods and economic development.

- A framework for reform and investment in agricultural research and harmonization of actions and actors of ARD in Africa,
- A new innovation systems approach to Agricultural research for development, i.e., the Sub-Saharan Africa Challenge Programme (SSA CP),
- Address the priority weaknesses in capacity building that constrain the effectiveness of Sub-Saharan Africa NARS, i.e. Strengthening Capacity of Agricultural Research for Development in Africa (SCARDA),
- Immediate applications that can make a difference and restore credibility in agricultural development, i.e., Disseminating New Agricultural Technologies in Africa (DONATA). A tool on the innovation platform for technology adoption (IPTA) is used to promote technology and best-bet practice innovation. The IPTA is a collective action tool and was validated by FARA, SROs and NARS, and som CGIAR Centres in order to promote technology and best-bet practice adoption in Africa.
- African stakeholders better able to learn and contribute to global knowledge exchange on agricultural science and development, i.e., Regional Agricultural Information and learning Systems.

These programs respond to FARA's primary functions, which are advocacy of the role of agricultural research, promotional of functional partnerships, and accelerating sharing of knowledge (FARA, 2007). The major donors of FARA are: The African Development Bank, the Canadian International Development Agency (CIDA), European Commission, the Governments of the Netherlands, United Kingdom, Germany, Ireland, Italy, France, the Consultative Group on International Agricultural Research (CGIAR), the Rockefeller Foundation, Bill and Melinda Gates Foundation, the World Bank and the United States of America Agency for International Development (USAID).

GAPTO

The Ghana Agricultural Producers and Traders Org. (GAPTO) is a non-governmental involved in the agricultural marketing system in Ghana and West Africa Sub-region. Promotes the principle of total quality management in the provision of the various marketing functions and aims to provide effective leadership by gathering all producers and distributors under one ethical group to provide a

common front for addressing the issues of transportation, storage, processing, credit facilities, market information, socio-economic factors, and the supply of farm inputs. GAPTO has committed itself to continuously monitoring consumer needs, market trends, identifying areas of glut and scarcity and also collect, compile, analyse, store and disseminate market information for end-users and make appropriate recommendations to members and other stakeholders. They have tried to maintain the highest standards of business ethics and personal integrity, participation in civic activities as well as striving to advance the growth and welfare of the members and communities they serve.

NADMO

The National Disaster Management Organization (NADMO) was established by Act 517 of 1996 to manage disasters and similar emergencies in the country. NADMO functions under a National Secretariat with ten (10) regional secretariats, one hundred and thirty eight (138) metropolitan, municipal and district secretariats and nine hundred (900) zone offices throughout the country. NADMO mission is to manage disasters by coordinating the resources of government institutions and non-governmental agencies and developing the capacity of communities to respond effectively to disasters and improve their livelihood through social mobilization, employment generation and poverty reduction projects.

NADMO has Technical Advisory Committees of experts at the National, Regional and District levels drawn from the Ministries, Departments and Agencies, Public Institutions and individuals requisite expertise and proven experience. These committees are tasked to draw disaster management plans and advice on the mode of implementing programmes and projects appropriate for hazards/disaster types. The National Technical Committees to deal with various disasters are:

- Fires and Lightning disasters committee (bush/wildfires, domestic and industrial fires and lightning),
- Pests and insects infestation committee (armyworm, anthrax, black fly, locust, larger grain borer),
- Geological disasters committee (earthquake, tsunamis, gas emissions and landslides),
- Hydrometeorological disasters committee (floods, windstorms, rainstorm, drought and tidal waves),
- Disease/epidemic disasters committee (cholera, yellow fever, cerebrospinal meningitis (CSM)),

- Man-made disasters committee (social conflicts, collapse of buildings, mines, aviation, marine, and railway disaster, dam burst and oil spillage etc.),
- Radiological disasters committee,
- Relief and reconstruction committee.

The Regional and District Technical committees are:

- Natural disasters committee, and
- Man-made disasters committee.

NADMO has recently shifted its focus from disaster management to disaster risk reduction in order to minimize man-made disasters. NADMO has made efforts to promote risk reduction that include the establishment of the journalists club for Disaster Prevention and the holding of the workshops and seminars to educate the public on the subject. Appeal has been made to the citizenry to focus on the preventive aspects of disaster to avoid the loss of lives and property. Ghana, has adopted Disaster Risk Reduction Strategy as a way of preventing and mitigating the effects of all human-induced and natural risks including climate change. NADMO also provides resources to its Technical Advisory Committees, to make them more vibrant and effective as well as ensuring that the national, regional, metropolitan, municipal and district platforms for disaster risk reduction ran effective programmes in their communities.

NADMO in discharging its functions coordinates with all the collaborating institutions, NGO Consortium, Voluntary organizations etc. The Disaster Volunteer Groups (DVGs) have been formed in communities to assist in fighting disasters. They are mobilized; trained and motivated through income generation activities especially in the area of agriculture to enable them remain in their communities**.** NADMO has secured an UNDP-Bureau for Crisis Prevention and Recovery and FAO (UN) grants to help improve livelihoods of vulnerable communities through income generation and improvement of social infrastructure in some selected communities in the northern part of Ghana.

NADMO Preventive &Mitigating Measure includes nation-wide preparedness for example in Flood Preparedness NADMO has put in place measures aimed at minimizing the intensity of floods and also for rapid and effective flood response. These include:

- Risk identification,
- Public Education/Sensitization,
- National Pre-Flood Clean-Up-Campaign?
- Capacity Building for NADMO,
- Identification of Causes of Floods,
- Building DVG's Capacities,
- Improvement of Livelihoods,
- Acquisition of Flood Machinery, and
- Clearing of Waterways.

NADMO has an operational office manned 24 hours linked to all 10 Regional offices. It also links up staff and collaborators by radio, telephone and facsimile system for exchange of information.

MOFA

The main goal of the Ministry of Food And Agriculture (MOFA) is to create an environment for sustainable growth and development in the Agricultural Sector.

MOFA's Mission is to promote sustainable agriculture and thriving agribusiness through research and technology development, effective extension and other support services to farmers, processors and traders for improved livelihood. Based on the role of agriculture in the national development framework, the objectives for the food and agriculture sector policy are as follows:

- Food security and emergency preparedness,
- Improved growth in incomes,
- Increased competitiveness and enhanced integration into domestic and international markets,
- Sustainable management of land and environment,
- Science and Technology Applied in food and agriculture development, and
- Improved Institutional Coordination

The projects in MOFA include:

- **Northern Rural Growth Programme (NRGP)** supervised by MOFA and whose overall goal is to achieve sustainable growth in agricultural and rural livelihoods and food

security for the rural poor in northern Ghana from 2006-2010. The specific objective is to develop remunerative and inclusive agricultural commodity value chains,

- **Northern Region Poverty Reduction Program (NORPREP) duration** 30th January 2004 to 31st March 20122 is supervised by Ministry of Local Government and Rural Development. The overall goal of the project is to improve the livelihoods and living conditions of poor rural communities, with emphasis on women and other vulnerable groups, through deepening and broadening rural development services and community and individual self-help capacity. Specific objectives are to:
    - Build the capacity of decentralized local government, civil society and community organisations to better respond to the needs of the poorest strata of the rural population;
    - Improve access to resources and services by the large rural population, especially women; an
    - Introduce operational changes and reforms needed to enhance the efficiency and sustainability of the institutions and community service providers in the Northern Region
- **Pro-Poor Agricultural & Development Policies and Advocacy** Project duration October 2007 – 2010 supervised by MOFA is aimed at improving coordination, harmonization and prioritization of agricultural and rural policies. It seeks to achieve further alignment of IFAD strategies and programmes with Ghana's policies and strategies affecting the agricultural and rural sectors.
- **Root and Tuber Improvement and Marketing Programme (RTIMP)** duration November, 2006-2014 supervised by MOFA main objective is to enhance income and food security to improve livelihoods of the rural-poor and to build a market-based system to ensure profitability at all levels of the value chain.
- **Rural and Agricultural Finance Programme (RAFiP)** duration 27th April, 2010 – 2016 and supervised by MOFEP (Ministry of Finance and Economic Planning) overall goal is to improve the livelihoods of the rural population including smallholder farmers and rural micro entrepreneurs with a special focus on women and vulnerable groups. The RAFiP objective is to enhance access of the rural and agricultural population to sustainable financial services through enhanced outreach and financial linkages of rural retail institutions and formal financial institutions. RAFiP also aims to strengthen

institutional performance, outreach and client orientation in all segments of the rural financial system; integrate them more closely with each other and with the financial system as a whole; and link them to support systems (particularly regarding technical aspects and risk management of agricultural value chains).

- **Rural Enterprise Project Phase II (REP II) and Agricultural Finance Programme** duration July 2003 to 2011 and supervised by Ministry of Trade and Industry Overall goal is to contribute to poverty reduction in rural areas by improving the living conditions of rural poor families. The immediate objective is to promote a competitive rural micro and small-scale enterprises (MSEs) sector in participating districts. The target group of REP-II are the 'entrepreneurial poor' of rural families living in poverty, with special attention for the most vulnerable households (http://www.mofa.gov.gh/projects_IFAD-padpap.html, http://www.mofa.go.jp/).

OXFAM

OXFAM first began working in Ghana in the West Mamprusi District in 1986 to tackle chronic water and sanitation issues that affected thousands of people in the Kubori area. Over 15 years Oxfam provided basic services and facilities including water and sanitation, micro finance, livelihoods, education, health and hygiene education as well as humanitarian relief for farm families. OXFAM has since grown to support many poor men and women across the country, with a particular focus on the three northern regions, led from a national office in Accra.

OXFAM has restructured its programme in Ghana to support efforts of national civil society organizations to address the incidence of poverty in the northern part of the country and to contribute to the growing importance of Ghana's political, social and economic development in Africa. In this new programme, OXFAM has become a key partner in bringing people and organizations together to engage in the governance processes, particularly poor men and women engaged in rural agriculture and healthcare.

Since 2009, OXFAM programme in Ghana has focused on sustainable agricultural livelihoods and free universal quality health care, sustainable rural livelihoods: building incomes, climate change impact mitigation, independence and safety nets of those working in agriculture. Oxfam's focus in Ghana has moved towards supporting the efforts of civil society organizations and groups of poor farmers to get involved in the decision-making process and

influence agriculture and healthcare policies. Oxfam supports networks of farmers, particularly in the north, as they engage with district, national and regional policy- and decision-making.

OXFAM works with small-scale farmers and producers to establish strong and credible platforms and use their collective voice to lobby and advocate decision makers to improve policies and practices in agricultural sector in the country. In Northern Ghana OXFAM is helping farmers ensure the government fulfils the promises it has made to invest in the Shea industry. OXFAM is collaborating with CARE International to provide a sustainable food supply to 9,000 households across five districts in Northern Ghana.

IWMI

The International Water Management Institute (IWMI) is a non-profit scientific research organization funded by the Consultative Group on International Agricultural Research (CGIAR) focusing on the sustainable use of water and land resources in agriculture and on the water needs of developing countries. IWMI's research agenda is organized around four priority themes covering key issues relating to land, water, livelihoods, health and environment. The Institute concentrates on water and related land management challenges faced by poor rural communities.

Its mission is to improve water and land resources management for food livelihoods and nature. The objectives of IWMI`s work is to:

- Identify the larger issues related to water management and food security that need to be understood and addressed by governments and policymakers;
- Develop, test and promote management practices and tools that can be used by governments and institutions to manage water and land resources more effectively, and address water scarcity issues;
- Clarify the link between poverty and access to water and to help governments and the research community better understand the specific water-related problems of poor people; and
- Help developing countries build their research capacities to deal with water scarcity and related food security issues.

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IWMI Africa shares the vision of the African Union for "an Africa free from hunger and poverty" and supports its NEPAD program. With offices in Pretoria, Addis Ababa and Ghana, IWMI is represented in all the sub-regions of sub-Saharan Africa (SSA).

The IWMI West Africa has its main office in Accra, Ghana, and activities throughout the sub-region. IWMI West Africa in Accra, Ghana works in collaboration with national, sub-regional, regional and international partners, other Future Harvest (CGIAR) centres and a large number of advanced research institutions. One of its sub-regional research portfolios has its focus on efforts to reduce poverty and provide improved food security through sustainable and efficient agricultural water use. Related projects range from the analysis of adoption factors for treadle pumps to basin scale modelling, irrigation policy development, the relationship between malaria and irrigation, and health risk reduction despite wastewater use.

EPA

The Environmental Protection Agency (EPA) has an on-going African Adaptation Programme that started in 2009 involving 21countries. EPA has an established telecommunication platform for the dissemination of Early Warning information using Vodafone. The recommendation is that while developing climate change scenario at national scale, the development of high-resolution ecological-based scenario is a necessity.

SADA

In order to bridge the North-South developmental gap, the Government launched the Savannah Accelerated Development Authority (SADA) to coordinate development efforts in the Northern Ecological Zone constituted by three Northern Regions and the northern portions of the Brong Ahafo and Volta Regions with an estimated poverty of 62%. SADA will improve community livelihoods through crops irrigation.

Tamale Learning Festival (TLF) forum is an annual forum for non-governmental organizations (NGOs), private business institutions and district assemblies to discuss and find solutions to identified developmental challenges facing the north and also share best practices.

SADA was initiated by the Netherlands Development Organization (SNV). Some stakeholders are ActionAid, Ibis, the SEND Foundation, Savannah Fruits Company, Trade Aid, Sekaf, and Christian Children Fund for Canada.

IFPRI

International Food Policy Research Institute (IFPRI) is supported by CGIAR and its main function is to provide information on livelihoods and household food and nutrition security in an urban setting through household and community surveys.

In collaboration with institutions throughout the world, IFPRI is often involved in the collection of primary data and the compilation and processing of secondary data. The resulting datasets provide a wealth of information at the local (household and community), national, and global levels. IFPRI freely distributes as many of these datasets as possible and encourages their use in research and policy analysis. For details visit website www.ifpri.org/dataset/ghana-0.

SARI

Savannah Agricultural Research Institute (SARI) has activities that include:

- Agricultural Economics, Agribusiness & Extension,
- Animal Science
- Horticulture, and
- Soil and Crop Sciences

The Manga station of the SARI is in the process of conducting trials on a drought-resistant maize variety, which would subsequently be made available to farmers for cultivation and when fully tried and replicated could hold the key to the country's quest for food security. This drought-tolerant maize could be capable of withstanding short spells of rain experienced in three Northern Regions yearly. SARI conducts research into agricultural sector in the Northern, Upper East, Upper West and Brong Ahafo Regions.

Mali

Public Radio and Television Office - Mali (ORTM)

From its headquarters in Bamako, the national broadcasting company produces two radio networks, a national television network, and directs the work of a number of regional radio stations. Mali is considered a world leader in community radio development, with ORTM helping to set up the Union des Radios et Télévisions Libres (URTEL), a network of over a hundred independently locally operated stations. OTRM also partners with other government and international organizations in education and development programs throughout Mali. The rural communication section of the office broadcasts agro-hydro meteorological information for the rural population. Bulletins produced by the National Meteorological Services, multidisciplinary working group and famine early warning system group are broadcasted at national and regional level.

Early Warning System Group-Mali

The Early warning system group of Mali was set up by the ministry of territorial administration to predict food crisis and improve the implementation of response actions. The System has the following missions**:**

- Identification of areas and people at risk,
- Determination of needs for food aid,
- Planning and distribution of aid.

The group is funded through the early warning system project, which collects data on food and nutritional status of population including rainfall, plants, vegetation, livestock, food trade and stocks, health and migration. The group meets every month to assess the food security situation and detect areas and population at risk. Regional reports, results of field surveys and

information collected from relevant technical services are analysed and consolidated in a national monthly report. This report is published as a national bulletin and distributed to authorities from local to national levels and international organizations for action.

INSAH/CILSS, Bamako (Republic of Mali)

The *Institute du Sahel* (INSAH) is a Specialized Agency of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS), responsible for coordination, harmonization and promotion of agro-socio-economic research and on population/development in the CILSS member states.

The collaboration between CILSS, ECOWAS and UEMOA and the member States on one hand and the technical partners (FAO, IFDC, Iowa State University, Agricultural Research for Development in Africa, etc.) put in place a regional organ and mechanism for purposes of generating the common regulation, namely the West African Seeds Committee and a tool, the West African Species and Plant Varieties to rectify a low rate of usage of improved seeds that has resulted in low productivity and the poor sustainability of the cropping systems. For dry crops like millet, sorghum and maize, the rate of disseminating the improved varieties is particularly low and varies from 10 to 20 %.

Niger

INRAN

The National Agricultural Research Institute of Niger (INRAN) was created in 1975 under the Ministry of Agricultural Development. Its main objective is to contribute to the attainment of food security and rural development in Niger. The 5 INRAN's research focus includes crops, agronomy, animal sciences, forestry, fisheries, and agroecological and environmental issues. These activities are carried out at four (4) regional agricultural research centres based in Niamey, Kollo, Maradi, and Tahoua. Each centre oversees various research stations and units known as development support points. A formal agreement between INRAN and Abdou Moumouni University (UAM) in Niamey has led to the establishment of a joint research laboratory. INRAN also collaborates with international agencies like the Institute of Research for Development (IRD, France), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Development Research Centre (IDRC, Canada), the

Sahel Institute (INSAH), the West Africa Rice Development Association (WARDA), and the World Agroforestry Centre (ICRAF).

CMB-SE

The second government agency conducting agricultural research in Niger is the Directorate of Cattle Breeding Centres and Livestock Stations (CMB-SE), under the Ministry of Animal Resources (MRA). CMB-SE comprises seven (7) research stations, one in each of the country's administrative regions. Researchers at these stations conduct research on livestock genetic improvement, and cattle selection and breeding. Four (4) higher-education agencies conduct agricultural R&D activities, all within the Abdou Moumouni University (UAM) in Niamey. The largest of these four (4) UAM units is the Faculty of Agriculture, which conducts applied research on vegetables, livestock, soil, water, forestry, agricultural engineering and socioeconomics. The three remaining higher-education agencies are the Biology Department of the Faculty of Sciences, focusing on crops and natural resources; the Human Sciences Research Institute (IRSH), focusing on the socioeconomics of rural life in Niger; and the Radio-Isotopes Institute (IRI), focusing on nuclear research. Unsurprisingly, no private companies directly conduct agricultural research in Niger. As in other countries in the region, however, various producer organizations and private enterprises engage the public agencies to conduct research on their behalf.

The joint projects with CMB-SE and UAM, INRAN participates in regional initiatives such as the Cowpea Project for Africa (PRONAF), the International Sorghum and Millet Collaborative Research Support Program (INTSORMIL), the AGHRYMET, and the West and Central African Millet Research Network (ROCAFREMI), and maintains close ties with agricultural research institutes in Algeria, Egypt, Japan, and Tunisia. CMB-SE jointly conducts a project on artificial insemination with Italy's University of Turin, and projects on Azawak cows—a variety of bovine—and red goats, in cooperation with Belgian development agencies.

UNICEF-Niger

UNICEF works in collaboration with the Government, NGO partners (Médecins Sans Frontières, World Vision, Save the Children, Plan International, IFRC, Serving in Mission, the Australian Conservation Fund, Helen Keller International) and sister UN agencies (WFP, FAO, WHO), to treat children suffering severe and moderate under-nutrition and reduce the

effects of household insecurity. UNICEF Niger has currently allocated US$1,235,400 to respond to the current crisis. UNICEF has delivered over 41 tons of therapeutic milk and 1.5 tons of therapeutic food (Plumpy'nut) to the government and NGO partners. Therapeutic food purchases by UNICEF are supporting 10 fixed therapeutic feeding centres and 21 outreach therapeutic centres. More than 190 tons of Unimix are being delivered to the government and to NGO partners. In collaboration with WFP, 614 tons of cereals have been delivered to 62 affected villages, benefiting an estimated 200,000 people, including 40,000 children under 5 years of age. Approximately 6 tons of seed (corn, wheat, potato) have also been provided and 900 additional tons of cereals will be delivered to 90 additional villages.

UNICEF Niger is urgently seeking US$ 14. 6 million to carry out the key activities that include:

- Therapeutic food and non-therapeutic food; shipping and handling ($8,700,000);
- Community support on under-nutrition prevention and training ($250,000);
- Cereal bank stocks, seeds and supply for irrigated gardening ($1,000,000);
- Essential drugs, anthropometric equipment, mosquito nets, vaccines, vitamin A and other micro-nutrients ($1,000,000); and
- Water/sanitation assessment, kits and training for families in affected areas ($800,000).

They have been continuous using the regional climate outlook forum (RCOF) products, the Prévisions Saisonnières en Afrique de l'Ouest (PRESAO) for 18 countries (16 West African countries, Chad and Cameroon) and they have used the forecast to put in place contingency measure for timely interventions to cope with seasonal climate extreme events (http://www.unicef.org/infobycountry/media_27816.html).

CARE International

CARE International has worked in Niger since 1974. CARE's programs are in livelihood security, civil society organisation development, governance, gender, health, HIV/AIDS and micro-finance. It is an independent, non-political organization working to reduce poverty in Niger and around the world. In Niger, CARE focus is on responding to the humanitarian needs of the most vulnerable people. It has solid experience in conflict resolution and community mobilisation around water, food security and natural resources management.

In Niger CARE has increased its work to address on-going food insecurity, focusing on the Diffa region in the eastern part of the country after some areas experienced poor seasonal rainfall. CARE is also implementing cash-for-work activities to provide poor families with money to purchase food and seeds in preparation for the coming planting season, and is distributing emergency food rations to vulnerable families. To increase resilience in the long-term, CARE is working with communities to strengthen cereal banks, improve water access points and rehabilitate and protect pastureland.

CARE is running a food crisis early warning system in Niger, which brings together information gathered, by the community, government and private monitoring agencies. CARE's Mata Masu Dubara Project ('mata masu dubara' means 'ingenious women') trains women to save and pool money in groups, so they can use it as a buffer in hard times. Many also take out loans to start small businesses, such as buying seeds to plant crops to eat and to sell, so they can work their way out of poverty.

Senegal

CORAF/WECARD

Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricole /West and Central African Council for Agricultural Research and Development (CORAF/WECARD) covering twenty four countries (24) with a population of more than 340 million people is one of the oldest sub-regional organizations (SROs) on the Continent and has been involved in the business of assisting these countries to increase their agricultural productivity aimed at stimulating and sustaining their economic growth. Positive changes are on-going, with more coordinated and harmonized initiatives from the political leaders themselves such as the Economic Community in West African States (ECOWAS), *Union économique et monétaire oust africaine* (UEMOA). CORAF/WECARD national focal institutions are in the following three (3) of the pilot countries:

- Mali: Institut d'Economie Rurale (IER),
- Burkina Faso: Institut de l'Environnement et de Recherches Agricoles (INERA), and
- Senegal: Institut Sénégalais de Recherches Agricoles (ISRA).

ACCC

Adaptation to Climate and Coastal Change in West Africa (ACCC) project is Strategic Priority on Adaptation funded project which aims to perform adaptation actions in pilot sites particularly vulnerable to natural climate changes and to anthropogenic degradation in the short, medium and long term. It also hopes to formulate national and regional adaptation strategies to help manage the impact of changes to the shoreline within the framework of Integrated Coastal Zone Management. The project is of four years from 2007-2010 and is taking place in Senegal including Cape Verde, Guinea Bissau, Gambia and Mauritania.

Boundary/Extension Organisations

Burkina Faso

FEWSNET-Burkina Faso

Famine Early Warning System Network (FEWSNET) is USAID supported activities to help developing countries mitigate vulnerability and adapt to climate variability and change. These activities are geared to building more resilience into economic sectors that may be affected by the increasing climate risks in agriculture, water, and key livelihood sectors in coastal areas. FEWSNET operates in numerous countries in Africa. The program provides decision-makers with information to respond effectively to drought and famine threats by analysing remote-sensing data and ground-based meteorological data produced in countries, crop and rangeland observations and seasonal climate forecasts to identify early indications of potential famine. Given the enormous momentum in climate change processes, FEWSNET is going to face increasing challenges especially in West Africa where agricultural production and food security is threatened by increasing climate variability linked to climate change.

Ghana

GLOWA Volta Project (GVP)

The Volta is a major river basin extending across 400,000 km square and 6 nations within the sub-humid to semi-arid West African savannah zone. Small-scale rainfed and some irrigated agriculture form the dominant economic activity of its predominantly rural citizens. The climate change impact over the river basin poses great challenges for users.

The interdisciplinary GLOWA Volta Project (GVP) in Ghana is under the Volta Basin Authority (VBA) based in Ouagadougou, Burkina Faso being funded by German Federal Ministry of Education and Research (BMBF) and aims to support sustainable water resource management in the countries of the Volta Basin in West Africa. The GVP scientists provide analysis of the physical and socio-economic determinants of the water demand and water availability within the Volta Basin in Ghana and Burkina Faso. The research outputs are integrated into models and tools for decision support, which are intended to support policy and decision –makers in water, agricultural, economic and energy sectors to improve water use and distribution among user sectors. This has led to improved agricultural and water management policies adopted in Ghana and Burkina Faso. Essentially the GVP established a decision support system for the Volta Basin Authority through provision of scientific advice to its members for transboundary water management.

The GVP activities which ended in May 2009, were followed-up by the Project "Sustainable Development of Research Capacity based on the GLOWA Volta Project". Having started in June 2009 to November 2010, the project sought to strengthen the human capacity and the research infrastructure, and to promote the dissemination of research results. GLOWA Volta Geoportal, a joint contribution developed by the Department of Computer Science and Centre for Development Research at the University of Bonn is a Web-based information system providing easy interactive remote access to GLOWA Volta data stock and enables exchange of geo-scientific information in spatial decision-making.

Through extensive trainings and workshops, stakeholders have familiarized with GVP's decision support tools and models. These trainings assist stakeholders to make use of these tools and models in their research or decision-making processes. The recent trainings were:

- 8-12 February 2010: Cape Coast (Ghana)

  Training course on "Modelling the onset of the rainy season and potential implications for agriculture in West Africa"

  Objective: Training on existing methodologies and tools for predicting the onset of the rainy season for agricultural management

  Organizers: Karlsruhe Institute of Technology (KIT), Institute for Meteorology and Climate Research Atmospheric Environmental Research (IMK-IFU)

Stakeholders: Members of water management and agricultural management related organizations within the Volta basin.

- 15-19 February, 2010: Ouagadougou (Burkina Faso)

  Training course on „Modelling the onset of the rainy season and potential implications for agriculture in West Africa“

  Objective: Training on existing methodologies and tools for predicting the onset of the rainy season for agricultural management

  Organizers: Karlsruhe Institute of Technology (KIT), Institute for Meteorology and Climate Research Atmospheric Environmental Research (IMK-IFU)

  Stakeholders: Members of water management and agricultural management related organizations within the Volta basin

It is noted from the foregoing that the project achieved a lot in creating a critical mass of stakeholders in the usage of climate information products in agriculture and food security.

HSD

The Hydrological Services Department (HSD) is a department under the Ministry of Works and Housing. It was established as a department on its own in 1995 when Architectural and Engineering Services Corporation (AESC) underwent restructuring to become a limited liability company. The Department before then existed as the Hydrological Division of AESC.

HSD derives its sources of income from the Government of Ghana, which funds its activities fully through budgetary allocations from government's consolidated fund. In addition to providing engineering services to the government in areas of hydrology and water resources engineering, HSD has the following core functions:

- Operational hydrology: Involves the design, establishment and monitoring of hydrological networks for the collection, processing, archiving and dissemination of hydrological data on rivers, streams and surface water bodies countrywide. Data collected include water levels, stream flow, sediment load and water quality. The river discharge data is obtained from the existing 156 river gauging stations. The collection of data on sediment and water quality is done in collaboration with the Water Institute of CSIR. HSD participates in the activities of UNESCO, WMO, UNEP and other international organizations

- Applied hydrology: Involves assessment of water resources in quantity and quality and their developmental potential for water supply, irrigation, hydro-power generation, lake transport etc. Activities in this area are:
    - Analyses and interpretation of hydrological data and information for water resources development,
    - Hydrological analyses for the design of bridges, culverts, dams, canals, drains etc.
    - Preparation of hydrological products such as monograms and regionalized curves and modes,
    - Preparation of technical reports on hydrology and water resources development.
- Design and supervision of engineering works involves field surveys; design; extraction of material schedules; the preparation of bills of quantities; the pricing of bills; contract administration; and the supervision of construction works.
- Drainage involves design and supervision of drainage works for control of flooding and the improvement of sanitation across the country.

  Coastal Engineering engages in:
    - Monitoring the country's coastline for dynamic changes in the shoreline i.e. erosion and accretion;
    - Analysis of coastal erosion problems in the country:
    - Design and supervision of coastal protection structures and measures, fish landing sites, mini harbours and similar coastal structures; and
    - Land reclamation pertaining to eroding beaches and low-lying coastal areas;

HSD receives climate data and information from GMet. Specifically they get information on rainfall, evaporation and hours of sunlight from GMet. HSD has over years been receiving climate data and other necessary services from Ghana Met.

HSD human resources include engineers, hydrologists, surveyors, quantity surveyors, technical officers and draughtsmen as its core personnel with supporting staff in administrative and accounting categories. HSD has seven regional offices throughout the country.

Mali

FEWSNET-Mali

Famine Early Warning System (FEWSNET) is a collaborative effort designed to provide early warning for food security to allow timely preparation and response to political, socio-economic and climate shocks. FEWS NET is USAID supported activities to help developing countries lessen their vulnerability and adapt to climate variability and change. These activities are intended to build more resilience into economic sectors that may be affected by climatic stresses, including agriculture, water, and key livelihood sectors in coastal areas. The Famine Early Warning System Network (FEWS NET) operates in numerous countries in Africa including Mali. The program provides decision-makers with information to respond effectively to drought and famine threats by analysing remote-sensing and ground-based meteorological data, crop and rangeland observations to identify early indications of potential famine, in addition to data provided by government.

FAO

The Food and Agriculture Organization (FAO) has developed field programmes to support Government priority areas through Technical Cooperation Programmes (TCPs) and trust funds projects covering agricultural production, processing, soil fertility management and emergency assistance. The FAO (2009) approved and implemented the following projects:

- Establishment of Tomato Processing Promotion Pilot factory,
- Integrated Community Land Management and Soil Fertility,
- Increasing Incomes of small farmers through export of organic and fair-trade tropical products,
- Emergency assistance for the control and prevention of Avian Flu,
- Country STAT to improve access to nationally owned quality statistics on food and agriculture in member countries of FAO,
- Aquaculture Investment for poverty reduction in the Volta Basin: Creating opportunities for low-income African farmers through improved management,
- Assistance to the Refugees of the UNHCR settlements in Bududuram and Krisan camps, and
- Telefood projects support to small-scale sheep and pig farming, grass cutting, and crop production.

FAO supported Government by providing inputs to farmers in three (3) Northern Regions to increase food production in the dry season. Farmers undertaking organic fruit production in the Volta and Central Regions also benefited from training to enable them operate under fair-trade certification for export to the EU. The support has resulted in higher yields of crops and vegetables in rural communities, but has brought along challenges in marketing because of poor access roads, improper handling and transportation and storage.

FAO has supported the training of staff of the Ghana Statistical Service and the Statistics, Research and Information Directorate of MOFA under the CountryStat Project. The series of training both abroad and in Ghana culminated in the official launching of CountryStat in November 2009. As a result, agricultural data collection and dissemination has been harmonized to make it easily accessible for national development.

The FAO development partners include Civil Society Organizations and United Nations Country Team (UNCT). The UNCT supports the Government to respond quickly to emergency situations in the country and also implement programmes to support the attainment of Millennium Development Goals (MDG) under United Nations Development Assistance Framework (UNDAF).

Ghana Poverty Reduction Strategy (GPRS II) policies are intended to promote equitable growth that will be sustainable over the medium to long period centred on three thematic pillars: Private Sector Competitiveness, Human Resource Development and Civil Responsibility. It has centred on priority areas including access to health care, economic growth, modernizing agriculture, and improved infrastructure. The UNCT has provided assistance to meet the objectives of GPRS II and MDGs. UNCT meets regularly to prepare joint programmes to support emergency situations, agriculture sector and poverty reduction.

The NEPAD-CAADP Compact was signed by the Government of Ghana and Development Partners including FAO as a non-legally binding document to coordinate their support for the implementation of the Government's Food and Agriculture Sector Development Policy (FASDEP II) through the Medium Term Agriculture Sector Investment Plan under a framework of a Sector Wide Approach and the CAADP. The FASDEP outlined priorities with urgent need to modernize the agriculture sector with emphasis on a few selected

commodities in order to fulfil the country's vision of becoming an agro-industrial country by 2010. The selected commodities are maize, soya, yam, poultry and fish.

The FAO programmes take into account the set priorities outlined in Ghana Poverty Reduction Strategy II (GPRS) and Food and Agriculture Sector Development Policy II and contribute to food insecurity and nutritional status and economic development of the country. FAO programmes support household food security dissemination of improved technologies of agriculture, fisheries and controlling of Avian Influenza.

UNDAF programme is used to strengthen cooperation and harmonization between UN agencies in the country. It also provides a collective and integrated response to national priorities outlined in GPRS II and MDGs in meeting the needs of the country.

The United States of America Millennium Challenge Cooperation (MCA) is providing financial and social services and infrastructural development in 30 districts of the country. Other bigger donors supporting agricultural sector are World Bank, African Development Bank (AfDB), International Fund for Agriculture Development (IFAD), CIDA, France Agency for Development (AFD) and German Development Assistance Agency (GIZ).

AGRA

The Alliance for a Green Revolution in Africa (AGRA) is a dynamic partnership working across the African continent to help millions of small-scale farmers and their families lift themselves out of poverty and hunger. AGRA programmes 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 from seeds, soil health and water to markets and agricultural education. AGRA works across sub-Saharan Africa and has offices in Nairobi, Kenya, and Accra, Ghana. New interventions in Ghana complements AGRA's existing investments in training a new generation of plant breeders, funding for breeding teams, support for seed multiplication by local seed companies and collaboration with other partners to improve the regulatory framework for seed and fertiliser markets.

AGRA's programs are based on partnerships with African governments, organizations of women farmers and associations of crop breeders. AGRA's programs and partnerships work for comprehensive changes across the agricultural system to benefit smallholder farmers

where the majority are women. Integrated programs in seeds, soils, market access, policy and partnerships and innovative finance are transforming subsistence farming into sustainable, viable commercial activity. 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. The programs pay special attention to the women farmers who produce the majority of Africa's food. AGRA programs seek to empower women with full and equal access to finance, land security, extension services and new agricultural tools and technologies. The programs include:

- Seeds Program supports the breeding of improved seed and works to ensure that this good seed gets to farmers. Currently, less than one-quarter of African farmers use high-yield, locally adapted seed. Poor seeds and depleted soils have kept farmers' yields at one-quarter the global average,
- Soil Health Program improves farm productivity through increasing farmers' access to locally appropriate soil nutrients and promoting integrated soil and water management. The Seeds and Soil Health Programs work together to raise farmers' yields. Both are key to environmental sustainability and helping farmers adapt to and mitigate climate change,
- Market Access Program pursues multiple routes to expanding market access for smallholders, once improved seeds and soils engender higher yields and the farmers need access to markets for their surplus,

For all of these efforts to have a widespread impact, agricultural policies must provide smallholder farmers with comprehensive support on national, regional and global levels. At the same time, partnerships are needed to marshal the resources and expertise that will catalyse change. AGRA's Policy and Partnerships Program tackles these challenges.

All of this takes resources, and one overlooked source is Africa's own commercial banks. AGRA's crosscutting Initiative on Innovative Finance works with Africa's financial institutions and other partners to increase access to low-interest loans for smallholder farmers and agricultural businesses.

AGRA, working with IFDC-Ghana and the Ghana Agricultural Associations Business Information Centre (GAABIC), has invested in capacity building and training program to strengthen the technical and business knowledge of agro-dealers. Additionally, the partners have built and supported already established trade associations, assisting agro-dealers' access

to investment finance for business development through risk-sharing arrangements. Shop owners have also trained in the methods of providing field demonstrations and soil testing, thereby transforming them into providers of basic extension services and creating an invaluable source of knowledge and advice to farmers.

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.

AGRA partnerships include those with: African government leaders and policy-makers; national agricultural research and extension systems; international and regional agricultural research centres; non-governmental organizations; community-based organizations; farmer organizations; private sector companies; international partners including bilateral aid organizations and foundations; and financial institutions including local banks, the World Bank, IFAD and the African Development Bank.

AGRA in collaboration with IFDC to launched an agro-dealer program in Ghana whose goal is to increase availability, accessibility and affordability of quality agro-inputs in rural areas and government will provide the regulatory framework through the passage and implementation of the seed, fertilizer and crop protection laws in Ghana. This program is part of the initiative to build a new era of seed dissemination in West Africa, where AGRA is actively building capacity of both public and private sector to ensure an active movement of inputs to reach remote rural farmers. The prospect of building on past experience has helped Ghanaian agro-dealers provide the essential inputs and services needed by smallholder producers to increase productivity.

On 25 November 2008 AGRA and IFDC launched the Ghana Agro-Dealer Development (GADD) project to increase the use of modern agricultural inputs recognising the importance of high-quality seeds, fertilizer and crop protection products in raising productivity and incomes of smallholder farmers. The agro-dealer shops were brought closer to the farmers – making seeds and fertilizers more available and affordable in remote rural areas. The

smallholder farmers in Ghana have to significantly increase their use of improved seeds and other modern inputs to increase their crop yields and improve their incomes. To increase their ability to serve farmers effectively, the agro-dealers were trained in business skills, safe handling, and use of modern technology.

The incentives to farmers include the Farmers Day held every first Friday in December annually. The day has been put aside to honour the best farmers by giving them prizes that include farming equipment among others. This National Farmers Day has regional and district farmers' day.

Comprehensive details about AGRA's programs and projects, and how each contributes to a revolution in African agriculture that promises to feed millions, raise rural incomes, grow national economies, and contribute to global food security are available at AGRA web site http://www.agra-alliance.org.

WFP

The 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. The policies governing the use of WFP food aid is oriented towards the objective of eradicating hunger and poverty. The ultimate objective of food aid should be the elimination of the need for food aid. Towards that 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, WFP works with sister UN agencies in Rome -- 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 WFP and the United States Agency for International Development (USAID) signed a Memorandum of Understanding (MOU) for 3.9 million dollar on 4th December 2010 to improve nutrition in northern Ghana. USAID is providing the money to assist WFP in Ghana provide a safety net of nutrition support to some of the poorest and most vulnerable in districts across northern Ghana with the highest malnutrition levels, including People Living with HIV on Antiretroviral. Therapy and their families, would receive food and nutrition support. Nutrition support was provided under the Protracted Relief and Recovery Operation

(PRRO), aimed at supporting 423,000 people across the three northern regions with relief and recovery activities.

Niger

FAO-Niger

FAO-Niger organizes agriculture and food security meetings where FAO is the leader and WFP the co-leader, with AGRHYMET, DMN-Niger, ACMAD, NGOs, farmers' organizations, among others, as partners. Farmers' organizations include: MOORI BEN (Niamey), FCMN NIYA (Niamey), AREN (Niamey), FUMA GASKIYA (Maradi), Fédération SA'A, FUBI (Zinder). Information is disseminated through articles and bulletins issued by the national consultant in communication at the FAO Emergency Coordination Unit in Niamey. Information is also disseminated through FAO headquarters Global Information Early Warning System (GIEWS).

WFP Niger

The WFP experience during the emergency intervention of 2005 demonstrated the urgency to rebuild and strengthen government capacities in supporting and coordinating emergency interventions. The WFP saw the need to have its Emergency Operation followed by a Protracted Relief and Rehabilitation Operation (PRRO) in order to rebuild and strengthen coping capacities of the affected populations and to reinforce government emergency structures. In this context, the PRRO was launched on 1 April 2006 for a period of 18 months. Through this operation, WFP mainly targets malnourished children and their families with nutritional activities but also food insecure households with food for work and food for training activities.

The first objective of the PRRO addresses the most critical aspect of underdevelopment in Niger, child malnutrition. Through the PRRO, WFP provides supplementary feeding rations for moderately malnourished children and 'blanket' supplementary feeding, in collaboration with UNICEF, to all children from 0-3 years old in the most vulnerable areas of the country to cover the most critical moments of poor rainy season.

WFP is also working with nutritional partners to support to malnourished pregnant and nursing women. In addition to nutrition activities, the PRRO includes food for training aimed at improving the self-help capacities and development planning of village communities and

village cereal banks planned to help reduce the risk of excessive price fluctuations in regions with poor access to the private markets.

Finally, the PRRO also includes a contingency stock that could be used for targeted free food distributions, based on the food security situation in the country. Besides the PRRO, WFP's on-going Country Programme (CP) continues to be implemented. This operation aims at improving the food security and living conditions of vulnerable populations through health, education and rural development activities.

On average the CP targets about 400,000 beneficiaries per year with 14,00 MT of food aid. In order to improve the government's capacity to monitor food security, WFP, together with other partners, provides technical support to the National Early Warning System of the Nation Food Security Mechanism. Activities include regular monitoring support of the food security situation, joint assessments and joint evaluation missions.

The United Nations World Food Programme (WFP) in December 2010 announced it is more than doubling the number of hungry people it feeds in Niger, providing assistance to 2.3 million people caught in a worsening food crisis caused by drought in the eastern Sahel.

ICRISAT

The International Crop Research Institute for the Semi-arid Tropics (ICRISAT) located in Niger is one of the many CGIAR research centres located around the developing world. The CGIAR has also been running a 'Climate Change Challenge Programme' that has developed useful research findings particularly on crop and livestock management in semi-arid and dry lands.

ICRISAT has a good number of on-going programmes of development research on Integrated Genetic and Natural Resource Management (IGNRM) in the Niger. ICRISAT has staff with specialized skills in weather driven crop simulation modelling and spatial weather generation, crop improvement, natural resource management, economic modelling and impact assessment and the social sciences with special emphasis on HIV/AIDS affected household vulnerability. ICRISAT has developed a range of simple spread-sheet-based tools to analyse climate**:** Rainfall, Temperature, and Risk, including training modules to enhance the capacity of national meteorological services and others organizations. Such trainings are in software including In-Stat, MarkSim, and AspSim. ICRISAT staff has participated directly in joint

projects and capacity building activities in partnership with ACMAD among other institutions.

Senegal

FAO

Food Agricultural Organization (FAO) has developed field programmes to support Government priority areas through TCPs and trust funds projects covering agricultural production, processing, soil fertility management and emergency assistance.

Food Security and Nutrition Support Project - Early Warning System Component

The project started in April 2010 and is expected to end by December 2013 as a joint initiative of Canadian International Development Agency (CIDA), World Food Programme and Government of Senegal. It aims at increasing food security for the most vulnerable populations in line with the Social Emergency Program of the Government of Senegal, as well as to improve the capacity of decision-makers to anticipate potential food security crisis.

The Early Warning System component of this project targets Senegalese food security monitoring mechanisms by strengthening their capacity to collect, analyse and disseminate reliable and timely information so that national decision-makers and development partners can follow the food security and nutritional situation prevailing all over the country.

Support Institutions and Initiatives

Ghana

UNU-INRA

The mission of United Nations University Institute for Natural Resources in Africa [UNU-INRA] UNU ISSER Building Complex, Botanical Gardens Road University of Ghana is to strengthen the capacity of Africa's universities and research institutions to conduct research and produce well-trained, well-equipped and motivated individuals, capable of developing, adapting and disseminating technologies that advance food security and promote conservation and the efficient use of the continent's natural resources for sustainable development. Activities of UNU-INRA are anchored in the following five planks:

- Strengthen partnership with African scientists and research institutions through networking with African universities and research institutes (the College of Research

Associates) and through strategic partnerships with like-minded organizations (such as FAO and the Institutes of the CGIAR),

- Develop/strengthen relevant post-graduate programmes in African universities including the establishment of UNU-INRA Operating Units (OU),
- Focus studies on the role of African women in natural resources management to inform policy,
- Engage the African Diaspora in the activities of UNU-INRA, and
- Make timely and relevant information available to African policymakers through the UNU-INRA Annual Lectures.

UNU postgraduate courses on building resilience to climate change focus on "Science, impacts and Vulnerability" and were developed under the framework of the University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR). UN-CECAR is a collaborative initiative of more than 20 leading universities across Asia, committed to develop post graduate educational and research programmes on climate and ecosystems change, adaptation and sustainability science. UNU-ISP acts as the UN-CECAR Secretariat.

The courses cover a range of issues on sustainability and adaptation to climate and ecosystems change. Topics included climate and atmospheric science, impacts assessment, climate and society, ecosystems resilience, risk and uncertainty, integrated solutions for mitigation and adaptation, mainstreaming adaptation into development planning and community-based adaptation. Students also received practical training in the use of Geographic Information Systems (GIS) and in downscaling rainfall forecasts.

KNUST

Kwame Nkrumah University of Science & Technology (KNUST) Faculty of Agriculture, which is in the College of Agriculture and Natural Resources, was established in 1953. As one of Ghana's major teaching and research centres, the Faculty makes significant contributions to the country's agricultural and economic development.

The faculty is made up of following four academic departments: i) the Department of Agricultural Economics, Agribusiness and Extension; ii) the Department of Animal Science; iii) the Department of Crop and Soil Sciences; and iv) the Department of Horticulture. In

addition to the existing programmes (B.Sc. Agriculture and B.Sc. Post Harvest Technology), the faculty admitted students into four new programmes during the 2009/2010 academic year. The four new programmes introduced this academic year are: (i) BSc Agribusiness Management, (ii) BSc Dairy and Meat Science and Technology, (iii) BSc Landscape Design and Management and (iv) BSc Agricultural Biotechnology. The introduction of the new programmes has increased the undergraduate student population to 1,025. Graduate programmes leading to the award of Master of Science (MSc), Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) degrees in Agronomy/Crop Physiology, Plant Breeding and Genetic, Soil Erosion and Conservation, Soil Fertility, Plant Nutrition, Soil Genetics, Morphology and Classification/Pedology, Soil Physics, Forage Crop Production and Management, Entomology, Plant Pathology, Nematology, Animal Nutrition, Reproductive Physiology, Meat Science, Animal Behaviour, Animal Breeding and Genetics, Agricultural Economics, Landscape Design, Floriculture, Olericulture, Pomology, Post Harvest Physiology and Science are also on offer in the Faculty.

College of Agriculture and Natural Resources (CANR) came into being in January 2005, following the promulgation of the revised University statutes in December 2004. It emerged from the former Faculty of Agriculture, the Institute of Renewable Natural Resources and the School of Forestry, Sunyani. The College is mandated to train and equip graduates with the requisite academic and entrepreneurial skills in the areas of agricultural production and natural resource management for sustainable national development, in addition to carrying out research and extension services in these areas.

CANR with a total of 13 academic departments is one of the six Colleges of the KNUST, with a mandate to train, research and disseminate knowledge in sustainable agriculture, renewable natural resources management and rural development. Located at the west end of the University campus, CANR houses three Faculties:

- Faculty of Agriculture which was originally established in 1953 as a Department of Agriculture;
- Faculty of Renewable Natural Resources formally Institute of Renewable Natural Resources; and
- Faculty of Forest Resources Technology, which is situated in Sunyani, in the Brong-Ahafo Region. In addition to the Faculties, CANR has four (4) Research Centres: Bureau

of Integrated Rural Development (BIRD); Centre for Biodiversity Utilisation and Development (CBUD); Dairy/Beef cattle Research Station, at Boadi; and Agriculture Research Station at Anwomaso.

The College is involved in a number of collaborative researches with National and International Institutions and Organizations such as MOFA, Forestry Commission, ICRAF, and CIDA among others.

CIDA programmes

The Canadian International Development Agency (CIDA) supported the implementation of Food and Agriculture Sector Development Policy (FASDEP II) and Agriculture Sector Plan, Food Security and Environment Facility in Northern Regions, Public Sector Development and the Food and Agricultural Budgetary Support (FABS). It is giving support to Food insecure people in Northern Ghana, School Feeding Programme in Ghana, Food Security and Environment Facility.

GIZ programmes

The German Development Assistance Agency (GIZ) has supported Government in upgrading skills of the public and private players in the seed industry to increase quality seed production. It is also assisting in the Market Orientated Agriculture Programme (MOAP) which aims at increasing the competitiveness of the producers and processors of agricultural products such as citrus and pineapple.

AFD projects

Agence Française de Development (AFD) is supporting the government with three projects: one focused on low-land rice development project, another on coconut sector development, and a third with Rubber Estates Limited to develop 400 ha of land for new rubber plantations.

IFRP

International Food Relief Partnership (IFRP) of the U.S. Agency for International Development (USAID) is the Food for Peace program that has brought hope and nourishment to the hungry corners of the world. Approximately 3 billion people in 150 countries have benefited directly from the food. If the symptoms of extreme malnutrition have already appeared, a nutritionally fortified ration with blended, fortified, and processed food is

provided. Initiated projects help protect communities from future hunger by providing them access to local markets for their produce, keeping them healthy, and improving their harvests. Such initiatives include:

- Working with farmers to identify better ways to sow and tend their fields or providing improved seed, thus improving their harvest by linking them with American knowhow,
- Improving women's education about nutrition, resulting in healthier babies and children,
- Encouraging the production of higher value commodities that could earn money in local markets,
- Providing micronutrients, such as vitamin A, iodine, zinc, and iron, that hungry children often lack, and
- Feeding children at school to encourage attendance and improve academic performance

Though there are many ways of providing food aid, Food for Peace's goal remains constant: to minimize hunger in the world so that people everywhere can enjoy active and productive lives and, ultimately, to ensure that one day no one needs food aid.

CSIR-CRI, Ghana

The Council for Scientific and Industrial Research (CSIR) - Crops Research Institute (CSIR-CRI) was established in 1964 and is one of the 13 Institutes of the Council for Scientific and Industrial Research (CSIR) of Ghana. The vision is to be a Centre of Excellence for innovative and quality agricultural research for development. The mission is to develop and disseminate appropriate technologies for high and sustainable food and industrial crop production. The goals of CSIR-CRI are to**:**

- Develop and disseminate appropriate technologies that are demand driven and acceptable to end users,
- Promote and strengthen strategic partnerships with relevant stakeholders to enhance the generation of solutions to challenges in agricultural research, technology development and transfer,
- Improve institutional capability to undertake effective research and service delivery to enhance agricultural productivity, and
- Enhance research and technology delivery through efficient mobilization and management and operating procedures and systems as a means of ensuring efficiency in research delivery.

The research mandate of CSIR-CRI covers the following food and industrial crops**:**

- Cereals (maize and rice),
- Legumes (cowpea, soybean, groundnut and Bambara groundnut)
- Roots and tubers (cassava, yam, sweet potato and cocoyam)
- Horticultural crops
- Plantain and banana,
- Tropical fruits (citrus, mango, avocado, pineapple, cashew and pawpaw)
- Vegetables (pepper, garden eggs, tomato, onion and leafy vegetables), and
- Industrial crops (rubber, sugar cane and tobacco).

WASCAL (Ghana and Burkina Faso)

West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL) is a German initiative to establish a Centre of Competence in West Africa on "Climate Change and Adapted Land Use" to generate knowledge and develop the analytical capability in the region on climate change and land resources in to design resilient land use systems. The initiative also aims to develop measures to conserve or restore healthy ecosystems that allow sustainable development in the major river basins and preserves the natural resource base for future generations. The WASCAL initiative builds on the research networks that African programs such as GLOWA and have established over the past decade. WASCAL aims to establish the Competence Centre in Burkina Faso, the heart of the area affected highly by climate change according to the IPCC projections and the country that lies on the crossroads of the GLOWA-Volta axis and the Biodiversity Observatories (BIOTA) West Africa axis, located to a large extent in the Volta basin.

To accomplish the tasks of WASCAL, two offices have been established; one in Accra (Ghana) in association with the Alliance for the Green Revolution for Africa (AGRA) and another one in Ouagadougou (Burkina Faso) temporarily hosted by the Volta Basin Authority (VBA). The first serves as the WASCAL Headquarters and is responsible for the design of the regional nodes for research and capacity building whereas the latter will coordinate the design of the Competence Centre and the core research program.

The Competence Centre in Ouagadougou, Burkina Faso involves establishment of a group of competent, mostly regional scientists that will work closely with colleagues in Germany in

providing science based policy advice to the policy makers in the region. There will be close collaboration with basin authorities in the region that are the advisory bodies on land and water use in West Africa. Scientific partnership will be established with the regional Education Centre of Excellence (2iE) and International Water Management Institute (IWMI) in Accra, Ghana. Other research institutes that are concerned with the earth system and climate change will be involved. The Competence Centre will serve as a hub connecting regional partners in data gathering networks while offering them infrastructure and expertise to analyse the impacts of climate change and to develop strategies and policies to cope with them.

The core research program brings together a German research consortium and a similar West African consortium. Both consortia will design and conduct a research program on adapted use and management of land under changing climatic conditions. The research will be focused on optimizing the trade-offs in land use, considering the key ecosystems services-sustainable food production, provision of clean water, carbon sequestration, biodiversity and creating resilience to cope with extreme environment events.

Niger

AMMA-Africa

African Monsoon Multidisciplinary Analysis, (AMMA)-Africa in its second phase with ACMAD is involving research and systematic observation and data collection to improve understanding of climate change and its impacts on health, food security and water resources. Its three principal goals are to:

- Develop observational strategies for improved description of climate change in West Africa;
- Enhance understanding of the West African Monsoon and its influence on the physical, chemical, and biological environment at regional and global scales; and
- Improve human capacity, knowledge and understanding of the relationships between climate variability and climate change and problems related to health, water resources, and food security in the nations of West Africa.

The AMMA-ACMAD project has the potential to significantly improve the ability to predict the onset and ending of the African Monsoon and to better describe climate change and its

impacts through reinforcement of the existing network by adding systematic observations in key sensitive areas (GCOS, 2003).

UAM

The Abdou Moumouni University (UAM) in Niamey, Niger is administered by the Ministry of Secondary and Higher Education, Research, and Technology (MESSRT). The UAM Faculty of Agriculture conducts applied research on vegetables, livestock, soil, water, forestry, agricultural engineering and socioeconomics. The other higher-education agencies are the Biology Department of the Faculty of Sciences, focusing on crops and natural resources; the Human Sciences Research Institute (IRSH), focusing on the socioeconomics of rural life in Niger; and the Radio-Isotopes Institute (IRI), focusing on nuclear research within UAM. UAM works closely with various African, European, and U.S universities, including the universities of Abomey-Calavi (Benin), Cairo, Gembloux, Hohenheim, Louvain, Paris, Toulouse, and Turin. Other UAM research partners include the agricultural and Veterinary Institute (IAV) Hassan II, Morocco; the Advanced National School of Agriculture (ENSA), Senegal; and the Swiss Federal Institute of Technology.

CBA project

The community-based adaptation (CBA) in Niger project is aimed at:

- Developing a framework, including new knowledge and capacity, that spans the local to the intergovernmental levels to respond to unique community-based adaptation needs;
- Identifying and financing diverse community-based adaptation projects in a number of selected countries; and
- Capturing and disseminating lessons learned at the community level to all stakeholders, including governments

Assessment of climate services

Good climate services rely on a series of important elements. Institutions involved should be open to clients, flexible enough to adjust or develop 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 outlooks, agro met forecasts, seasonal climate forecasts, climate change projections, climate change vulnerability assessment maps, advisories/alerts for extreme climate events, early warnings for 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 timely dissemination of climate information for effective planning. It was noted that the rainfall onset-date forecasts are sometimes not accurate; as such, there was a call for some effort for improved skill in predicting seasonal rainfall onset dates.

The region's meteorological observing network is poor, and there is need for the rehabilitation of surface and upper-air stations, the 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 forecasts as an early warning tool for agriculture, food security and water resources management sectors.

Institutions

The national meteorological service of each pilot country was visited over the course of the study. The agrometeorology divisions in these services are the main suppliers of climate products and services for agriculture. In Niger, the organizations visited included the AGRHYMET centre of the Interstate Committee for Drought Control in the Sahel (CILSS),

FEWSNET, the National Agricultural Research Institute (INRA), UNICEF and FAO. In Burkina Faso the institutions visited were Famine Early Warning System (FEWS), the Institute for the Application and Dissemination of the Sciences, the Ministry of Agriculture, the CILSS country office, OXFAM and WFP. In Mali these included the Ministry of Agriculture, the Mali's National Radio and Television Office (OTRM), the National Centre for Locust Control, the Office for Plant Protection, the Food Security Commission, the National Early Warning System, the Office of the Upper Niger River Valley, and the Civil Protection Service.

Institutions visited in Ghana were the Environment Protection Agency (EPA), WFP, FARA Headquarters, NADMO, Ministry of Food and Agriculture (MOFA) Statistics, Research & Information Directorate, the Hydrological Services Department (HSD), AGRA West Africa and Senior Program Officer of Soil Health Program (Research and Extension) Alliance for a Green Revolution in Africa, West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL) and FAO Regional Office.

Institutional arrangements

At the national level, multidisciplinary working groups involving providers and users have been operating in most of the Sahelian countries of West Africa. Climate and relevant non-climate information are exchanged, discussed and a report published every ten days in countries mostly during the wet season. National climate services providers in the region were mostly national meteorological services under a ministry with limited opportunities, usually as a result of administrative bureaucracy and weak influence on state budget allocation decisions. Recently, emergence of meteorological agencies or authorities with some degree of administrative, financial and staffing autonomy was noted, giving more flexibility and opportunities for networking and partnerships for development.

Institutional capacities for provision and dissemination

Technological advances have improved strategies in the dissemination of climate information and prediction products to various user sectors and stakeholders. For instance, dissemination now takes place through the following websites:

- The World Agro-meteorological Information Service (WAMIS), which is a dedicated web server that has been assisting countries and organizations like ACMAD in the

dissemination of climate products where users can quickly and easily download and evaluate various bulletins, and provide suggestions for improvement to meet their specific needs;

- The Flemish Institute for Technological Research (VITO) in collaboration with the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and partners like ACMAD project disseminate environmental data and information through EUMETSAT.

ACMAD is bridging of the gaps between sub-regional and national units through capacity building and training support activities in development and applications of weather and climate watch operational products, numerical analysis and prediction tools for support decision making systems solve urgent regional climatic risks.

The NMHSs are not fully able to access the information and process products to meet various sectors demands. The lack of computing facilities – in some cases, for example, five meteorologists share one computer – needs to be addressed urgently. The existing Internet is very weak with regular interruptions. This is another major drawback to accessing and dissemination of climate information products and services.

Gaps in institutional capacities for provision and dissemination

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. This information is not yet provided by the climate community and is estimated assuming that forecasts of rainfall for each 10-day period during the cropping season is approximately equal to the seasonal forecast available at the start of the season. Because a given cropping season can experience dry and wet spells lasting several days to a few weeks, this assumption is frequently not valid. As such, it is the main cause of huge discrepancies between forecasts and recorded crop yields in the Sahel. To correct this, collaboration between agriculture and climate community of the region to develop better climate inputs to crop models is necessary. 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 to implement required contingency plans and measures. In most cases in the region, food crisis are not anticipated in

advance and, as a result, costly response measures are applied, including tax-free imports of commodities and mobilization of national and international emergency food aid.

The joint NMHSs-ACMAD expertise in seasonal climate forecast has been appreciated. However, the centre has to face the challenge of scientific and technical evolution to be able to remain a reference provider of climate services to NMHSs and end-users. Lack of expertise including computing facilities and applications software make the NMHSs be unable to produce specific tailor made products. The questionnaire analysis shown on Table 1 indicates that the dissemination and accessing of the climate information through Internet and media are good while workshops, postal mailing and use of telephone are modes also frequently used.

The poor observational network is an impediment to provision of climate information products and services, especially where some localised information is required. The potential solutions are expected from ClimDevAfrica Framework Programme, which might lead to the formulation of integrated project proposals for climate services using the ClimDev Special Funding mechanisms (AfDB) and ACPC/UNECA Planning Process. However, some institutions need improved Internet facilities in the dissemination and accessing of the climate information products and services.

Table 1: Survey questionnaire responses

	Providers	Users	Boundary/ Extension	Support/ Initiatives	Total
Internet	4	16	3		
Tele-phone	4	12	3		
Postal mail	3	13	2		
Fax	1	9	2		
Media	4	14	3		
Workshops	3	13	2		
Field days	3	11	2		
Traditional methods		9	2		
Personal communication	1	13	1	1	
Other	2	4			
RESPONSES	4	19	3	1	27

Table 1: Shows the survey questionnaire responses and analysis of climate information and services modes of dissemination and accessing by provider

institutions, user communities, boundary/extensions organizations, support institutions and initiatives.

Networking, partnerships, and knowledge sharing

In the countries of West Africa, current assistance programmes focused on information exchange are weak, lacking the capacity and enabling environment to undertake research in climate and agriculture/food security for the development of new products or the tailoring of existing climate information. There are, however, opportunities for a better future because governments, organizations and donors are becoming increasingly aware of policy, institutional reforms, and arrangements required to better define farmer expectations and develop relevant capacities involved in adaptation of agriculture and food security to climate change. Interdisciplinary working groups in Sahelian countries of West Africa are examples of frameworks or platforms needed to better develop, share and use climate information in the agriculture and food security sector. A more sustainable and service-oriented meteorological assistance programme for farmers disseminated via farmers' journals, newsletters or other professional media are needed for better food-crisis management and the improvement of livelihood resilience in the agriculture sector.

With strong support from WMO, international, regional and national institutions and development partners have increased the number of people working on this issue. These have focused on the following thematic workshops and seminars:

- Climate data management and rescue;
- Climate modelling, models downscaling and Interpretation;
- Data and information dissemination;
- Development and Applications climate monitoring and prediction tools;
- Seasonal climate forecasting and forecasts verification;
- Climate change scenarios generation for impacts and vulnerability assessments; and
- Integration of climate information products into decision-making and investments in various socio-economic sectors.

Climate information products

With improvements in climate science, models and high-speed computing capabilities, forecasts from days to seasons are increasingly being used in agriculture and food security.

Effective and widespread use of forecasts was reported in Mali to adjust sowing calendars, guide ploughing, fertilizer and pesticide spray, harvesting and food conservation. Seasonal forecasts facilitate a broad appraisal on the food production potential at country level. Because seasonal forecasts are not localized, its use is limited to broad and qualitative assessments. Field surveys are undertaken to better assess the food situation, estimate production, and detect areas under threat of food insecurity.

Experts interviewed for this study indicated that significant errors in food production estimates are due to empirical approaches considered for the estimations with climate effects usually unaccounted. More objective methods and tools that take into account climate parameters and indices have the potential to improve forecast of food production and prices on commodity markets. This is among the most immediate challenges that must be addressed to effectively take preventive measures, prepare for food crises, and reduce response and rehabilitation costs.

Seasonal forecasts with better quantitative estimates of expected rainfall at more local levels, forecasts of the expected timing and frequency of dry and wet spells, information on early or late onset and/or withdrawal of rainfall, and on the length of rainy season would facilitate adjustments of agricultural calendars given the high year-to-year variation in rainfall over West Africa. These improvements would help optimize agricultural practices leading to increased production and adaptation to climate change. Optimal decisions to apply fertilizers and pesticides require more local weather forecasts of winds and rainfall. In an attempt to facilitate understanding and use of seasonal forecasts, FEWS network has developed a forecast interpretation tool that transforms the rainfall probability maps into quantities. Food risk maps are also being prepared. However, in spite of evidence on the high sensitivity and exposure of agriculture to current climate variability and projected change, climate information is still not well used in agriculture and food risk assessments. The Alliance for Green Revolution in Africa is funding projects on seeds, soil, market and policies. Through a possible CCAFS/AGRA collaboration, climate change might also be incorporated into this project.

Few institutions in the agriculture sector are making use of climate change scenario products developed by the Intergovernmental Panel on Climate Change. The analysis of historical and current conditions in climate and agriculture and the definition and analysis of indicators (e.g.

length of cropping season, late and early onset or withdrawal of rainfall) and indices (e.g. water satisfaction indices) are all prerequisites for the effective use of climate scenarios for agricultural decision-making. These analyses, combined with agriculture and food security datasets, will help users to understand climate change-agriculture/food security relationships and to detect thresholds or triggers of negative or positive climate impacts on agriculture. When the conditions, thresholds for impacts and trends are well characterized from historical data, the projections from climate models can be used to estimate plausible future impacts and adaptation options. Organizations visited expressed the need to understand present-day changes on agricultural calendars, flood and drought frequencies in the Niger, Senegal and Volta river valleys and to determine plausible changes in future decades.

A robust determination of future impacts requires local climate data covering all the decades of the current century. The time period of current scenarios from many climate models is 2045, which is quite far into the future for users. Technical and computational requirements to use these data and difficulties for data access from West Africa are major impediments for development and use for agriculture and food security adaptation options. Decadal predictions experiments (Meehl et al. 2009) and downscaling of climate scenarios (Giorgi et al. 2009) initiatives have been recognized and are under development. Historical data over stations run by agriculture and food-security organizations are required to generate local climate scenarios.

Delivery and communication strategies

National meteorological services daily weather forecast are often transmitted through radio, television and newspapers. Responses to the questionnaire indicated that websites are becoming the main media of communication of the climate information. The NMHSs also provide meteorological data for research, models development, models validation including environmental impact and vulnerability assessments for articles and publications.

Regional Climate Outlook Forums (RCOFs) are opportunities for communication of climate information to the media and users. Press conferences and releases, meetings, media interviews and documentaries are organized during or following these forums in many countries to further explain climate conditions, describe possible impacts and suggest action options. Regional food security workshops are organized after climate outlook dissemination in the Sahel to further analysis and exchanges on the implications of the outlook on food

security in West Africa. Climate information is well delivered through websites, e-mails, conferences and seminars. The main gap found has been the limited effort to communicate sector specific climate information in agriculture and food security professional journals. In Mali and Burkina Faso, farmers' federation and associations requested development and dissemination of climate information in their journals that is used to communicate agricultural practices and advices.

From seasonal to multi-decadal timescales, local forecasts and scenarios are required from the climate community. Farming practices, agricultural calendars, food production models, crop yield estimation and assessment tools, food demand, supply and 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 West Africa. Current operational interdisciplinary working groups (currently in Mali and Burkina Faso) should be expanded to more countries and liaise with research groups to improve current climate information provided and address new needs.

The RAdio and InterNET technology (RANET) system (Figure 3) for mainstreaming agro-hydro-meteorological, climate and environmental information into rural systems, established in 1999 by ACMAD with support from the NOAA Office of Global Programs, the Cooperative Institute for Mesoscale Meteorological Studies (CIMMS) and other development partners is today recognized as good practice with success stories from NMHSs that are using the system. This information was received through the Afristar Satellite, which had been centred over Africa. The RANET became a very popular and effective system for mainstreaming weather and climate information, public education and awareness raising and promoting community participation and ownership. The RANET phase II is currently on going at ACMAD.

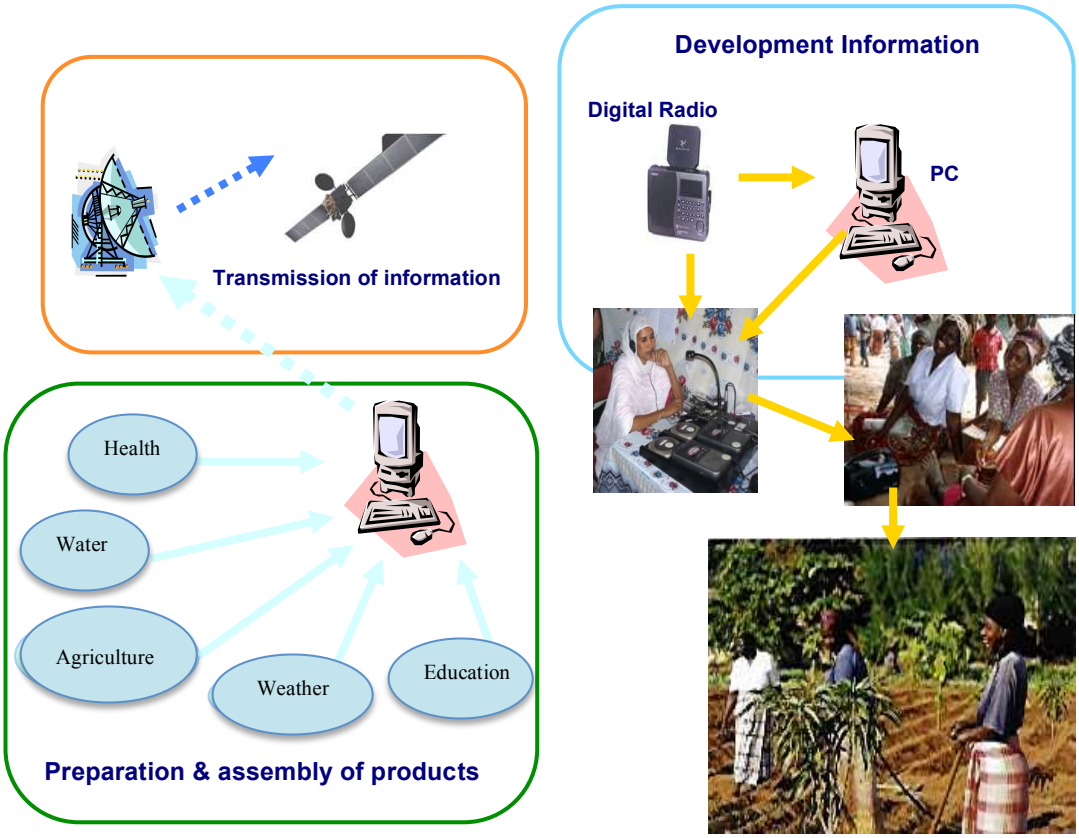

Figure 3: Mainstreaming climate information to rural communities using the RANET system.

Existing strengths and gaps

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 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 the interdisciplinary databases and undertake research for adaptation to climate variability and change.

In Niger, Mali, and Burkina Faso, interdisciplinary operational working groups were established involving climate experts from national meteorological services and institutions in sectors with a very high sensitivity to climate shocks. This working group meets once every dekad during the wet season to review the climate, water, food (access, availability, quality and trade), agriculture and health situation of the country and provide advices to the public,

stakeholders involved in climate sensitive activities including decision and policy makers. It is the main opportunity for face-to-face interactions between the operational climate and user communities well appreciated in these countries. However, in Ghana such an arrangement is limited to Gmet and NADMO who regularly meet during the rainy seasons. The need of user specific information some of which have been mentioned above requiring special arrangements between climate and specific user sector (e.g. farmer associations) has been noted and should be addressed.

Climate projection data in the region are mostly available in universities or other institutions for climate change studies. National meteorological services are in the process of developing climate scenario capabilities. Their work is currently mostly limited to analysis of historical data to detect and understand past and current climate. Therefore, climate forecasts at the decadal timescale are not available for operational use by the agriculture and food security community in the region. However, climate change scenarios from the IPCC are relevant for planning beyond the next few decades and over regional scales. This situation raises the question as to why it is so and how to encourage uptake in a region where over 60% of the population depend on the agriculture sector very much exposed and sensitive to climate change. National support for agriculture has been quite low and the development of this sector has mostly benefited from NGOs and international cooperation for development programmes.

Some research and training tools have been developed to generate local climate variables and their impacts from outputs of global coarse resolution climate models. Operational activities in agriculture and food security have not yet been well exposed to climate scenarios products and their use. More efforts are required via climate-agriculture alliances to build national capacity and to raise awareness on the availability of downscaling tools and benefits from progress on local climate change scenarios development.

Even though observations and forecasts made days to a season ahead are provided and used, to some extent, for agriculture and food security in the region, requests for improvements and development of new products have been made. To satisfy these needs more effectively for adaption to climate change, interdisciplinary databases, methods and tools (global to local climate models, impact models), products and information systems would be crucial in the region.

Initiatives such as National Adaptation Programmes of Action have significantly benefited from national climate information products and services for the vulnerability and adaptation assessments of countries' National Communications to the UNFCCC.

The joint NMHSs-ACMAD and Partner Institutions' expertise in seasonal climate forecast has been appreciated. However, the centre has to face the challenge of scientific and technical evolution and bridge the gaps to be able to remain a reference provider of climate services to NHMS and end-users. Meanwhile, collaboration with partnering institutions such as IRI, the Hadley Centre, Meteo-France, UK Met Office and Universities has strengthened the climate services capacities of the Sub-region in a coordinated manner, by providing relevant knowledge for developing tailored climate information products and services.

Recommendations and the Way Forward

Climate change is expected to intensify existing problems with warmer summers and colder winters already taking place over much of sub-Saharan Africa (Collins, 2010) where there is poverty and heavy reliance on climate-sensitive natural resources. The agriculture and food security sectors employing more than half of the population in this region are quite frequently impacted by climate shocks. The following recommendations, based on the analysis and assessments above, are expected to guide development of the underpinning scientific knowledge and information to facilitate adaptation to climate change in the agriculture and food security sector of West Africa.

Recommendation 1: Climate information including observations, analyses, climate summaries, bulletins, statements, reports, atlases and assessments are used to a certain extent in some countries for planning and operations. Capacity building to develop joint climate-agriculture research group to support operational interdisciplinary working groups, expand climate information interpretation and use to all countries of the region, improve understanding, packaging, quality and communication of information is required.

Recommendation 2: Integrated local sub-seasonal and seasonal forecasts, decadal predictions and multi-decadal climate scenarios needed for short-to long-term planning are rarely used for agriculture development. Scientific development is required to provide local predictions at

daily to decadal timescales and to deliver the downscaled climate scenarios needed to adjust agricultural calendars, estimate crop yield, food demand, supply and prices.

Recommendation 3: Agriculture and socio-economic modelling communities are encouraged to develop, improve, or adapt existing food-system models so that they can take advantage of climate information as input.

Recommendation 4: The climate science community should focus on research to generate climate information required to formulate or suggest actionable adaptation policies, prevent and better manage food crises, improve livelihood of farmers and cope with climate shocks.

Recommendation 5: Reactive management of climate change risk has been noted in many countries. The adaptation science community must develop more anticipatory adaptation measures for agriculture and food security sector.

Recommendation 6: Climate, agriculture and socioeconomic science communities are challenged to develop interdisciplinary end-to-end systems, providing climate, crop yield, food production, supply, demand, and price information required to manage climate risks in agriculture and food security.

Recommendation 7: Agricultural development planners should further mainstream climate variability and change into agriculture and food security development programmes at national and regional levels.

Recommendation 8: Specific climate information for the agriculture and food security sectors should be developed and disseminated via farmers' association journals.

Recommendation 9: With the development of Information technologies, expression of views and exchange of knowledge, interdisciplinary collaboration, collection, storage and sharing of information have become standard practices with unprecedented benefits for stakeholders. Regional platforms such as RCOFs for sub-Saharan Africa are key for building the capacity of scientists, service providers, and agriculture communities.

Recommendation 10: Many meteorological services providing climate information products and services are under government ministries (usually ministries of transport) because the most important client of these services has been the transport industry. With climate change and its impact on agriculture and food security, other ministries including environment and

agriculture are becoming important clients, making governance reforms necessary to develop and provide relevant climate information for all. Collaborations available now with climate-sensitive sectors are limited at the technical level between experts in many countries. Some countries are in the process of better positioning meteorological services as national authorities or agencies providing climate services to all climate-sensitive stakeholders and particularly ministries of agriculture and food institutions. These reforms should be encouraged and extended to deliver the governance structures required to better combat climate variability and change impacts and vulnerability in the region.

Recommendation 11: High-speed Internet connectivity and acquisition of computers is recommended for efficient downloading of data and information as well as for processing and timely dissemination of climate information products and early warning information.

Appendices

Appendix 1: Survey Questionnaire of Existing Climate Information Products and Services

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.
Deadline 15th November 2010.

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 Centers 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 30th of October 2010 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 (Governmental, intergovernmental, local, non-government, private, association, educational, international, etc.)	
Date it was created	
Mission	
Relationship to Agriculture and Food Security	
Size of organization (number of professional staff)	
Contact person (name and designation)	
Address	
Telephone number	
Fax number	
Email address	

Web site	
Add any other relevant information	

2. 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 operationally and how many users do you serve under each category and type? Please specify below

No.	Category and Type	Equivalent Title of your Product	Number of users
1	Daily Weather Forecasts		
2	Weekly Weather Forecasts		
3	Agromet 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		

2.2 What are the sources of your climate information and how often do you source?

No.	Climate information sources	Never	Occasionally	Frequently
1				
2				
3				
4				
5				
6				
7				
8				

2.3 Are there any institutional linkages for cooperation (or any relationship) with other providers of climate information? If yes, please specify.

No.	Providers	Bilateral/MoU/Other	Type of products and services
1			
2			
3			
4			
5			
6			

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			
4			
5			
6			

2.5 In the Table below, please rank the modes of dissemination of your climate products and services to users starting with 1 as the most frequently used to 6 the least used mode.

No.	Mode of dissemination	Rank.
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	

In case you apply any of modes "between" 6 to 10 please give details in the space provided below.

2.6 What strategies in your opinion are needed to improve your products or add value to new products as well as improve dissemination of your climate products and services? Please specify.

3. USER OF CLIMATE INFORMATION PRODUCTS AND SERVICES

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

3.1. The applications/utilization of climate information products and services can be classified as shown below. As a user, which is your area of utilization? Just put (X) as appropriate.

Agriculture ☐ Water management ☐ Disaster prevention ☐

Energy ☐ Health and welfare ☐ Transportation ☐

If none of the above. Please specify.

3.2. What types of climate information products and services do you use? Indicate the source and how you apply these in your operational activities?

No.	**Type**	Source	How do you apply it in your activities
1			
2			
3			
4			
5			
6			

Use more space if necessary

In case of any <u>other relevant information</u> please describe in the space provided below.

3.3. As a user, do you have any framework for cooperation (i.e MoU or others) with your provider of climate information products and services? If yes, please describe specifically.

No.	Providers	Bilateral/MoU/Other	Type of products and services
1			
2			
3			
4			
5			

3.4. How important do you consider the following category and types climate information products and services? Just put 1 for not important, 2 for quite important, 3 for important and 4 for very important in the next column.

Category and Type		Category and Type	
Daily Weather Forecasts		Climate Change Projections	
Weekly Weather Forecasts		Climate Change vulnerability assessment maps	
Dekadal Climate Outlook		Advisories/Alerts (Extreme Climate Events)	
Monthly Climate Outlook		Early Warnings (outbreaks of pests and diseases)	
Agromet Forecasts		Frost occurrence forecast	
Seasonal Climate Forecast		Seasonal rainfall onset and cessation dates	

3.5. If you use any other climate information products and services different from the above please indicate in the space provided below.

No.	Category and Type	Not Important	Quite important	Important	Very important
1					
2					
3					

3.6. As a user, how would you rate the access of climate information products made available to you for each category and type listed below? Just put 1 for very poor, 2 for poor, 3 for adequate, 4 for Good and 5 for Excellent

Category and Type		Category and Type	
Daily Weather Forecasts		Climate Change Projections	
Weekly Weather Forecasts		Climate Change vulnerability assessment maps	
Dekadal Climate Outlook		Advisories/Alerts (Extreme Climate Events)	
Monthly Climate Outlook		Early Warnings (outbreaks of pests and diseases)	
Agromet Forecasts		Frost occurrence forecast	
Seasonal Climate Forecast		Seasonal rainfall onset and cessation dates	

3.7. If you access for use any other information products different from the above, please indicate in the space provided below.

No.	Type of information products
1	
2	
3	
4	

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 Are the products you receive tailored to meet your needs? Just put a tick (√) as appropriate.

☐ **YES** **NO** ☐

If No please suggest how it could be tailored to meet your needs.

3.10 Which of the modes do you use to access the climate information products and services for your operational activities? Ranking them with 1 being the most frequently used mode up 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		
	Personal contact/Communication		
10	Others		

If "others" please specify in the space provided below.

3.11 In your opinion which of groups do you feel best placed to disseminate climate information to **rural communities** for enhanced agricultural production and food security?

Group	Give organization name if possible	Mean of Dissimination?
United Nations affiliated Organization		
International Climate/Weather Centers		
National meteorological and Hydrological Services		
Agricultrural 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.

3.12 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 30th of October 2010 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

CLIMATE SERVICES PROVIDER INSTITUTIONS			
COUNTRY	**No**	**INSTITUTION**	**PRODUCTS & SERVICES**
NIGER	1	DMN-Niger	Daily weather Forecast, 10-dayl climatological bulletin, TV weather (rainy season), Bulletin *agrométéorologique décadaire,* Seasonal rainfall forecast, Agro-hydro-meteorological dekadal bulletin, and Bulletin Special Policymakers (twice during the crop year)
	2	AGRHYMET	• Dekadal bulletin, Monthly bulletin, Prévision et programmations de l'irrigation des cultures, •
	3	FEWSNET	• Monthly FEWS report
GHANA	1	Ghana Meteorological Agency (GMet)	a) Provision of daily weather forecast, b) Early warning forecasts of changing weather conditions e.g. imminent storm, wind (hurricanes), c) Agrometeorological Bulletin and other meteorological publications such as intensities and return periods of rainfall, d) Advisory on catastrophes'such as bush fires etc, e) Provision of seasonal climate forecast,
BURKINA FASO	1 2	DMN-Burkina Faso	10-day agrometeorological bulletin; Monthly climate watch; Climate data and related statistics; Seasonal rainfall forecast bulletins; and Short range weather forecasts in collaboration with ASECNA;
MALI	1	DMN-Mali	10 day agro-meteorological bulletin; Monthly climate watch; climate data and related statistics; Seasonal forecast bulletins from May to October; Forecasts of monsoon onset and withdrawal; Weekly climate outlooks and related weather forecast from April to November; Short range weather forecasts in collaboration with ASECNA and Guide for agricultural practices.
	2	FEWSNET-Mali	Monthly FEWS reports

CLIMATE SERVICES USER COMMUNITIES			
NIGER	1	UNICEF	*Saison de pluie / Importance des précipitations, Preparation aux épidém, ies de Cholera et de paludisme, Harmattan et poussière / prévision des épidémies de méningites*
GHANA	1	NADMO	Pandemic Influenza-HINI

BOUNDARY/EXTENSIONS ORGANISATIONS			
NIGER	1	Food Agricultural Organization (FAO)	FAO-Niger information is disseminated through FAO headquarters Global Information Early Warning System (GIEWS).
GHANA	1	Food Agricultural Organization (FAO)	FAO-Niger information is disseminated through FAO headquarters Global Information Early Warning System (GIEWS).

Appendix 3: Officers Interviewed

Country	Officer & Designation	Institution
NIGER	Seydou Traore (Agrometeorologist) Alkajil Adoum (Fewsnet expert)	AGRHYMET/CILSS/FEWSnet
	Khaled Bensaid (Senior Chief Health and Nutrition)	Senior Chief Health and Nutrition, UNICEF
	Moussa Mahaimouni	Direction de la Meteorologie Nationale (DMN)
	Nourou Macki Tall, Assistant Coordinator Food Security Cluster.	Food Agricultural Organization (FAO)
BURKINA FASO	Ali Garane (Director) Judith Sanfo (Meteorological Applications Officer)	National Meteorological Service/Burkina Faso
	Abdou Karim Ouedraogo (Deputy national representative)	Famine Early Warning System/Burkina Faso
	Ouedraogo Delphine Bernadette (Permanent Secretary)	Permanent Secretary of the national CILSS committee
	Salam Richard Kondombo (Expert) Stephane Degueurce (Food security expert)	FAO/Burkina Faso
	Alertte Badolo (Journalist)	Sahel sciences institute/Burkina Faso
	Aouba Abdul Moumouni (Officer in charge of relations with partners)	Interprofessional committee on cereal/NGO in Burkina Faso
	Issaka Ouandogo (Resource Mobilization Officer) Blaise Kienou (Food security officer) Alice Armelle Zongo (Programme officer on food risks)	Intermon Oxfam / NGO in Burkina Faso
MALI	Djibrila Maiga (Deputy Director) Tandja Fanta (Chief of agrometeorology operations) Cheikh Oumar Keita (Agro meteorologist) Modibo Koné (Agro meteorologist) Guousbou Traore (Agro meteorologist) Issa Traore (Agro meteorologist) Mohamed Koite (Researcher) Modibo S. Coulibaly (Chief of climatology section) Adama Konate (Chief of maintenance section)	National meteorological services /Mali
	Tamba Kanoute (hydrologist)	National Hydrological service/Mali
	Sibily Bengaly (Statistician) Mohamadou Thé (Focal point for agromteorology)	National agricultural service/Mali
	Bakaye Thiero	Office for plant protection/Mali
	Bocary Allaye Kossibo (Program officer)	Food Security Commission/Mali
	Navon Cisse (Senior hydrologist)	National Hydrological Service/Mali
	Bina Tangara (expert)	Textile development company/Mali
	Diakite (Director) Aboubacar Diarra (Deputy director) Soli Cisse (Information and communication officer)	National Locust Centre/Mali
	Mary Diallo (Coordinator)	Early Warning system/Mali
	Mamadou Traore (Director General)	National civil protection service/Mali
	Moussa Kienta (Coordinating officer for environment and fisheries)	Permanent assembly of chambers of agriculture/Mali

Country	Officer & Designation	Institution
GHANA	Zinedeme Minia (Director General) Andrew Nkansah (Director) Charles Yorke (Principal Meteorologist, Head Of Research) And Acmad/Ccafs –Gmet Designated Focal Point	Ghana Meteorological Agency (GMet)
	Daniel Benefor Tutu (Senior Programme Officer Energy Resources And Climate Change Unit)	Enivironment Protection Agency (EPA)
	Thomas Yeboah (Procurement Officer)	World Food Programme (WFP)
	Eric Mcgaw (Communications And Public Awareness Specialist), Gbadebo Odularu (Regional Policies &Markets Analyst), Emmanuel Tambi (Director,Regional Policies & Markets) Leonard O. Oruko (Marketing & Evaluation Specialist) Alain L. Ange (Technical Advisor Partnerships And Strategic Alliance)	FARA Headquarters
	Ndokurugu (Co-Ordinator)	National Disaster Management Organization (NADMO)
	Samuel Oku (Deputy Director) Godsway Banini (Officer) James Ayittey (Officer)	Ministry of Food And Agriculture (MOFA) Statistics, Research & Information Directorate.
	J. Wellens-Mensah (Director)	Hydrological Services Department (HSD)
	Andre Bationo (Director)	AGRA West Africa and Senior Program Officer of Soil Health Program (Research and Extension) Alliance for a Green Revolution in Africa
	Mamadou Ouattara (Coordinator For Capacity Building)	West African Science Service Center on Climate Change and Adapted Land Use (WASCAL)
	Godfrey Baidoo-Tsibu (National Programme Assistant)	Food and Agriculture Organization (FAO) Regional Office

Appendix 4: Contact Officers for Future Collaboration

COUNTRY	No.	NAME	DESIGNATION & INSTITUTION	ADDRESS & E-MAIL
GHANA	1	Ange Alain Louis	French Technical Advisor (Technical Advisor Partnerships and Strategic Alliance), FARA)	aange@fara-africa.org
	2	Eric Mcgaw	(Communications and Public Awareness Specialist) FARA	emcgaw@fara-africa.org
	3	Gbadebo Odularu	(Regional Policies &Markets Analyst) FARA	godularu@fara-africa.org
	4	Emmanuel Tambi	(Director,Regional Policies & Markets) FARA	etambi@fara-africa.org
	5	Leonard O. Oruko	(Marketing & Evaluation Specialist) FARA	loruko@fara-africa.org
	6	Karbo Naaminong	Director-CSIR Animal Research Institute (CSIR-ARI)	P.O. Box M32-ACCRA minongkordam@yahoo.com
	7	Nutsukpo Delali Kofi	Deputy Director, Environment and Land Management, Ministry of Food & Agriculture	P.O. Box M37-ACCRA kofi_nutsukpo@live.com
	8	Mamadou Ouattara	Coordinator for Capacity Building West African Science Service Center on Climate Change and Adapted Land Use (WASCAL)	WASCAL, AGRA Office Accra, Complex #6Agostino Neto Road Airport Residential Area, PMB KIA 114, Airport-Accra Tel Direct : +233 -302 740 666 Fax: +233-302 768602 mouattara@agra-alliance.org ouattaram@wascal.org www.wascal.org
	9	Zinedeme Minia	Director General, Ghana Meteorological Agency (GMet)	P.O. Box LG87, Legon-Accra, Tel: +233 30 251 1981 Email: gmet@meteo.gov.gh; minia_zin@yahoo.com
	10	Andrews Nkansah	Gmet	P.O. Box LG 87 Legon-Accra Ghana Meteo@africaonline.com.gh a.nkansah@meteo.gov.gh
	11	Ch Arles K. A. Yorke	Gmet	P.O. Box LG 87 Legon-Accra Ghana Meteo@africaonline.com.gh Yorke_charles@yahoo.co.uk
	12	J. Wellens-Mensah	Director, Hydrological Services Department (HSD)	P.O.Box MB 181, Accra Tel: +233 -21-666694 / +233 -21-666695 Fax: +233-21-677384 Email: hsd@ghana.com
	13		University of Kumasi	P.O. Box 40, Kumasi Email: admin@brri.org
	14		Water Research Institute	P.O. Box M 32, Accra Email: wri@ghana.com
	15	Ayilari-Naa Awupeyagi Juati	Gmet	P.O BOX LG 87, LEGON a.juati@meteo.gov.gh juatia@yahoo.co.uk
	16	Benjamin Lamptey	Region Maritime Univ. Nautical Service Dept.	P.O. BOX GP 1115 Accra bllamptey@GMetil.com
	17	Dady Demby	Programme Officer, Forum for Agricultural Research in Africa (FARA)	PMB CT 173 , ACCRA ddemby@fara-africa.org
	18	Lamourdia Thiombiano	FAO	P. O. Box GP 1628, ACCRA Lamourdia.Thiombiano@fao.org
	19	Roger Lewis Leh	Environmental Protection Agency (EPA)	rogerlewisleh@epaghana.org
	20	Mawuli Gbekor	Environmental Protection Agency (EPA)	mgbekor@epaghana.org
	21.	Ebenezer Dossoo	National Disaster Management Organization (NADMO)	ebendosso@yahoo.com, nadmo@live.com
	22	Naabuyi Dokurugu	National Secretary General, Ghana Agricultural Producers and Traders Organization Disaster Management Organization (NADMO)	ndokurugu@yahoo.com
	23	Haruna Agesheka	Secretary General Ghana Agric. Producers and Traders Organization (GAPTO)	Box 1040, Accra Central. Tel: +0233 302-672357 Cell: +233 244-379268/ 264-379268/ 273-942882 gaptosheka@yahoo.com
	24	Raja Najjar	CEO, Agricultural Services Ltd (AGRISERV)	rnajjar@agriserv.net, raja_najjar@hotmail.com
	25.	Georgette Yarboi-Quayson	Deputy Regional Environmental Coordinator	gyarboi-quayson@usaid.gov
	26	Lanto Harding	Chief, Operations & Regional Integration	West African Monetary Institute (WAMI) lharding@wami-imao.org
	27	Odame Larbi	LANDNET GHANA, Contacts of Resources Person	owlarbi@yahoo.com

COUNTRY	No.	NAME	DESIGNATION & INSTITUTION	ADDRESS & E-MAIL
GHANA	29	Stephen Nutsugah (	Council for Scientific and Industrial Research-Savanna Agricultural Research Institute (CSIR-SARI)	P.O. Box TL 52, Tamale, Ghana Tel (+233)243265430 sknutsugah@hotmail.com
NIGER	1	Adamou Baye Issoufa Baye	Ingenier Biotechnologies, Institut National de Recherches Agronomiques – (INRAN)	Bayuss2001@yahoo.fr
	2	Beninati Noel	WA interim Facilitator, ICRISAT	n.beninati@cgiar.org
	3	Diao Ba Maty	Head Information and Research AGRHYMET Regional Centre	m.badiao@Agrhymet.ne
	4	Harouna Niandou Abdel-Aziz	Ingenieur des Eaux et forets Mercy Corsp	abdelaziziandou@yahoo.com
	5	Hassane Yaye	Agroeconomist, Siege social immeuble UNC	befacrep@Yahoo.fr
	6	Kadi Kadi Hame Abdou	Scientist, Institut National de Recherches Agronomiques – (INRAN)	BP 429 Niamey hkkadi@GMetil.com
	7	Limani Aissa D. Diallo	DMN	limanaissa@yahoo.fr
	8	Ousman Baoua Youchaou	DMN	ousmanebaoua@yahoo.fr
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	3	Water Research Institute P.O. Box M 32, Accra Tel: (+23321)775-351/2, 779-514/5, 775-511 Fax: (+23321)777-170 Email: wri@ghana.com
	4	The Council for Scientific and Industrial Research (CSIR) - Crops Research Institute (CSIR-CRI) http://www.cropsresearch.org/
	5	International Water Management Institute (IWMI) CSIR Campus, Martin Odei Block, Airport Res. Area, Accra PMB CT 112, Cantonments, Accra Telephone: +233 30 2 784752-4 Fax: +233 30 2 784752
	6	Ghana Agricultural Producers and Traders Org. (GAPTO)
	7	Ministry of Food And Agriculture (MOFA)
	8	Kwame Nkrumah University of Science & Technology (KNUST), University Liaison Office, Kumasi Telephone/Fax: 00233-(0) 51-60206 Email: iwmi-kumasi@cgiar.org; iwmi-ghana@cgiar.org
	9	National Disaster Management Organization (NADMO)
	10	Environmental Protection Agency (EPA)
	11	Savannah Accelerated Development Authority (SADA)
	12	International Food Policy Research Institute (IFPRI)
	13	Savanna Agricultural Research Institute (SARI)

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

COUNTRY	No.	PROGRAM / PROJECT
BURKINA FASO	1	SOFITEX-Burkina Faso
	2	SOFITEX-Burkina Faso
	3	Association pour le Développement Rural
MALI	4	Early Warning System Group – Mali
NIGER	5	CARE International programs in : livelihood security, civil society organisation development, health and micro-finance.
	6	MOORI BEN (Niamey)
	7	FCMN NIYA (Niamey)
	8	AREN (Niamey)
	9	FUMA GASKIYA (Maradi)
	10	ICRISAT Integrated Genetic and Natural Resource Management (IGNRM)
	11	WFP Protracted Relief and Rehabilitation Operation (PRRO)
	12	Community-based Adaptation (CBA)-Niger
SENEGAL	18	Adaptation to Climate and Coastal Change in West Africa (ACCC) project
	14	CIDA Food Security and Nutrition Support Project
	15	ENDA-TM Programme Energie- Environnement
GHANA	16	*Agence Francaise de Development* (AFD)
	17	interdisciplinary GLOWA Volta Project (GVP) in Ghana is under
	18	FAO Technical Cooperation Programmes (TCPs)
	19	FAO Trust Funds (UTF) projects
	20	Ghana Agricultural Producers and Traders Org. (GAPTO)
	21	Northern Rural Growth Programme (NRGP)
	22	Northern Region Poverty Reduction Program (NORPREP)
	23	Canadian International Development Agency (CIDA)
	24	German Development Assistance Agency (GTZ)
	25	Pro-Poor Agricultural & Development Policies and Advocacy
	26	Root and Tuber Improvement and Marketing Programme (RTIMP)
	27	Rural and Agricultural Finance Programme (RAFiP)
	28	Rural Enterprise Project Phase II (REP II)and Agricultural Finance Programme

Appendix 7: Climate Products

DMN-NIGER : Dekadal agro-hydrometeorological Bulletin

2ème décade septembre

N° 12 de l'année 2010

GROUPE DE TRAVAIL PLURIDISCIPLINAIRE (GTP-NIGER)

Bulletin agro-hydro-météorologique décadaire

SITUATION METEOROLOGIQUE: précipitations faibles à modérées à l'ouest et modérées à fortes à l'est du pays

Situation synoptique

L'air humide s'est manifesté sur toute la décade sur une épaisseur d'environ 1 500 m.

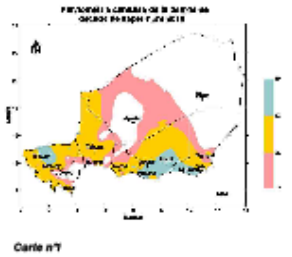
Le Front Inter Tropical a gardé une position moyenne sur l'axe Arlit–Iférouane– Nord N'gourti.

Situation pluviométrique

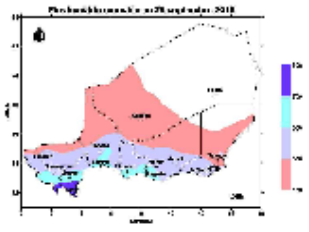
La deuxième décade du mois de septembre 2010 a été caractérisée par des précipitations faibles à modérées à l'ouest et modérées à fortes à l'est du pays (voir carte n°1).

Le cumul pluviométrique décadaire a varié entre 10 et 90 mm sur la majeure partie du pays. Quant au cumul saisonnier, il a varié entre 300 et 800 mm dans la grande majorité de la bande agricole comme l'indique la carte n° 2.

Comparé à l'année passée et à la moyenne 1971_2000 le cumul saisonnier au 20 septembre 2010 est excédentaire respectivement sur 78 et 85% des postes suivis comme le montre la carte n°3.



Carte n°1



Carte n°2

SITUATION AGRICOLE : Non parvenue

Dans ce numéro :

Sommaire :

- *Précipitations faibles à modérées à l'ouest et modérées à fortes à l'est du pays;*
- *Cote d'alerte du niveau du fleuve Niger à Niamey;*
- *Bonne situation hydrologique dans l'ensemble du pays;*
- *Maturation du mil sur l'ensemble de la zone agricole;*
- *Conditions agrométéorologiques favorables au séchage des produits récoltés.*
- *Baisse des prix des céréales sèches et légère hausse au niveau du riz importé.*

3ème décade novembre

année 2010

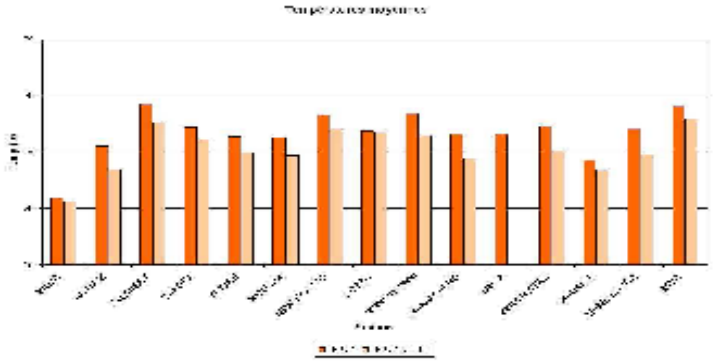
e-mail: dmn@intnet.ne
site web: www.meteo-niger.net

REPUBLIQUE DU NIGER
MINISTERE DES TRANSPORTS DU TOURISME ET DE L'ARTISANAT
DIRECTION DE LA METEOROLOGIE NATIONALE

BULLETIN CLIMATIQUE DECADAIRE

Les températures

Les températures moyennes de la troisième décade du mois de novembre 2010 ont varié entre 21,0 et 29,3°C. Elles sont en hausse par rapport à la moyenne 1971_2000 sur l'ensemble des stations synoptiques. La température minimale la plus basse (5,5°C) a été enregistrée à Bima le 30 novembre et la température maximale la plus élevée (39,1°C) à Tillabéri et Gaya respectivement le 28 et le 27 novembre.

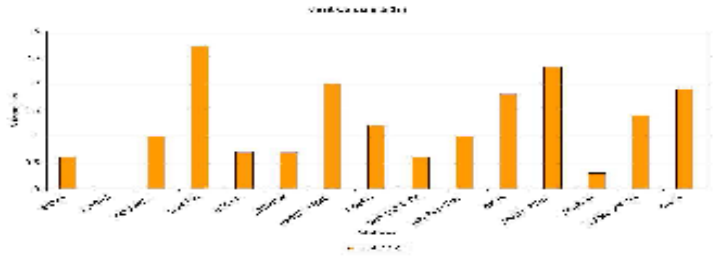


L'évapotranspiration

L'évapotranspiration moyenne journalière a varié entre 2,8 et 7,4mm. Elle est en baisse par rapport à la moyenne 1971_2000 sur la majorité des stations synoptiques.

Le vent

Les vitesses du vent ont varié entre 0,3 et 2,7 m/s. Elles sont en baisse sur la moitié des stations par rapport à la décade précédente.



L'humidité

L'humidité moyenne de l'air est en baisse par rapport à la décade passée sur la majorité des postes de mesure. Elle a varié entre 16 et 44%.

Early warning system bulletin

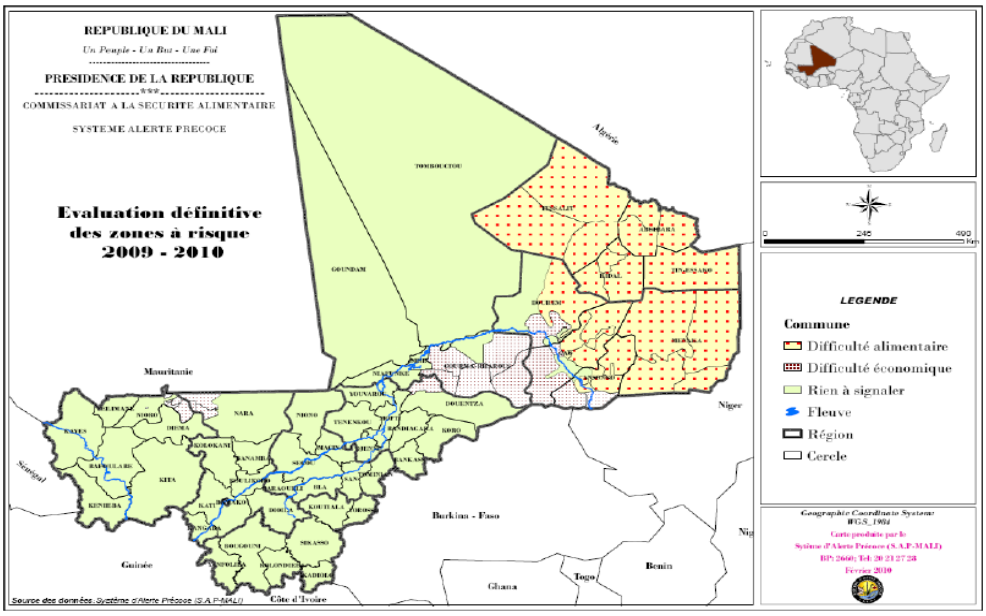
This bulletin is issued by the food security commission in Mali. It describes the food situation at local level, highlights areas at risk, and proposes policies and decision options to improve food situation.

PRESIDENCE DE LA REPUBLIQUE
COMMISSARIAT A LA SECURITE ALIMENTAIRE

REPUBLIQUE DU Mali
Un Peuple – Un But – Une Foi

BULLETIN SAP

N° 283 Situation fin février 2010



Système d'Alerte Précoce – S.A.P. – B.P. 2660, Bamako, République du Mali – Tél : (223) 20.21.27.28

Adresse email : sapmali@afribone.net.ml
Adresse site Web : www.sapmali.net.ml

FEWSNET Report

FAMINE EARLY WARNING SYSTEM NETWORK ◆ MAURITANIA
USAID Project managed by Chemonics International Inc.

TEL: (222) 525 39 18 FAX: (222) 525 39 18 E-mail: HSy@fews.net

MONTHLY REPORT FOR AUGUST 2002
RAPPORT MENSUEL DU MOIS D'AOÛT 2002

This report covers the period from July 30 to August 28, 2002

Summary

The dry season is continuing in the farming and herding areas of the southwestern, central and northern parts of the country. In the southeast, rainfall totals recorded through the end of the second dekad of August were less than for the same period in 2001 and less than the 1987-2001 average. In many agricultural areas, the farmers had to re-plant their fields. In low-lying areas, the crops that are farthest along are at the height-growth and tillering stages.

The thickest pastures and most advanced crops are seen in the southern strip of the country bordering on Mali (from the Maghama *Moughataa* (department) in Gorgol *Wilaya* (Region) to the Djiguenni *Moughataa* in Hodh El Chargui), but even there, the farmers are skeptical about how this season will turn out. Everywhere else, the farmers are still waiting for the first rains sufficient for planting.

Grazing conditions are improving throughout the eastern part of the country but remain particularly worrisome in the center and the southwest, where increasing numbers of animals are dying.

Food insecurity is at its worst ever, and extremely food-insecure areas (the pastoralist *moughataas* of Trarza, *moughataas* in the Senegal River valley and the Aftout, and central *moughataas* of Hodh El Chargui and Hodh El Gharbi) are slipping inexorably into pre-famine conditions. In the Aftout [Brakna, Gorgol and Assaba *wilayas* , there is an increasing number of cases of acute malnutrition, night blindness, scurvy, and even death due to undernourishment and thirst. Survival strategies, which are based on careful use of the meager contributions sent by "emigrant relatives," are no longer adequate to manage the prevailing food crisis.

The World Food Programme (WFP) has still not been able to bring together the funds necessary for an intervention. Sporadic food distributions organized by the *Commissariat à la Sécurité Alimentaire* (CSA) [Food Security Commission] have not been sufficient to stop the ongoing deterioration of food conditions.

The prices of all foodstuffs (traditional cereals and imported products) are rising everywhere in the country, and in some growing areas (Trarza, Brakna, Gorgol and Hodh El Chargui *wilayas*) the price of sorghum has reached an all-time high. However, with the exception of sorghum, foodstuffs are in good supply. The market is well supplied with imported food products for those who can afford to buy them.

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The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic initiative of the Consultative Group on International Agricultural Research (CGIAR) and the Earth System Science Partnership (ESSP), led by the International Center for Tropical Agriculture (CIAT). CCAFS is the world's most comprehensive global research program to examine and address the critical interactions between climate change, agriculture and food security.

For more information, visit www.ccafs.cgiar.org

Titles in this Working Paper series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

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IRI The International Research Institute for Climate and Society

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