Regional priorities for strengthening climate services for farmers in Africa and South Asia

Working Paper No. 71

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

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Abstract

This report captures a process of shared South-South learning and planning towards defining priorities for strengthening and scaling-up climate information and advisory services for agriculture and food security in West Africa, Eastern and Southern Africa, and South Asia. The process began at the international workshop on "*Scaling up Climate Services for Farmers in Africa and South Asia*" (Saly, Senegal, December 2012), where participants collectively identified critical gaps in the design, delivery and effective use of climate services for smallholder agriculture; and self-organized into working groups to develop a set of priority actions for strengthening climate services for smallholder farming communities within and across regions in sub-Saharan Africa and South Asia. Following up on a commitment made at the workshop, USAID and CCAFS partnered to develop a small grants program and sponsor a set of guided planning workshops to enable the working groups that emerged from the Saly workshop to further develop their visions, and obtain resources to begin to implement them. Expert working groups from all regions prioritized improving the scientific capacity of National Meteorological and Hydrological Services (NMHSs) to develop location specific seasonal climate forecasts at the subnational scale, and enhancing institutional frameworks for collaboration between the different agencies involved in the production and communication of climate services. The Eastern and Southern Africa working group also emphasized the co-production with farmers of location-specific climate services, and the importance of assessing the added value of climate services for enhancing agricultural production and managing risk. The West Africa working group prioritized communications mechanisms for reaching marginalized groups, including rural radio and Information and Communications Technologies (ICTs), and training farmers to access and use climate information. Building on the region's existing strength in ICTs, the South Asia group emphasized efforts to identify appropriate ICT tools and build the capacity of smallholder farmers, women, poor and socially marginalized groups to access and utilize climate information services.

Keywords

Climate information services; Africa; South Asia

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Contents

Acronyms

ACMAD	African Center of Meteorological Application for Development
AGRHYMET	Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle
AMMA	African Monsoon Multidisciplinary Analyses
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
AWS	Automatic Weather Station
CCAFS	CGIAR Research Program on Climate Change, Agriculture, Food Security
CSP	Climate Services Partnership
GHACOF	Greater Horn of African Climate Outlook Forum
ICPAC	IGAD Climate Prediction and Applications Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and Communication Technology
IDRC	International Development Research Centre
ILRI	International Livestock Research Institute
IRI	International Research Institute for Climate and Society
NARS	National Agricultural Research System
NMHSs	National Meteorological and Hydrological Services
RANET	Radio and Internet for the Communication of Hydro-Meteorological and Climate-Related Information
RCOF	Regional Climate Outlook Forum
RIMES	Regional Integrated Multi-Hazard Early Warning System for Asia and Africa
SADC	Southern African Development Community
SARCOF	Southern Africa Regional Climate Outlook Forum
USAID	United States Agency for International Development
WMO	World Meteorological Organization

Introduction

In December 2012, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), the United States Agency for International Development (USAID), the World Meteorological Organization (WMO), and the Climate Services Partnership (CSP) organized the international workshop on "*Scaling up Climate Services for Farmers in Africa and South Asia*," in Saly, Senegal (Tall et al., 2013). More than 100 experts, representing 30 countries and roughly 50 institutions, collectively identified critical gaps in the design, delivery and effective use of climate-related information for risk management among smallholder farmers in sub-Saharan Africa and South Asia, and the strategies for addressing them. The diverse set of researchers and practitioners present reached a consensus that five key challenges must be targeted in order to substantially improve climate services for farmers and strengthen their livelihoods:

- *Salience*: tailoring content, scale, format and lead-time to farm-level decision-making;
- *Access*: providing timely access to remote rural communities with marginal infrastructure;
- *Legitimacy*: ensuring that farmers own climate services, and shape their design and delivery;
- *Equity*: ensuring that women, poor and socially marginalized groups can access and use available climate services; and
- *Integration*: providing climate information as part of a larger package of agricultural support and development assistance, enabling farmers to act on information.

Through creating a space for shared learning between and within the regions represented, the workshop initiated a collective process toward defining priorities for strengthening and scaling-up climate information and advisory services for agriculture and food security in these regions, and identified actionable steps towards achieving this vision. After examining case studies that present good practices in overcoming the key challenges to effective climate services for smallholder farmers, workshop participants met in self-organized regional working groups (West Africa, Eastern and Southern Africa, and South Asia) to identify the key strengths, gaps, and priority opportunities for growth in each region. Fifteen ideas were put on the table for up-scaling and strengthening the impact of climate services for smallholder farmers in the target regions. Participants then collectively prioritized and self-

organized into working groups around seven of these ideas, and articulated their collective vision and commitment to those ideas within draft concept notes. The concepts drew from a broad range of expertise across the full scope of agro-meteorological advisory systems: information producers, enabling institutions and communicators to end-users.

In the final session of the workshop, the workshop sponsors (CCAFS, USAID, WMO, IRI, and the Climate Services Partnership (CSP)) outlined plans to support the further development of these concepts into actionable strategies for strengthening climate services within and across regions, and pledged to help participants move these ideas forward. This included support for planning and proposal writing workshops, competitive start-up grants, and assistance in identifying potential sources of further funding. Following through on that pledge, USAID subsequently sponsored regional workshops in June-July 2013, to support further development of regional plans for action, and funding proposals for implementing the different components of each regional plan. This report describes the process by which USAID and CCAFS; in collaboration with IRI, WMO and CSP; supported workshop participants to further develop their ideas into actionable regional roadmaps and secure seed funding to begin to implement those plans. It summarizes the regional visions and strategies that were defined through the process.

Planning and organizing small grants proposal workshops

As a follow-up to the Saly workshop process, USAID, through its Climate Change Resilient Development Project (CCRD) program, proposed a competitive small grants program to catalyse implementation of the ideas that emerged from the Saly meeting. Planning workshops in June-July 2013, supported by CCRD, provided working groups with opportunity and expert guidance to develop their ideas into small grant proposals to advance climate services for smallholder farmers in these climate vulnerable regions.

As a continuation of the South-South learning process initiated in Saly, the grant call placed priority on activities that would enhance collaboration among institutions within and across Eastern and Southern Africa, West Africa and South Asia. Discussions in Saly identified

increased integration across the agricultural and climate communities and other relevant institutional communities and disciplines as an important stepping-stone to scaling up climate services; therefore, the USAID small grant program also aimed to support activities that involve multiple types of organizations and bring in expertise to address across the full scope of climate services systems within the different regions.

Between June and July 2013, four Proposal Writing and Planning Workshops were held in Nairobi, Kenya; Kathmandu, Nepal; and Dakar, Senegal to build upon the accomplishments of the previous meeting in Saly, Senegal. These workshops brought together the working groups from the Saly workshop that submitted actionable ideas focused on approaches to scaling up climate services in Africa and South Asia. The workshop objectives were to (a) further develop and consolidate concepts into a vision and initial roadmap for strengthening climate services for the region, in part as a springboard for approaching other interested development funders, and (b) provide help to groups in developing and refining proposals for the USAID-funded small grants opportunity.

The planning workshops were jointly convened by CCAFS and USAID, and facilitated by Dr. Mannava V.K. Sivakumar, Senior Consultant and formerly Director of the Climate Prediction and Applications Branch of the World Meteorological Organization. Each of the four workshops followed schedule of concept note and proposal development. Workshop participants divided themselves into working groups based on their individual interests and regional priorities. Their task was to further develop the priority "big ideas" that were agreed on during the Saly workshop to advance climate services for farmers across Africa and South Asia. These groups first drafted two page concept notes that further developed their visions for strengthening climate services in each region. The working group leaders then presented the concept notes in a plenary setting for review. Working groups reconvened following the presentations and discussions to begin the process of preparing draft grant proposals.

The groups spent the remainder of their time together writing, revising, and presenting their grant proposals. Each of the four proposal-writing workshops developed their own timetable for proposals to be finalized by the final deadline of 22 July 2013. Group members were encouraged to work through e-mail exchanges after the workshops to move towards a finalized version of their proposals.

This workshop process enabled the various key regional stakeholders; including regional climate centres, agricultural experts, professional communicators and farmer representatives; to come together to identify regional priorities to scale up climate services for farmers, and develop action plans for implementation. This process led to the development of concrete project proposals for the USAID CCRD small grant program. The regional action plans resulting from the workshop process, which represent each working group's collective vision of what is needed to scale up climate services for farmers in their respective regions, are described in the following section.

Regional priorities for scaling up climate services

Eastern and Southern Africa

Eastern and Southern Africa Regional Priorities

- Improve collaboration between meteorological, academic, agricultural research and extension services.
- Develop and test effective communication methods for timely delivery of climate services for various stakeholders in the agriculture and food security sectors, including ICT based mechanisms.
- Achieve co-production of knowledge by enabling farmers to collect climate data and express needs for specific locations.
- Enhance the capacity of NMHS to generate location-specific forecasts and integrate different types of weather data to overcome the lack of analysed historical data and low density of observation networks in the region.
- Evaluate the effectiveness of value-added climate services for disaster risk reduction and enhancement of smallholder farm productivity.

Climate-related development challenges

The economies and livelihoods of farmers in the Eastern and Southern Africa regions are highly dependent on rainfed agriculture and hence vulnerable to climate extremes associated with increasing climate variability and change. In East Africa, agriculture contributes 40% to GDP (Kadi 2011a). Nearly 80% of residents depend on agriculture for a living. It is anticipated that climate change will enhance the current variability in climate and threaten the

region's reliance on agriculture for socio-economic development. In particular, extreme weather events, such as severe storms, droughts, floods, storms, lightning and frost are expected to become more prolonged, frequent and severe. In addition, sea level rise is predicted to threaten coastal areas, potentially causing major population shifts and disrupting agricultural ecosystems (Parry 2007).

The resultant consequences are manifesting in form of degraded agricultural land resources, increased poverty, food insecurity, increased vulnerability of agricultural systems to climate change, increased dependency of the region on relief food supplies, and collapse of livelihood support systems. As a result there is an increasing need to build resilience in the regions' agricultural systems that would assure increased capacity to adapt to adverse effects of climate change and climate variability related hazards.

Current initiatives

The Eastern and Southern Africa (ESA) working group described existing regional and national meteorological agencies and agricultural research organizations across the territory as a solid foundation for up-scaling climate services. Skilled forecasts are available for the region as well as strong networks of NGOs, extension services, and available human resources. These entities are poised to put this information to use to enhance farmer capacities (Tall et al. 2013).

Regional climate institutions such as the IGAD Climate Prediction and Applications Centre (ICPAC) in Eastern Africa and Southern African Development Community (SADC) in Southern Africa, and the National Meteorological and Hydrological Services (NMHS) have initiated efforts to generate and disseminate climate information to a variety of users and stakeholders through knowledge sharing platforms such as regional climate outlook forums (Greater Horn of Africa Climate Outlook Forum (GHACOF) and Southern African Regional Climate Outlook Forum (SARCOF)).

With the realization of the potential value of seasonal climate forecasts in reducing the vulnerability of smallholder farmers to climate risks, several institutions have initiated studies on how best to deliver climate services to farmers. These include efforts by ICPAC to develop relevant agro-meteorological products in easily understandable formats and their timely distribution with support from the Rockefeller Foundation; evaluation of the usefulness of

forecasts in farm level decision making by the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) within the International Development Research Centre (IDRC) supported projects in Kenya, Tanzania, and Ethiopia; agro-meteorological advisory services provision in Ethiopia, Kenya and Uganda supported by the Rockefeller Foundation; and an International Crops Research Institute for the Semi-Arid Tropics/CCAFS project on communicating probabilistic seasonal climate forecasts in the Wote district of Makueni County in Kenya, Oloitokitok, Nganyi, Nyahera and Reru Communities in Kenya (ICPAC) and other specific findings from similar projects by ASARECA.

Gaps

However, challenges remain in downscaling information from regional climate outlook forums and NMHSs to specific locations to provide tailored and accurate climate services. Meteorological services have limited capacity to generate high quality, location specific, and farmer relevant climate information, and availability of and access to observational data is limited. NMHSs are characterized by inadequate computing and information technology capacity to undertake up-to-date weather and climate modelling activities. In general, most NMHSs in the region are often confronted with a lack of funding, climate expertise, and equipment for weather observations, which is a critical basis for efficiently delivering weather and climate information.

Weather and climate monitoring infrastructure in the region has deteriorated, and human resource capacity is not keeping pace with the increasing demand for climate services due to climate change. Many weather observation stations have closed and stations that are still operational observe a limited set of weather parameters, less frequently and sparsely, using instruments that are aging and frequently failing. This creates frequent data gaps that constrain meaningful analyses that could deliver location specific climate information for agricultural decisions. This fact creates an immense weather data gap in the ESA region.

Extension services and agricultural researchers have low levels of awareness about climate variability and the potential opportunities to manage its impacts, and low levels of capacity to interpret climate information for on-farm decision making and for developing appropriate agricultural strategies. Climate information users also have low levels of awareness and

understanding of climate information products and their relevance, and limited access to tailor-made information in a timely manner from reliable sources.

Other challenges include the low uptake and utilization of seasonal climate forecasts; limited understanding of the probabilistic nature of seasonal climate forecasts and their reliability; lack of timely access to seasonal climate forecasts in a format that can be easily understood by end users; and limited capacity to utilize seasonal climate forecasts by both farmers and extension agents in planning and decision making in agriculture. The uncertainty inherent in the probabilistic nature of the climate forecasts is an additional constraint to the utilization of seasonal climate forecast information.

Regional priorities

The working group recognized that one pathway to the realization of sustainable development in the region is to explore ways of supporting regional governments to formulate appropriate policies and plans that will guide climate-informed decisions. This calls for availability of reliable climate services and communication mechanisms that will complement routine weather forecasts and severe weather warnings, which are currently used to inform the public on impending extreme weather conditions. This process will enable better management of the risks of climate variability and change and inform adaptation to climate change, through the development and incorporation of science-based climate information and prediction into planning, policy and practice on the regional and national scales.

To achieve this goal, the capacity and institutional linkages to generate, package and communicate user-oriented climate services to facilitate smallholder farmer decision-making must be improved. Increased institutional linkages are needed to improve collaboration between meteorological, academic, agricultural research and extension services, allow for better feedback from farmers to climate service providers, and ultimately enhance climate services for farmers. The multi-disciplinary working group structure from Mali allowing meteorological services to collaborate with rural development services was proposed as a model. Involving agricultural extension agents in meteorological services training is another opportunity to leverage existing resources for better integrating the agriculture and meteorology communities.

The second pillar of this approach is developing and testing effective communication methods for timely delivery of climate services for various stakeholders in the agriculture and food security sectors, including ICT based mechanisms. The development, testing and promotion of appropriate training modules to enhance understanding and implementation of probabilistic climate information is a parallel strategy, addressing the need to improve the capacity of smallholder farmers to interpret and apply climate information and related agro-advisories in farm level planning and decision making. Gender and equity considerations should be paramount in developing training modules and methods of service delivery. Networks of 'intermediaries' that already support farmers, including international and regional NGOs, can be leveraged to support data collection and provision of climate services at the farmer level.

In order to address the issue of informational salience, the group recommended the co-production of knowledge achieved through enabling farmers to collect climate data and express needs for specific locations. This action addressed the challenge of tailoring forecasts to the appropriate scales. The co-production of knowledge could also be a foundation for donor supported micro-projects addressing risk management for the smallholder farmers.

On the technical side, research partnerships with NMHS were recommended for enhancing their capacity to generate location specific forecasts. The ESA working group also established that the sharing of good practices for integrating different types of weather data (from traditional measurements, Automatic Weather Stations (AWS), and satellites) could help overcome the lack of analysed historical data and low density of observation networks in the region. Seeking donor support for the promotion of AWS and model climate data management systems was also suggested (Tall et al. 2013).

Finally, the ESA working groups identified the need to evaluate the effectiveness of value-added climate services in disaster risk reduction and enhancement of smallholder farm productivity. It is their belief that if this is done properly, it will lead to an improved understanding of the outcomes accruing from the use of quality climate services.

The development of this roadmap, by working closely with the ongoing initiatives by international and regional bodies such as ICRISAT, CCAFS, ICPAC, SADC and other relevant projects in the Eastern and Southern Africa region, will strengthen the development of tailor-made location-specific climate information products and the dissemination component by identifying climate products tailored for use by the vulnerable communities;

exploring alternative but more effective communication pathways for timely delivery of climate information to farming communities and for the private sector to disseminate seasonal climate forecast information; and enhance the capacity of farmers and their support agents in the understanding and use of climate information in planning and decision making.

West Africa

West Africa Regional Priorities

- Strengthen scientific capacity of NHMSs to develop improved seasonal climate forecasts, downscaled to subnational level.
- Develop technical group schemes that will provide agro-meteorological assistance (agrometeorological advisories).
- Develop communication mechanisms to reach end-users (e.g. through rural radio, ICT) and marginalized groups, including women, through specific communication channels including innovative use of communications intermediaries.
- Develop public-private partnerships in ICT, such as governmental contracts with cell phone companies, for information services provision and enhanced utilization of local radio and ICT.
- Develop improved methods to train farmers to access and use climate services.

Climate-related development challenges

In West Africa, the livelihoods of millions of smallholder farmers in the semi-arid and sub-humid regions depend on subsistence agriculture. Regional agriculture is mainly rainfed and subsistence based (cereals, roots and tuber, legumes) with some cash crops, and is the major source of livelihood for about 290 million. It employs 60% of the active labour force and contributes to 35% of the GDP (Kadi 2011b).

Climate variability and climate change are the major threats to agriculture and food security in the region. The growing incidence of climate extremes is currently affecting agricultural productivity due to weather related crop failures, fisheries collapses and livestock deaths, resulting in economic losses. Food insecurity and malnutrition are recurrent and widespread and thus poverty levels are increasing. For example, the dependence on uncertain rainfall and exposure to climate risk characterize the livelihoods of roughly 70% of the region's

population; and frustrate efforts to sustainably intensify agricultural production, reduce poverty and enhance food security (Hansen et al. 2011).

Current initiatives

Recent and current climate related programs in the region include CCAFS sites in West Africa: Kaffrine (Senegal), Segou (Mali), Yatenga (Burkina Faso), Lawra-Jirapa (Ghana) and Kollo (Niger). From 2011 to 2013, the CCAFS West Africa Program placed emphasis on strengthening the capacity of farmers and NMHS in on seasonal forecast communication and evaluation. Research efforts at these sites address five issues including the tailoring of climate information to the needs of West African Farmers; historic weather data reconstruction, methodology development, data set development and capacity building; documentation and preparation of African Monsoon Multidisciplinary Analysis (AMMA) data in support of crop and rangeland forecasting; evaluation of Mali's agro-meteorological advisory program with a view towards strengthening and up-scaling; and climate risk management through participatory action research. Key partners include the Regional Centre for Training and Applications in Agricultural Meteorology and Operational Hydrology (AGRHYMET) of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS), NMHS, National Agricultural Research Systems (NARS), farmers, and decentralized government directorates.

Regional Climate Outlook Forums (RCOFs) have been the focal point of international efforts to produce and deliver seasonal forecasts to stakeholders in climate-sensitive sectors in West Africa since the late 1990s. The RCOF model was conceived as a way to support NMHSs, which were expected to downscale consensus forecasts and tailor them to the needs of stakeholders within their countries. The RCOFs in Africa were initially designed to enhance the credibility of forecasts by strengthening NMHSs and by reconciling multiple and sometimes conflicting information sources.

The West African RCOF, *Prévision Saisonnière en Afrique de l'Ouest* (PRESAO), like other regional African RCOFs operate with the backing from the World Meteorological Organization (WMO), and support from WMO Global Producing Centres and other international climate centres (e.g. International Research Institute for Climate and Society (IRI), UK Met Office, Météo-France). The RCOFs bring together the HMHS and various users from a region to develop, distribute, and discuss potential applications of a consensus forecast of rainfall and sometimes other variables for the coming season. PRESAO releases

forecasts that target the monsoon season of the Sahelian belt, and produces monthly updates, but does not service the rainfall seasons of the southern coastal region of West Africa (Hansen et al. 2011).

Looking beyond RCOFs, is the Climate for Development in Africa (ClimDev-Africa), which is a new program of the African Development Bank, the African Union, and the UN Economic Commission for Africa (UNECA) that seeks to overcome the lack of necessary climate information analysis and options required by policy and decision makers at all levels. Its objectives are to build the capacity of African climate institutions to generate and disseminate useful climate information (beginning with regional climate centres: ACMAD, AGRHYMET, ICPAC, SADC-DMC); enhance the capacity of end-users to mainstream climate into development; and implement adaptation and mitigation programs that incorporate climate-related information. ClimDev-Africa was developed in response to the identified gap between supply and demand in currently offered climate services available to the regional stakeholders (Hansen et al. 2011).

Another example of a contemporary best practice climate service program is the far-reaching Roving Seminars on Weather, Climate and Farmers (METAGRI) project, which is a WMO-sponsored endeavour implemented in cooperation with West Africa NMHSs in over 15 countries. The project has resulted in the organization of more than 300 roving seminars from 2008 to 2012. More than 10,000 farmers and agriculture extension agents have been trained in the use of climate and weather information for better food security and increased agricultural production.

The dissemination of relevant climate based information to smallholder farmers is a major building block for the West African region. Current initiatives such as the Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information (RANET) project is seen as an innovative communication approach by providing remote communities with beneficial radio based information services. The project provided community members with windup radios and community groups with local broadcasting stations, (solar powered in some locations), with the capacity to download information from the Internet using satellite linkages. In addition, the African Farm Radio Research Initiative (AFRRI), which was started in 2007, is documenting how rural radio can be used to best serve the information needs of

smallholder farmers in Africa, and how ICTs when combined with radio can increase effective information dissemination (Jost 2013).

Gaps

The working group identified several gaps that would prevent or hinder the scale-up of climate services in the West Africa region. They focused particular attention on information delivery and penetration.

One of the key aspects in the recognized limitations of communication with farmers includes the present costs, low coverage of ICTs, and the need to translate advisories into local languages. Since most farmers are illiterate, they are unable to use SMS-based services. Local community radios are one solution to this problem but their coverage is not widespread. Supporting NMHSs in translating information into local languages is one strategy for better serving end user needs, as is establishing an effective dialogue between end users and climate service providers.

Current seasonal and near-term weather forecasts issued by NMHS are seen as supply driven, and do not necessarily reflect understanding of the needs of end-user such as farmers. Accurate climate forecast information that could assist with agricultural management decisions (planting, fertilization, harvesting) could help improve productivity and profitability, and reduce losses. Effective adaptation to climate variability and climate change is highly dependent on access to and use of climate information for the coming seasons and years to enable decision-making for the present and the future; hence there is a need to tailor climate information to the needs of farmers.

Working group members cited a sparse data collection network, especially in poor rural communities, as a major challenge to up-scaling the provision of location specific climate information. This is part of the larger need to enhance capacity at all levels of climate services including salient forecast development, comprehensible communication products/methods, and end user engagement. This challenge also includes improving observing networks, conducting roving seminars (similar to METAGRI) with farmers and training them in data collection as well as incorporating local knowledge into the climate services development (Hansen et al 2011).

Regional priorities

The West Africa working groups built on the identified gaps and challenges such as the need for strong engagement and participation of local stakeholders in climate services production and delivery, with emphasis on putting farmers' needs first; acknowledging indigenous knowledge and combining it with scientific forecasts; capacity strengthening; evaluation and regular feedback; and monitoring and evaluation.

The way forward includes: strengthening scientific capacity of and the NHMS to develop improved seasonal climate forecasts, downscaled to subnational level; developing technical group schemes that will provide agro-meteorological assistance (agrometeorological advisories); and developing communication mechanisms to reach end-users (e.g. through rural radio, ICT) and marginalized groups, including women, through specific communication channels.

In order for these improvements to be made, broad collaboration among various institutions and agencies must be institutionalized. These include NMHSs, national agricultural research and extension services (NARES), regional centres, academic institutions, NGOs, civil society and private sector, local decentralized public directorates (e.g., agriculture, livestock, environment,), International Agricultural Research Centres (IARCs), farmers associations and the media. Coordinated institutional frameworks for the generation of farmer-focused climate services should be established, with Mali's multi-disciplinary working group serving as an effective model allowing meteorological services to collaborate with rural development services. This is an example of what the Saly working group highlighted as an area for further development- disseminating lessons learned and training materials from organizations that have successfully built capacity over the past five years as a means of useful strategy for building capacity and preventing its erosion (Tall et al. 2013).

The working group's focus on climate information access provides a solid starting place for scaling up climate services in the region. They noted that existing communication technologies and networks in West Africa offer a strong foundation to build upon. Recent research also shows that in particular, radio is one of the most successful means of information dissemination to rural communities, which is supplemented by the rapid growth in mobile-phone usage throughout the region (Jost 2013). Internet and television also have a strong potential for increasing the penetration of climate information into rural communities.

In addition to access, the credibility of climate information is improved through cooperation of both scientific and non-scientific organizations in the delivery of such information (Jost 2013). This highlights the need for integrating services from multiple sources and stakeholders. A participatory approach to developing communications solutions was proposed, with special attention to gender challenges in communications.

Opportunities to meet the previously mentioned communication challenges include the establishment of governmental contracts with cell phone companies for the provision of effective information services, and enhanced utilization of local radio and ICTs. Public-private partnerships in ICT, an approach that has found success in South Asia, were also suggested to help create demand and reduce the costs for usage in extension systems. Utilization of multiple channels of communication, and innovative uses of communications intermediaries, can also help overcome ICT cost constraints. This method would work towards multiple stakeholder engagement and the building of a diverse information base.

To address the communications gap between agro-climatic information producers and users, a participatory approach involving farmers was proposed, with special attention to gender challenges in communications. For example, the working groups recognized that understanding social differentiation broadly is important, but in particular, crops and tasks should be considered by gender in order to understand the relevance of climate information services to different groups. Researchers and extension workers should also be attentive to information channels, languages, and the particularities of participatory group processes, which may impact whether dialogues with farmers should be conducted in separate groups (Tall 2013). Currently in West Africa, innovative programs address these issues, such as the Jokko Initiative of the Community Empowerment Program, which teaches the basics of SMS to women in communities before launching SMS communication applications (Jost 2013).

Recognizing that developing improved methodologies to train farmers in the access and use of climate services should go hand in hand with improving the delivery systems, the working group proposed an activity around “capacity-building” to create sustainable conditions for enabling actors in West Africa to supply and effectively use climate services. Through a focus on participatory development of solutions and mobilization of trained local intermediaries, the project will help to introduce technologies built upon farmers’ indigenous knowledge systems and existing social groups and networks to enhance ownership and sustainability. Potential

methods to be employed include sensitization seminars and collaboration with known institutes on agrometeorological services and knowledge in capacity building for the purposes of knowledge transfer (Tall et al. 2013). Additionally, recent research has shown that since facilitated group interaction appears to be the most effective method to communicate seasonal forecast information in a way that farmers can use, climate information should ideally be a routine part of agricultural extension services where they are functional (Hansen et al. 2011).

South Asia

South Asia Regional Priorities

- Create appropriate mechanisms to promote greater interaction between smallholder farmers, agricultural research agencies, and NMHSs in the generation of climate information and its dissemination.
- Develop more robust infrastructure and capacity of NMHSs through increased national, regional and international collaboration, to enable them to provide more effective climate services.
- Identify appropriate ICT tools, and make better use of them for more effective and efficient dissemination of climate information for smallholder farmers**.**
- Build the capacity of smallholder farmers, women, poor and socially marginalized groups to use ICT tools.
- Strengthen collaboration between different agencies involved in the production and communication of climate services through better networking and improved institutional frameworks.

Climate-related development challenges

South Asia, home to more than 23% of the world's population, has shown tremendous progress in last four decades in food production and availability, yet 1/4 of the world's hungry and 40% of the world's malnourished children and women live here. An increasingly erratic climate and the rapid pace of other drivers of change are overwhelming indigenous knowledge and traditional coping practices of farming communities in South Asia.

The region is prone to climatic risks such as floods, droughts, cyclones, heat waves; and these are projected to increase. The coastal regions are projected to face increasing salinity and sea level rise, whereas changes in rainfall and in glacier flows will make irrigation more variable

and uncertain. The majority of the farmers in South Asia are smallholder farmers and the rate of growth in agricultural productivity in the region is slow. Thus, agricultural priorities in the region appropriately include increasing production, reducing inequities, enhancing stability in the face of climate variability, and increasing resource use efficiency.

In the face of increasing uncertainty, climate information and advisory services offer great potential to inform farmer decision-making, improve management of climate-related agricultural risk, and help farmers adapt to climate change. In this context, the limitations of supply-driven approaches to providing climate information have fuelled a push to scale up more effective methods of supporting farmers' livelihoods with climate information services by building and responding to demand.

Current initiatives

Overall the South Asia region includes many areas of advanced climate services development as well as sectors where a solid foundation of services can be utilized for the purposes of further climate services scale-up. These factors include the development and use of advanced forecast simulations, robust data collections, and widespread extension service utilization.

India's Integrated Agro-meteorological Advisory Service (AAS) program has been operating in its current form since 2008, reaching more than three million farmers. The AAS was created after a series of pilot-level experiments that began in 1988—led by the National Centre for Medium Range Weather Forecasting (NCMRWF)—making the AAS the oldest national agro-meteorological service delivery program in the world. In 2007, the AAS was combined with the India Meteorological Department (IMD) under the Ministry of Earth Sciences, and as a result the District-level Agro-meteorological Advisory Service (DAAS) was launched in June 2008. DAAS aims to generate district-level agro-meteorological advisories based on weather forecasts. The advisories help farmers make decisions about crop and livestock management. The DAAS has a four-tiered structure: meteorological (weather forecasting), agricultural (identifying how weather forecasts affect farming), extension (two-way communication with users) and information dissemination (media, IT and others). Today, by combining weather forecasts with agronomical research, India's AAS program currently provides three million farmers with integrated advisory services. The advisories, which are valid for five days, help orient decision-making on the timing of farm operations (e.g., when

to plant, when to apply pesticides and fertilizers), and inform management of climate-related risks throughout the season.

While attending the Saly, workshop, the South Asia (SA) working group members reflected on implementing a future case study on India's proven model for forecasting and advisories, the AAS, as a source of guidance for developing similar programs in the region. The SA group recognized the potential to exploit AAS innovations in combining ICTs (e.g., SMS and voice messages) and human interaction platforms (rural extension centres, national extension services as well as NGOs), with lessons that are transferable across South Asia, as countries share similar ecological regions.

In other South Asian countries, similar support efforts are currently underway. For example, the Bangladesh Meteorological Department (BMD) maintains a network of surface and upper air observatories, radar, satellite stations and agro-meteorological observatories, etc. The Meteorological Department maintains the database and has digitized all the 60 years of meteorological data collected at 35 meteorological observatories. The BMD then uses these data to issue one-month long-range forecasts for agricultural planning and 10-day agro-meteorological forecasts for regular agricultural operations (Ramakrishna, 2013).

The Regional Integrated Multi-Hazard Early Warning System for Asia and Africa (RIMES) serves as an additional regional hub for climate forecasting capacity building. RIMES supports climate services in Bangladesh through rainfall-based flood forecasting using the European Centre for Medium Range Weather Forecasting (ECMWF) deterministic forecast data. Further support can be seen though the South Asian Association for Regional Cooperation (SAARC) research programs that are currently developing methods and information sharing networks for climate data in Bangladesh. WMO is also supporting countrywide climate service development with a focus on agro-meteorological observation systems; agro-meteorological data management; weather forecasts and agro-meteorological products; agro-meteorological advisory services; information communication; human resource development and capacity building (Ramakrishna, 2013).

Nepal's Department of Hydrology and Meteorology (DHM) is responsible for weather data collection and forecasting management. They are currently undertaking an initiative to make climate data available to users through published reports, bulletins and computer media outputs. It is noted that the infrastructure is currently lacking throughout the country.

Although there is not a special entity in Nepal that produces agro-advisories at the national or local levels, some organizations such as the Argo Enterprise Centre are currently monitoring all aspects of agricultural production including market, financial, and other information that is relevant for the farming community (Ramakrishna, 2013).

Another program in Nepal with scale up potential currently operates under the National Information Technology structure and is linked to the Global Knowledge Partnership (GKP). Under this project, agricultural advisories are being issued through telephone or through the Internet in 21 villages in the eastern portion of the country (Ramakrishna, 2013).

On a much larger scale the Finish government has been working in Nepal since 2010 under the Institutional Cooperation Instrument (ICI) in an effort to modernize Nepalese weather services and train weather department personnel. In addition, both the Asian Disaster Preparedness Centre (ADPC) and RIMES have been assisting the country through the application of weather forecasts from ECMWF data through monsoon forums and seasonal forecast applications (Ramakrishna, 2013).

The Building Resilience to Climate Hazards (BRCH) project between the Government of Nepal and the World Bank, signed on 30 April 2013, aims to transition Nepal's NMHS into a modern service-oriented system that will build resilience today as well as adaptive capacity for the future. It intends to enhance government capacity to mitigate climate-related hazards by improving the accuracy and timeliness of weather and flood forecasts and warnings for climate-vulnerable communities. An Agriculture Management Information System (AMIS) is being established by the project to provide critical and timely agro-climate and weather information to farmers in an easily understandable language in order to increase productivity of main crops such as rice, wheat, maize, pulses, sugarcane, potatoes as well as livestock and enhance the ability of farmers to reduce losses from meteorological and hydrological hazards. In South Asia CCAFS focuses on the Indo-Gangetic Plains, including India, Nepal, Bangladesh. At CCAFS Climate Smart Village sites, farmers are provided with weather forecasts and ICT-based agro-advisories in local languages, among other climate smart farming interventions.

Gaps

The preparation and dissemination of agricultural advisories is at different stages of development across the South Asian region. Countries like India and Bangladesh have made considerable progress in developing their agricultural advisory networks and extension systems in reaching the farmers through the Internet and mobile phones. In these advanced countries, the major concern is the content of these agricultural advisories and their usefulness in minimizing the climate risks and increasing agricultural production. Meanwhile, agricultural advisory services in other countries in the region, including Nepal, are still in preliminary stages of growth (Ramakrishna 2013).

One area that the SA group singled out as a gap in delivery is the fact that agro-meteorological infrastructure, services, and human capacity are still inadequate and unevenly distributed across the region (Tall et al. 2013). Since agriculture is the main livelihood in South Asia, there is an urgent need to strengthen agro-meteorological services everywhere (Ramakrishna 2013).

Insufficient infrastructure and poor institutional linkages constrain the potential of ICTs for delivery of climate information and agro-meteorological advisories to farmers. Leveraging the full potential of information delivery for climate services to smallholder farmers, particularly agro-meteorological advisories through ICT tools, will require significant improvements in supporting infrastructure, content development, client targeting and development of farmers' skills and a suitable policy environment.

The structure and ability of district-level agricultural officers in providing crop cycle and pest/disease status information is uncertain for many of the SA nations. Likewise the exchange of information between AMFUs and agricultural department officials is considered weaker than necessary for accurate advisory delivery. In addition, weather-based advisories are not currently scaled down in a robust fashion for district level smallholder farmers (Ramakrishna 2013).

Crop-specific agricultural advisories can be very limited or totally absent, except in regions where rice, cotton or wheat is a predominant crop over a large area and crop status information is available. Also, advisories are not specific to different types of farmers such as progressive, marginal and small farmers (Ramakrishna 2013).

The two major gaps in forecast and advisory services appear to stem from the fact that the evaluation system of AAS in Bangladesh and Nepal is not clear. The mode of collection of information on crops, growth stage, pest status etc., and its use in the preparation of AAS by AMFUs is also not clearly defined. Similarly, the role of agricultural research organizations in providing research information on crop-weather relationships for crops grown in different agro-climatic regions and its use in AAS, is not well developed (Ramakrishna 2013).

The production and delivery of climate forecasts needs further regional development in South Asia in addition to agro-advisories. Research has shown that there are gaps in both the collection of data, construction, and dissemination of these forecasts. This includes, but is not limited to, the inclusion of the previously mentioned downscaled climate data in order to make forecasts more relevant at the local level for smallholder farmers (Ramakrishna 2013).

Forecasts for smaller countries like Nepal do not contain concrete information or advice on any of agricultural operations to be taken up by farmers. It simply gives a forecast for next two days. The agricultural advisories by these countries thus need to be more focused and prepared separately, indicating the appropriate response for farmers cultivating specific crops, taking into account forecast weather and the phenological stage of the crop. Further, agricultural advisories, at present, are issued by agro-climatic zone in many of these countries. There is a need to further expand the advisory network to smaller regions (district/block level) for better services to the local farming communities (Ramakrishna 2013, pg. 47).

Finally, South Asian forecasts currently issued by NMHS often do not predict extreme weather events, thus putting farmers at greater risk for crop damage and loss. Therefore, there is a need to improve the predictability of extreme events and their impacts on different crop-growth stages (Ramakrishna 2013).

Regional priorities

To overcome these gaps, the working group identified the creation of appropriate mechanisms to promote greater interaction between smallholder farmers, agricultural research agencies, and NMHSs in the generation of climate information and its dissemination as a requirement. This will be further strengthened by the development of more robust infrastructure and capacity of NMHSs through increased national, regional and international collaboration for the provision of more effective climate services.

The working group also highlighted the need for climate information communication services that are appropriately identified, utilized, and disseminated for smallholder farmers. Building on this concept, there should be an effort to identify appropriate ICT tools and make better use of them for more effective and efficient dissemination of climate information for smallholder farmers. Further, efforts to build the capacity of smallholder farmers, women, poor and socially marginalized groups in the use of ICT tools were recommended. Ultimately, for these ideas to come to fruition, there needs to be a concerted effort to strengthen cooperation and collaboration between different agencies involved in the production and communication of climate services through better networking and improved institutional frameworks.

If this framework can be effectively constructed then there should be an increase in smallholder farmer productivity and a reduction in climate vulnerability. This achievement will result in smallholder farmers being better empowered in the use of climate information. Through the development process, the appropriate mechanisms will be established for greater interaction of NMHSs with the stakeholders as well as a greater understanding of the appropriate climate information needs of smallholder farmers by NHMSs and improved feedback from the users/stakeholders. All of these outcomes will ultimately lead to improved livelihoods of the smallholder farmers in South Asia.

Cross-regional priorities

Despite the large differences in country baselines, Africa and South Asia face many of the same challenges in scaling-up climate services for smallholder farmers. A number of Saly workshop participants held a secondary meeting at the Proposal Writing and Planning Workshop in Nairobi, Kenya to formulate a plan towards developing cross-regional approach to these issues. The premise of this meeting was that a large majority of smallholder farmers can improve their incomes through sharing knowledge, successes and failures; encouraging one another; and promoting joint efforts by bringing together key players at the sub-regional and regional levels.

Workshop participants noted that there is a growing volume of climate products and services that can help farmers improve upon their agricultural output. With the rapid advances in numerical modelling and the improved availability of data, the reliability of climate forecasts on the sub-seasonal to seasonal scales has improved. However, such climate products and services are not disseminated in a timely and understandable manner to the end users. In

addition, farmers have limited interaction with NMHSs. Availability of such improved climate products and services that address pertinent seasonal weather and climate challenges will help the farmers plan their agricultural activities and achieve improved agricultural productivity, enhanced farm incomes and better livelihoods.

In addition, weak agricultural extension services and poor communication infrastructure remain as some of the main barriers in the provision of weather and climate information and their application to smallholder farmers. Sharing experiences of Farmers Associations across Africa and South Asia could help take appropriate steps to address this problem at the national level.

This Cross-regional group took the approach of breaking the workshop into two parallel but separate working groups. The first analysed how to reduce climate vulnerabilities and improve resilience of smallholder farmers by providing climate and weather services through scaling up of integrated and sustainable approaches. The second addressed inter-regional capacity building initiatives for improved climate services for farmers.

The first working groups' objectives are based on the delivery of climate services to smallholder farmers in the affected regions. They have identified three major objectives for an integrated cross-regional system of climate information services:

- Relevant institutions that are currently working closely with farmers (e.g. extension, NGOs, CBOs, farmer organizations, private sector, agricultural research), in collaboration with the NMHS, provide climate information and services in a flexible, integrated, and sustainable manner.
- Rural households across multiple countries in sub-Saharan Africa have access to climate information that they can effectively utilize for planning and managing their livelihood and agricultural production activities.
- Determine the effectiveness of services provided in reducing vulnerability and increasing adaptive capacity partly through understanding how farmers and other key actors have responded to information and services, including how decision making has been influenced. Identify key lessons for scaling up, including institutional and policy arrangements that have greatest influence on success.

The second working group focused on capacity building activities at different levels to promote the understanding of weather and climate information and applications. They

established the following five key objectives for this capacity building aspect of the cross-regional approach to scal up climate services:

- Identify and address knowledge and capability gaps using and sharing regionally situated expertise in Africa and South Asia to improve smallholder farmers' resilience to climate variability and climate change.
- Strengthen or improve capacities of professional experts in developing countries of Africa and South Asia through the establishment of linkages for capacity building with appropriate regional centres and institutions.
- Enhance improved applications of science and technology through its incorporation in all training initiatives of rural and local intermediaries.
- Establish regional networks that link farmers' knowledge and practices across countries and regions to enhance knowledge sharing and content development that is demand-driven and need-based.
- Promote social equity (gender, class and age) at all levels in the provision of climate services to farmers.

Together the two working groups concluded that developing a strong network of farmers and climate services across the regions of both Africa and South Asia will provide a platform for recognizing gaps, identifying best practices, and thus establishing robust programs that benefit smallholder farmers. This will ultimately lead to better farmer decision-making and increase resilience in the face of ever changing environmental conditions.

Conclusions

The Saly, Senegal workshop on "*Scaling Up Climate Services for Farmers in Africa and South Asia*" began a process of mobilizing communities of practice in each region, and also across regions, for enhancing the provision of climate services for farmers. The follow-up Proposal Writing and Planning Workshops and competitive small grants proposal process articulated shared visions for strengthening climate services within and across regions, and identified gaps and priorities for future investment (Table 1). Working groups from the four regions placed emphasis on improving the scientific capacity of NMHSs to develop location-specific seasonal climate forecasts, and enhancing institutional frameworks for collaboration

between the different agencies involved in producing and communicating climate information. The Eastern and Southern Africa working group also emphasized the co-production of climate services with farmers, and the importance of assessing the added value of climate services in disaster risk reduction and enhancement of agricultural productivity. The West Africa working group prioritized development specific communications mechanisms for reaching marginalized groups, including rural radio and ICTs, and training farmers in the access and use of climate services. Building on the region's existing strength in ICTs, the South Asia group emphasized efforts to identify appropriate ICT tools and build the capacity of smallholder farmers, women, poor and socially marginalized groups for accessing and utilizing climate information services.

Table 1. Top five priorities identified for each region.

Priority	Eastern and Southern Africa	West Africa	South Asia
1	Improve collaboration between meteorological, academic, agricultural research and extension services.	Strengthen NMHSs and their scientific capacity to develop improved seasonal climate forecasts, downscaled to subnational level.	Create mechanisms to promote greater interaction between smallholder farmers, agricultural research agencies, and NMHSs.
2	Develop and test effective communication methods for various stakeholders in the agriculture and food security sectors, including ICT based mechanisms.	Develop technical group schemes that will provide agro-meteorological assistance (agrometeorological advisories).	Develop infrastructure and capacity of NMHSs through increased national, regional and international collaboration for the provision of more effective climate services.
3	Achieve co-production of knowledge through enabling farmers to collect climate data and express needs for specific locations.	Develop communication mechanisms to reach end-users and marginalized groups including women, including communications intermediaries.	Identify appropriate ICT tools and make better use of them for more effective and efficient dissemination of climate information for smallholder farmers.
4	Enhance the capacity of NMHSs to generate location-specific forecasts and overcome low density of observation networks.	Develop public-private partnerships, e.g., governmental contracts with cell phone companies, to enhance use of local radio and ICT for climate services.	Build the capacity of smallholder farmers, women, poor and socially marginalized groups in the use of ICT tools.
5	Evaluate the effectiveness of value-added climate services in disaster risk reduction and enhancement of smallholder farm productivity.	Develop improved methodologies to train farmers in the access and use of climate services.	Strengthen collaboration among agencies involved in climate services through improved networking and institutional frameworks.

The Proposal Writing and Planning Workshop approach initiated a collective process of South-South learning and prioritizing of needs for strengthening and scaling up climate services across West Africa, Eastern and Southern Africa, and South Asia. Key components of the resulting visions for improving climate services for farmers in these regions are being initiated through five USAID-funded Small Grants projects: "*Enhancing coordinated institutional frameworks for the provision, communication and utilization of climate information services to support risk management by smallholder farmers in West Africa*," "*Improving Agricultural Productivity and Food Security through Enhanced Provision and Delivery of Climate Services for Smallholder Farmers in Eastern and Southern Africa Region*," "*Strengthening Generation and Dissemination of Climate-Based Agro-Advisories for Smallholder Farmers in South Asia*," and cross-regional projects "*Laying the Foundation for Establishing Networks Linking Farmers across Africa and South Asia for Demand-Driver Climate Services*" and "*Responsive, Integrated and Sustainable Climate Services for Farmers in West, Eastern and Southern Africa*."

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