Rwanda Climate Services for Agriculture

Transforming Rwanda's rural farming communities and national economy through improved climate risk management

Project Newsletter 2018

Contents

Project highlights

The 7th Africa Agriculture Science Week (AASW7) created an opportunity for policymakers, scientists, technical experts and other stakeholders learn from and build on examples of good practice in farmer-focused climate information and advisory services in Rwanda and Senegal, and to share elements of good practice in agricultural planning and food security

The Maproom is a collection of maps and other figures that are used to monitor past and present climate and societal conditions. The maps and figures can be manipulated and linked to the original data and users can choose which datasets are particularly useful for monitoring current conditions.

Around 100 delegates among them key government agencies in Rwanda, research organizations, farmers, development partners, non-governmental organizations and media attended the launch

2016

2018

Project launch and commissioning

CCAFS organized a training of trainers session on the Participatory Integrated Climate Services for Agriculture (PICSA) approach in Nyamata, in the outskirts of Kigali, Rwanda.

Live broadcast on Huguka Radio -a local extension radio station that covers 70% of Rwanda.

RCSA wins the Climate Smart Agriculture Project of the Year Award 2018

Transforming Rwandan agriculture through climate information and historical climate data reconstruction.

Message from the Project Coordinator

Dear Readers,

We are pleased to share with you updates from the Rwanda Climate Services for Agriculture (RCSA) project.

The project was launched on World Meteorological Day 2016, and aims to transform Rwandan agriculture through climate information and historic climate data reconstruction. Through research and engagement, the project has made significant progress over the past three years. The project uses novel approaches that include Enhancing National Climate Services initiative (ENACTS) and Participatory Integrated Climate Services for Agriculture (PICSA).

Through ENACTS and in partnership with the International Research Institute for Climate and Society (IRI), the project is supporting Meteo-Rwanda to overcome major gaps in historical climate records from the 1994 genocide which decimated the country's observing network. This is achieved by merging available data from meteorological stations with data from proxies such as satellite estimates for rainfall and digital elevation models and reanalysis products for temperature. This yields data at a high spatial and temporal resolution, going back over 35 years for rainfall and over 50 years for temperature. Consequently, Meteo-Rwanda is providing one of the most advanced suite of online operational climate information products in Africa through web-based "Maprooms". Farmers and agricultural institutions in Rwanda now have free online access to one of the most advanced suites of gridded (4 * 4km^2) historical, monitored and forecast climate information products available in Africa. Subsets of the Meteo-Rwanda maprooms have been extended in East Africa through IGAD Climate Prediction and Applications Centre (ICPAC) and considered as a model for other African countries.

The PICSA approach, developed by University of Reading in partnership with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), is a structured process for evaluating current farming and livelihood opportunities in light of historic climate risks, for identifying promising alternatives, and for adjusting management when seasonal forecasts shift relevant risks sufficiently. Through PICSA, climate services are integrated into Rwanda's national agricultural extension service by training extension staff, volunteer farmers, development NGOs, and other intermediaries to integrate climate services into their work with farming communities. To date, PICSA has been implemented in 14 districts, providing training to approximately 75,000 farmers. Preliminary evidence indicates that over 85% of participating farmers use the information. The project is also developing a suite of climate information, drought early warning, and planting date decision support tools for use by the government; and is preparing to pilot training and use of these tools with a set of districts and sector government offices.

Recently, the RCSA project won the first Climate Smart Agriculture Project of the Year Award at the inaugural Africa Climate Smart Agriculture Summit 2018 organized by the Aid & International Development Forum (AIDF). The Climate Smart Agriculture Project of the Year Award 2018 recognizes outstanding projects that bring together multiple stakeholders in agriculture —from governments, donors, and NGOs to the private sector—to form new partnerships that improve productivity, resilience, and efficiency while lowering carbon output.

Désiré Mbarushimana Kagabo

Project Coordinator

Reaching a million farmers in Rwanda with useful climate services

Innovative project set to transform Rwanda's farming communities and national economy through improved climate risk management.

By Vivian Atakos

Smallholder farmers in Rwanda's rural districts face a myriad of challenges; the main one being loss of productivity—occasioned by an increasingly variable climate. The Intergovernmental Panel on Climate Change (IPCC) predicts a warmer and wetter climate for Rwanda. Rainfall patterns are changing, becoming irregular and unpredictable.

To build a more climate-resilient agriculture sector, the Rwandan government and partners are taking action to provide nearly a million farmers timely access to essential climate information services. On 23 March 2016, on World Meteorological day, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) in collaboration with Rwanda's Meteorological Agency (Meteo Rwanda), Rwanda Agriculture Board (RAB), the International Research Institute for Climate and Society (IRI) at Columbia University and the International Center for Tropical Agriculture (CIAT) launched the Rwanda Climate Services for Agriculture project.

"We're very excited about this project and what it plans to achieve in the next 4 years. We believe it's transformative," said Malick Haidara, the director of United States Agency for International Development (USAID) Rwanda's Economic Growth Office, during the official launch. The four year climate services project is funded by USAID.

Around 100 delegates among them key government agencies in Rwanda, research organizations, farmers, development partners, non-governmental organizations and media attended the launch held at Serena Hotel in Kigali.

Climate services for agriculture

This new project seeks to transform Rwanda's rural farming communities and national economy through improved climate risk management. The goal is to improve agricultural planning and food security management in the face of a variable and changing climate at both local and government levels. Key to this project is the wealth of applied research on climate services generated by CCAFS and its partners in Africa and beyond.

Enhancing national access to climate services (ENACTS)

ENACTS is an ongoing initiative led by IRI that aims to bring climate knowledge into national decision making by improving availability, access to, and use of climate information. Through ENACTS, Rwanda has filled in a 15-year gap in its historical meteorological records.

Through ENACTS various countries, including Rwanda, can now provide a range of high-resolution climate information products tailored to agricultural user needs through web-based "maprooms".

"We had to address this 15-year gap in our meteorological records," said Didace Musoni from Meteo-Rwanda. "This was not an abstract problem: the absence of such data has had significant impact on society here," said Didace Musoni from Meteo Rwanda. Tufa Dinku, a research scientist at IRI, lists a number of questions that are difficult to answer without

Farmers in Rwanda's Ngororero district prepare their field for the new planting season. Ngororero is one of the districts in Rwanda set to benefit from the project.

solid historical data: How is climate change unfolding in the country? Are there certain areas seeing more impacts than others? What is the year-to-year variability in rainfall and how has that changed? What has been the trend between climate and agricultural productivity?

" However, availability of climate data may not necessarily lead to their uptake by itself. Climate information must be made available to users who need to be engaged on the value and application of climate information products," said John Ntaganda Semafara, Director General, Meteo Rwanda.

The new project will therefore explore use of the Participatory Integrated Climate Services for Agriculture (PICSA) approach to reach farmers.

Participatory Integrated Climate Services for Agriculture (PICSA)

PICSA involves agriculture extension staff working with groups of farmers ahead of the agricultural season to first analyse historical climate information and use participatory tools to develop and choose crop, livestock and livelihood options best suited to individual farmers' circumstances. Then soon before and during the season, extension staff and farmers consider the practical implications of seasonal and short-term forecasts on the plans farmers have made. The approach was developed by Reading University.The Rwanda Climate Services for Agriculture project will improve on the PICSA approach to incorporate use of downscaled probalistic seasonal forecasts.

Farmer extension model: Twigire Muhinzi

Twigire Muhinzi is a farmer extension model implemented by Rwanda's Ministry of Agriculture (MINAGRI) and Ministry of Local Government (MINALOC) to ensure that all farmers have access to advisory services. The model enables farmers to easily access basic extension messages through mobilisation and demonstration plots in each village.

"Twigire Muhinzi is currently reaching 1,110,000 farmers grouped into 78,000 Twigire groups," reported Moussa Senge from One Acre Fund— seconded to RAB— during the launch.

According to Peter Doward from Reading University, the PICSA approach could fit well within the TWIGIRE model, since it already involves discussions with groups of farmers.

Key outcomes of the project

The project aims to deliver four specific outcomes:

- **Climate services for farmers:** Farmers across Rwanda's 30 districts will have decision-relevant, operational climate information and advisory services, and be trained to use the information to better manage risk. In the first year, four districts are targetted: Kayonza, Nyanza, Burera and Ngororero.

- **Climate services for government and institutions:** Agricultural and food security decision makers in the Ministry of Agriculture and other national and local government agencies and institutions will use climate information to respond more effectively to risks.

- **Climate information provision:** Meteo-Rwanda will design, deliver, and incorporate user feedback into a growing suite of weather and climate information products and services tailored to the needs of decision makers.

- **Climate services governance:** A national climate services governance process will oversee and foster sustained coproduction, assessment and improvement of climate services.

The project implementing partners include CCAFS, RAB, Meteo- Rwanda, IRI, CIAT, Reading University, World Agroforestry Centre (ICRAF), and the International Livestock Research Institute (ILRI). Other local NGOs working within Rwanda are expected to join and contribute to the various outcomes of the project.

"Through this project, we will learn how good practices for climate services can be implemented in other countries in a way that builds resilience of farming populations in various economies to a variable and changing climate, " said Jim Hansen, IRI Research Scientist and CCAFS Flagship Leader, Climate Risk Management.

Managing uncertainty in a changing climate: what's the role of climate services?

On the sidelines of the Africa Agriculture Science Week, various stakeholders discuss exciting opportunities to make climate services available to farmers.

By Catherine Mungai, Vivian Atakos and Jim Hansen

Apply science, impact livelihoods. This was the theme of the 7th Africa Agriculture Science Week (AASW7). The event took place from 13 to 16 June 2016 in Kigali, Rwanda.

The CGIAR Research Program on climate Change, Agriculture and Food Security (CCAFS), the Center for International Tropical Agriculture (CIAT), the Rwanda Agriculture Board (RAB) and the Rwanda Meteorological Agency (Meteo-Rwanda) held a side event on strengthening climate services for agricultural transformation in Africa on the sidelines of AASW7 in Kigali. The event created an opportunity for policymakers, scientists and technical experts from the CGIAR and other research institutions, as well as the National Meteorological and Hydrological Services (NMHSs) and other stakeholders to learn from and build on examples of good practice in farmer-focused climate information and advisory services in Rwanda and Senegal, and to share elements of good practice in agricultural planning and food security management in the face of a variable and changing climate.

Setting the scene, current status and new initiatives

In his welcoming remarks, John Ntaganda Semafara, Director General of Meteo-Rwanda, emphasized the loss of climate data as a result of the 1994 genocide tragedy in Rwanda; and described the work his agency is doing with partners to rebuild the database. This is in recognition of the key role that climate data plays informing decision making in critical sec-

tors such as health, agriculture and aviation. For agriculture, which accounts for a third of Rwanda's GDP, climate services can inform effective decision making, and more so for rural households (especially women) who rely on this as their main source of livelihood.

"There is hope. On 23 March, the Rwanda Climate Services for Agriculture project was launched," pointed out Désiré Kagabo during his presentation on transforming the agriculture sector with improved climate information services. The project is the result of collaboration between CCAFS, Meteo Rwanda, RAB, CIAT and the International Research Institute for Climate and Society (IRI) at Columbia University through funding by the United States Agency for International Development (USAID). According to Kagabo, the aim of the project is "to benefit nearly one million farmers by 2019, and transform Rwanda's rural farming communities and national economy through climate services and improved climate risk management." The project seeks to improve the supply, communication and use of climate-related information in a balanced manner using products co-developed by both providers and users. According to Malick Haidara from USAID Rwanda's Economic Growth Office, who participated in the discussions, climate services are crucial for all investments related to agriculture including USAID's Feed the Future initiative ongoing in several countries.

A farmer in Rwanda looks at beans on his farm. Various opportunities exist to ensure such farmers can access and use climate services for agricultural transformation.

Ousmane Ndiaye (centre) gives a keynote address during the side event.

Opportunities for south-south collaboration

Senegal has made great strides in applying climate services in the agriculture sector. Ousmane Ndiaye, from Senegal National Meteorological Agency (ANACIM, French acronym), shared some lessons through his presentation on challenges and opportunities of delivering climate information and services from the national perspective, Senegal experience.

"Because of the uncertainty associated with forecasting, trust is the building block for an effective climate services project to be successful," emphasized Ndiaye. *"Understanding the social dimensions that influence farm level decision making and the role of indigenous knowledge are two very key ingredients for this to work,"* he reiterated.

Also, partnerships, which are both long-term and multi-stakeholder, are essential to facilitate the compilation, packaging and sharing of useable information which is context-specific and in a language and format that farmers can use to make decisions.

Data is the foundation for building climate services

In his presentation, titled 'Technical innovations enabling African National Meteorological Services (NMS) to provide information at the local scale of farmer decision-making', Tufa Dinku, from the International Research Institute for Climate and Society (IRI), Columbia University, highlighted the key role that climate data plays in the development of effective climate services for agriculture.

Some of the challenges which affect the availability of climate date include: the inadequacy of the number of weather stations over many parts in Africa; location of most stations along main roads hence limited availability of climate information and services to the rural community; gaps in observations (missing data); questionable data quality and limited access and use of the available data.The Enhancing National Climate Services (ENACTS) initiative seeks to address these challenges by focusing on the creation of reliable climate information that is suitable for national and local decision making. This approach has been used to generate over 30 years of rainfall and temperature data for every 4km grid.

Enhancing climate services for agriculture in Africa

A panel session created an opportunity to deliberate on examples of good practice in farmer-focused climate information and advisory services, and to share elements of good practice in agricultural planning and food management in the face of a changing climate. The panel also highlighted possible areas of investment and areas that require policy intervention.

The following key messages emanated from the event:

- Data are the foundation of any effective climate services. The development of useful information products for end users along the agricultural value chain calls for filling in of data gaps and facilitating data accessibility.

- Partnerships with key stakeholders involved in the generation of data and development and delivery of information are critical to ensure accessibility and timely delivery of information.

- Countries need to put in place policies that enable researchers and a range of users to access climate data, which are a critical component of developing useful climate services and products.

- Climate services should be gender sensitive, ensuring that all end users including women and youth are reached by relevant climate information. Feedback loops are necessary to ensure the development of relevant and targeted products which take into consideration user needs. Social norms that affect access to information at community level should be examined.

- Information is most useful for farmers if it is communicated through a range of channels, including trained agricultural extension staff, radio and mobile phones. Social media is emerging as a new way to reach out to youth engaging in agriculture.

- Investment in climate services is an essential component of Africa's agricultural transformation, as stakeholders in the agricultural sector need forecasts and advisories that will enable them to make decisions in the context of an increasingly variable climate.

3

Building capacity of intermediaries to avail climate services to farmers

A workshop session introduces participatory integrated climate services to agriculture extension workers in Rwanda.

By Vivian Atakos

From 6 to 10 June 2016, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) organized a training of trainers session on the Participatory Integrated Climate Services for Agriculture (PICSA) approach in Nyamata, in the outskirts of Kigali, Rwanda. The training session was part of key activities under the recently launched Rwanda Climate Services for Agriculture project, funded by the United States Agency for International Development (USAID Rwanda).

The training was conducted by staff from the University of Reading who have developed and implemented PICSA in several countries and staff from Rwanda Agriculture Board (RAB) who are running the Rwanda Climate Services for Agriculture project and collaborating with other key organizations including the Rwanda Meteorology Agency. A total of 30 intermediaries, representing agricultural extension staff, development non-governmental organisations and other intermediaries attended the five-day training discussing the twelve steps of the PICSA approach as documented in a manual published by University of Reading. On the fourth day, participants worked with groups of farmers in Muyumbu district to try out and gain experience in the use of the methods they had been trained on. On the final day they identified and developed plans for key follow up activities and to prepare for roll out.

The PICSA approach

The PICSA approach, which will be used in the project, involves agriculture extension staff working with groups of farmers ahead of the agricultural season to first analyse historical climate information and use participatory tools to develop and choose crop, livestock and livelihood options best suited to individual farmers' circumstances. Then soon before and during the season, extension staff and farmers consider the practical implications of seasonal and short-term forecasts on the plans farmers have made.

PICSA will be crucial in ensuring over a million farmers across Rwanda's 30 districts have decision-relevant, operational climate information and advisory services, and are better trained to manage risks. In the first year, four districts are targeted: Kayonza, Nyanza, Burera and Ngororero.

Rwanda climate services for agriculture project

This project, launched on March 23 2016, seeks to transform Rwanda's rural farming communities and national economy through improved climate risk management. The goal is to improve agricultural planning and food security management in the face of a variable and changing climate at both local and government levels. Key to this project is the wealth of applied research on climate services generated by CCAFS and its partners in Africa and beyond.

One of the officers who participated in the training of trainers facilitates a discussion with farmers on the PICSA approach.

Participants read through diagrams they developed during the PICSA training.

Local beats global when it comes to national climate services in Rwanda

Recent analyses show that national gridded climate data sets can produce higher quality climate forecasts for agricultural decision-makers than the best global gridded data sets.

By Dannie Dinh, Jim Hansen, Floribert Vuguziga, Madeleine Thomson, Yohana Tekeste, and Aisha Owusu

Climate information—and its use for farming decision-making, index-based agricultural insurance, government agricultural planning and food security management—can benefit smallholder farmers. But these interventions depend on high-quality, long-term climate records, and are difficult to implement at scale in part because of inadequate observation networks and major gaps in historical records across much of sub-Saharan Africa (Hansen 2012).

In addition to the data challenges that many developing countries face, Rwanda is faced with a near complete loss of data during a devastating period in its history. In the decade following the 1994 Rwanda Genocide, the number of operating weather stations dropped from more than 100 to less than 10, and did not begin to recover until 2010 (Figure 1).

Meteo-Rwanda is using the ENACTS approach to overcome the challenges

The Enhancing National Climate Services (ENACTS) approach, developed by the International Research Institute for Climate and Society (IRI), focuses on enabling countries to produce reliable quality climate information suitable for national and local decision-making. Through the ENACTS initiative,
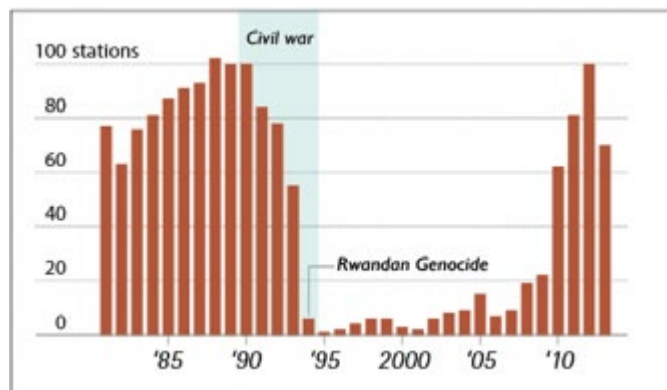
Figure 1: Number of weather stations operating in Rwanda by year

Rwanda's National Meteorological Agency (Meteo-Rwanda) quality controlled its observational data, and merged their observations with global climate proxy satellite and reanalysis data using years with large amounts of data to calibrate global proxies for years where data are sparse.

The result is a 30+ year historical database of rainfall and temperature (minimum and maximum) at a 4-5 km spatial resolution, with no gaps in space or time, readily accessible through the web-based "Maprooms" that are built using the IRI's Data Library software and hosted on the Meteo-Rwanda website. The current climate Maprooms include historical climate analysis, climate monitoring, climate prediction, and

Local decision-makers and farmers, such as these pictured in the Ngororero district in Rwanda, will potentially benefit from the higher quality seasonal forecast products and other climate information that are now available.

information about climate and health. The Maprooms are being expanded to include additional information tailored to the needs of Rwanda's agriculture sector, including downscaled seasonal and climate forecasts.

African national meteorological services can provide higher-quality climate information than global information providers

Previous research has shown that the quality of a merged satellite-station climate data set is largely a function of the amount of quality-controlled ground observations that go into the data (Dinku et al. 2016). National meteorological services in Africa typically own more than an order of magnitude more data than they make publically available, and can therefore produce higher quality data sets than any global information provider.

Results from a recent science and training workshop, funded by the Strengthening Climate Information Partnerships - East Africa (SCIPEA) project and held at the IRI, provide further evidence of the added value of using national data sets to provide national climate services. Floribert Vuguziga, from Meteo-Rwanda, joined meteorologists from Ethiopia, Uganda and the IGAD Climate Prediction & Applications Centre (ICPAC) to explore predictability of the seasonal climate in Eastern Africa.

During the analyses, Vuguziga noticed that the same seasonal forecast model showed very different prediction skill (or accuracy relative to the information available without the forecasts) when it was developed and tested with different rainfall data sets (Figure 2). When global satellite-based rainfall datasets that incorporate limited local observations (ARC2 and CHIRPS) were used to train and test the prediction system, the seasonal forecasts appeared to have little skill.

When offered less reliable seasonal forecast products with little prediction skill, a user might wonder whether it is worth using them at all. Using Meteo-Rwanda's ENACTS data has allowed the forecast system to make better use of the potential predictability in the climate system, resulting in a higher level of skill that could potentially provide useful information to local decision-makers.
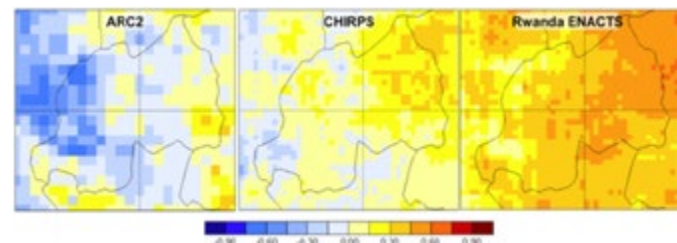

Figure 2: Skill of seasonal rainfall forecasts for September-December 2016, made in August 2016 based on a global climate model (CFS v.2), as produced by two global data sets (CHIRPS and ARC2) and by a national data set (ENACTS). Higher correlation (red and orange) indicates more skillful forecasts.

Despite the significant loss of data in Rwanda's meteorological observations record, the work of Meteo-Rwanda, using the ENACTS approach, is filling the gap and forming a foundation for climate services. "We have always wanted to reach people; that is our mission. Now users can self-serve through the Maprooms on Meteo-Rwanda's website," says Vuguziga. "Before ENACTS we thought our data gap would mean we could not provide a quality climate service. Now all that has changed."

Close collaboration among partners, projects and donors is enabling significant advances in the quality and utility of climate information available to farmers and other local decision-makers in East Africa. The aforementioned science and training workshop is part of the ongoing work in Rwanda and East Africa jointly sponsored by the U.K. Department for International Development (DfID) funded Weather and Climate Information Services (WISER) projects (ENACTS and SCIPEA) and the U.S. Agency for International Development (USAID) funded Rwanda Climate Services for Agriculture initiative. Implemented by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and its partners through CCAFS's Climate Services for Africa project, the Rwanda Climate Services for Agriculture initiative seeks to develop sustained capacity to provide climate services and support their use for agricultural planning and food security management.

5

Establishing the foundation for climate services in Rwanda

A baseline survey unravels farmers' information needs in Rwanda, and sets the stage for testing the practical value of climate information in farmers' decision-making.

By Catherine Mungai, Eliud Birachi and Jeanne Coulibaly

Rwanda has been confronted by the vagaries of a changing climate in recent years. Hailstorms, floods, strong winds, heavy rains leading to landslides, prolonged droughts and changed weather patterns have become more recurrent, making seasons increasingly unpredictable and traditional indicators no longer suitable. This has many implications for the mostly rain-fed agriculture sector in Rwanda, which is also the main source of subsistence for the majority of the country's population. Agriculture contributes to 30% of the GDP, whereas pastoralism, practiced only in small pockets of dry areas in the country, contributes to 10% of the GDP.

Setting the base

The CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS) and the World Agroforestry Centre (ICRAF) in collaboration with the International Center for Tropical Agriculture (CIAT) are leading the research-based monitoring and evaluation component of the Rwanda Climate Services for Agriculture project. Funded by the United States Agency for International Development (USAID), the project seeks to transform Rwanda's rural farming communities and national economy through improved climate risk management. In order to establish a research baseline for the project, surveys were conducted in 30 districts in Rwanda. The survey sought to assess:

- Climate risks and coping strategies among farmers;

- Climate information, sources of information, use of information for decision making by farmers and institutions; and

- Climate information services and impacts on crop farming, livestock management and other livelihoods.

Using a combination of computer aided personal interviewing (CAPI) and key informant interviewing techniques, information on key outcome indicators was collected including basic household socio-economic characteristics, climate risks, access and use of climate services, types and sources of information to inform their agricultural activities, farm management decisions, agricultural technologies adopted by households, crops, livestock, and livelihood activities and food security.

The survey was conducted in

30

districts in Rwanda

A farmer working on the field in Rwanda's Ngororero district.

Next steps

The baseline information will be used to track changes in behavior associated with the delivery of climate forecasts yearly for each rainfall season to inform on program's effectiveness. Data is being analyzed and will be used to inform national partners, researchers and other stakeholders on the needs of farmers and pastoralists for climate services in Rwanda. The baseline data will also be used to evaluate how successful the program has been in impacting decision making at household and community levels.

Collecting farmers' feedback on climate information services in Rwanda

Using radio to communicate and collect farmers' feedback helps assess the current quality of climate information services and dispel myths regarding climate and weather forecast.

By Desire Kagabo, Gloriose Nsengiyumva, Florentine Mukarubayiza, Catherine Mungai and Dannie Dinh

The impacts of climate variability are increasingly visible in Rwanda, especially in the agricultural sector. Yet farmers often point to the lack of access to the relevant information related to climate variability as the reason they cannot manage risks for better agricultural production.

Through a live broadcast on Huguka Radio —a local extension radio station that covers 70% of Rwanda—Twahirwa Anthony, a senior weather forecaster from the Rwanda Meteorological Agency (Meteo Rwanda), highlighted the type of climate services information available to farmers and discussed how this information is disseminated and used. Farmers then directly provided feedback by calling during the show, sending text messages, and commenting on social media. During the broadcast, Anthony explained what the weather forecast is and what people should have in mind once they receive it: "The forecast is a prediction; therefore it should not be surprising once it changes."

Getting the relevant, up-to-date information to farmers

"Except God, no one else can predict the weather," said some of the farmers who called in during the show.

The views received from listeners, especially farmers, show that seasonal forecast information often do not match the realities on ground. Farmers expressed frustration and lack of trust in the weather forecast information from Rwanda Meteorological Agency. In an interview with Huguka Radio, Mukamana Francine, a farmer from the Muhanga district commented: "Meteo Rwanda says that the seasonal amount of rainfall is enough to grow beans, but it does not." "Meteo specialists should consider checking their machines because they give mismatching information, so that farmers could fully benefit from climate services information," added another farmer from Muhanga district, Nsengiyumva Epa.

Photo: C.Schubert (CCAFS)

Huguka Radio —a local extension radio station that covers 70% of Rwanda.

A farmer heading to work in Rwanda's Ngororero district.

Speaking on the availability and accuracy of climate services and information, Anthony explained how data from different Meteo Rwanda weather stations are gathered and compiled for publication. He pointed out that the misunderstanding stems from farmers not being updated about the changes that occur along the season. "As we give the seasonal forecast, there are possibilities to access to short term forecast (3days, 10days forecast, etc.) which helps farmers to cope with seasonal weather variabilities," Anthony noted.

Anthony also acknowledged that the current large scale of weather forecast information provided to farmers (province level) is not fine enough to use in daily decision-making. He advised farmers to request for more detailed weather information available with agriculture extension services and agencies such as the Rwanda Agriculture Board (RAB) and other appropriate agronomic advisory services in order to bridge the gap between forecast dissemination and use. Regarding the issue of meteorologists using weather forecast

Farmers provide feedback by calling during the show, sending text messages, and commenting on social media.

terminologies unfamiliar or unknown to farmers, Anthony commented that Meteo Rwanda has the responsibility to approach and explain to stakeholders or users of the information the meaning of different terminologies so that the disseminated climate and weather information is more accessible and better understood.

Efforts to increase capacity to deliver climate information at local level

Feedback from radio listeners from different districts such as Gicumbi, Gakenke, and Burera emphasized the need for better means of dissemination for climate-informed agricultural advisories, such as through text messages. Anthony stated that, in collaboration with RAB and the local government, the existing home-grown decentralized, farmer oriented national agricultural extension and advisory services delivery model locally known as "Twigire Muhinzi" can be used to empower agronomists to disseminate climate information to farmers efficiently.

Joint efforts and strategies are being used to ensure that climate services information is downscaled and relevant to smallholder farmers in Rwanda. Through the Rwanda Climate Services for Agriculture project funded by the United States Agency for International Development (USAID) and implemented by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Meteo Rwanda is increasing its capacity to provide climate information services as well as develop tools tailored to farmers' needs. Anthony highlighted few concrete examples including the downscaled, gridded historical climatic data and downscaled climatology forecast available online in the Meteo Rwanda Maproom developed by the International Research Institute for Climate and Society (IRI). Through the collaboration between Meteo Rwanda, RAB, International Center for Tropical Agriculture (CIAT), and CCAFS, there is hope that farmers will have access to climate services information for better decision-making to cope with climate variability and to wave away smallholder farmers' myths on climate and weather forecast.
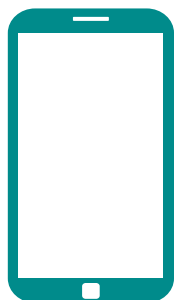
Delivering targeted climate information services and products for farmers in Rwanda

Following trainings on climate information, smallholder farmers in Rwanda are turning to locally-tailored climate forecast to help them make decisions.

By Desire Kagabo, Gloriose Nsengiyumva and Yvonne Munyangeri

Now we are real farmers!" say smallholder farmers in Rwanda.

Through the Participatory Integrated Climate Services for Agriculture (PICSA) approach developed by the University of Reading, trained farmers are able to use climate information services to make decisions about when to plant, which crops to plant and which inputs to use—and they are doing so at an increasing rate. Indeed, farmers are relying on seasonal and short-term forecast information to update their farming calendars. Farmers acknowledge that some of the losses incurred in the past could be attributed to poor access to climate information services. The PICSA approach builds on the existing farmer-to-farmer extension service model locally known by its Kinyarwanda name as "Twigire Muhinzi."

During the first year of the Rwanda Climate Services for Agriculture project, funded by the United States Agency for International Development (USAID) and implemented by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), the PICSA approach has been implemented in four districts (Burera, Ngorero, Nyanza and Kayonza). Led by experts from the University of Reading, this process involved an initial 'expert trainers' workshop held in June 2016, where 31 senior staff from the Rwanda Meteorological Agency (Meteo Rwanda), Rwanda Agriculture Board (RAB), the International Center for Tropical Agriculture

(CIAT) and a number of non-governmental organizations (NGOs) were trained in the PICSA approach. The training yielded a core team of PICSA trainers who will continue to train other stakeholders in the PICSA approach during the four-year period of the project and beyond. This initial training was followed by two parallel sessions covering the project's four implementation districts. During these sessions, CIAT staff and 'expert trainers' trained 48 farmer promoters in the PICSA approach. Farmer promoters in turn rolled out the PICSA training with 2,631 farmers in the four districts. Of these farmers, 1,254 (48%) were women.

The information provided within the project is locally specific and tailored to farmers' needs and written in the local language to enhance farmers' understanding. The information includes parameters such as the start and end of the rains, length of the growing season, total seasonal rainfall amount, longest dry spell within a cropping season, and short-term and long-term forecast. The farmer promoters were trained in advance and given printed copies of the

48%
of the participants were women

Through PICSA, farmers are using climate information services to make decisions. The approach builds on the existing farmer-to-farmer extension service model.

information to be shared with famers. Given the various levels of training from expert trainers to farmer promoters then to farmers, copies of the climate information products and training materials were distributed to all farmers to avoid distortion of information.

Following the trainings, farmers can now read, understand, and correctly interpret graphs or tables of historical climatic parameters of their villages. Farmers also understand that seasons vary annually, requiring different response measures. "Farmers are very enthusiastic to attend trainings because they are getting the information that can help them find solutions to their crop losses related to extreme weather events," explained J.D'Amour Nzabandeba, a farmer promoter from Ngororero district, during a monitoring and evaluation visit. Farmers commended the effective communication on climate information services to farmers through PICSA and

reinstated that this will positively impact future farmers' actions.

Concurrently, and also through the Rwanda Climate Services for Agriculture project, Meteo Rwanda is increasing its capacity to provide climate information services as well as develop tools tailored to farmers' needs, including the downscaled, gridded historical climatic data and downscaled climatology forecast. Forecast information and climate tools are available online in the Meteo Rwanda Maproom developed by the International Research Institute for Climate and Society (IRI).

PICSA training of trainers: strengthening national and local capacity for climate services for agriculture in Rwanda

Providing farmers with localized, context-specific information which is easy to understand and interpret, enables them to make better farming decisions and helps build their resilience to climate risks and ensures their food security.

By Catherine Mungai, Desire Kagabo, Gloriose Nsengiyumva and Maren Radeny

Through the USAID funded Rwanda Climate Services for Agriculture project, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is helping communities in Rwanda and national government build their resilience and adapt to climate-related shocks by integrating climate services into decision making processes.

The project builds on and aims to scale up the Participatory Integrated Climate Services (PICSA) approach—which has successfully been used in seven countries in Sub Saharan Africa—to reach rural communities in Rwanda. PICSA is a participatory process that encourages farmers to take decisions by providing them with weather and climate information, the skills to interpret it, and a range of livelihood, crop and livestock options that best fits their needs and the expected weather. Through the PICSA approach, agricultural extension staff, development partners and other intermediaries will be trained to integrate climate services into their ongoing work with farming communities across Rwanda's 30 districts.

Using weather and climate information to make informed decisions

A PICSA training of trainers (ToT) workshop was conducted in Huye town from 12 to 16 June 2017. Organized by CIAT, RAB and Meteo Rwanda, the workshop equipped 68 stakeholders with skills to implement PICSA in their districts. Participants were drawn from all over the country and represented different organizations such as RAB, Meteo Rwanda, the IFAD-funded Climate Resilient and Post-harvest Agribusiness Support Project (PASP), Agriculture Information and Communication Program- Ministry of Agriculture and Animal Resources, Radio Huguka, DEveloppement Rural du Nord (DERN), Caritas Kibuye, CARITAS Kibungo, CARITAS Butare, IRI, IGAD Climate Prediction and Applications Centre (ICPAC) and CCAFS.

The training, which was conducted in two languages (English and Kinyarwanda), was facilitated by experts from CIAT, RAB and Meteo Rwanda with technical support from Peter Dorward from University of Reading and Tufa Dinku from IRI.

The training module combined short presentations by experts, group discussions and presentations by participants,

Augustine Shiragahinda is a farmer from Kidaho, Burera district in northern Rwanda.

Usinng weather and climate information to help farmers make informed decisions

a field practice session, and a wrap up planning session. Specific knowledge gaps as highlighted by the trainees included how to share information with farmers on climate services for agriculture, how to interpret forecasting information, how farmers obtain information on climate change, how farmers can cope with climate variability and change, how to differentiate between climate variability and change, and how to develop seasonal calendars using climate information, amongst others.

The trainees learnt how to use local climate information from historical data to seasonal forecasts to reduce risks associated with climate variability. The trainees and stakeholders were expected to use the knowledge and skills to train farmers how to use climate information to make better decisions in areas where they work. It is anticipated that in so doing, the agricultural productivity would be increased and farmers would become more resilient to future climate change.

This is the third training in Rwanda since the project began in 2016. It is expected that 150,000 farmers will have been trained directly and 750,000 farmers trained indirectly by the end of the project. This target seems ambitious, but through the Twigire Muhinzi approach, this will be achieved. Twigire Muhinzi is a farmer extension model implemented by Rwanda's Ministry of Agriculture (MINAGRI) and Ministry of Local Government (MINALOC) to ensure that at least one farmer in a village here referred to as a "farmer promoter" is empowered with better skills to improve his livelihood through better use of agricultural advisory information, and neighbours will learn from him or her. Through this model, farmers can easily access basic agricultural advisory information, including weather and climate information through trainings from farmer promoters, mobilisation and demonstration plots in each village.

Photo: T. Mutchaba (CCAFS)

Rwandan stakeholders learned about how to encourage farmers to take decisions by providing them with weather and climate information.

Could this be the game changer in climate information services innovation?

What would you do if someone returned your lost wallet with a $100 note in it?

By Tabitha Muchaba

This is the feeling farmers from Cyanika centre, Eastern province, Rwanda had after participating in the Participatory Integrated Climate Services for Agriculture (PICSA) field training process. The excitement and motivation to go back to the farm to apply what they had learnt from the training could not be hidden from their faces.

"I always wait for rain in order to start planting, but now, I know how to make projections and prepare my farm," Niweshuti Aline, farmer.

The field training was part of a four-day training of trainers on PICSA that took place in Huye district in the southern province of Rwanda from 12 – 16 June 2017. The training allowed participants to work hands-on with a group of 40 men and women smallholder farmers to test both skills and knowledge gained during the training and to build their confidence in the PICSA process. This exercise, conducted in Kinyarwanda (the national language), served as both intermediary training and as a trial for the PICSA approach. The participants had an opportunity to assess first-hand the effectiveness of PICSA and identify areas that need improvement.

The farmers shared the traditional indicators that they use to anticipate weather and climate conditions such as birds, frogs, and invertebrates such as termites. They were also trained on how to develop a time series bar graph of recorded seasonal rainfall totals and validate it against their collective memory.

The field activity provided a great opportunity for CCAFS to interview some of the farmers on their challenges and expectations from the PICSA process. The testimonies are summarized below.

Name: Kubwimana Generoze

As a single mother, I have to work hard to provide for my children. I grow and sell beans, maize, Irish and sweet potatoes and depend a lot on rain. Recently, the planting season has changed, I used to start preparing my farm in September but this has changed to October or sometimes late November and December. While I receive weather

information from the radio, I feel that it is not reliable. The training was very informative as I have learned more about climate change and its impacts on the farming process, how and when to plant and the type of crops to plant. I also like meeting new people and discovering new things that I did not know.

My parting words to the trainers, "I would love to receive monthly information on weather."

Name: Niweshuti Aline

I am a single mother with two children. I provide for my family by working on other people's farms. I also have a kitchen garden and I plant soya beans, beans, sweet potatoes, and maize. As a young female farmer, it's hard for me to own land. I farm on rented land and the money is never enough to cater for my family.

In addition to this, the weather has really changed. The rain intensity has increased in the past years destroying crops and causing a lot of erosion. I have never received any weather information, thus this training has been very beneficial to me. I now know how to carry out a climate forecast, develop a seasonal calendar, project the onset of rain and measure rainfall. I would like to participate in more trainings like this and receive daily information on the weather forecast.

Name: Munyeshema Tharcise

I am married and have two children. Every morning I wake up to go to the farm while my wife is left at home to take care of the children. I grow beans, maize, cassava and potatoes and I also keep a goat for manure.

In my opinion, the climate has really changed. It's getting hotter and hotter and farm production has reduced. I have been receiving weather information from the radio which has helped me prepare my farm before onset of rain. The government has also been very supportive as they have subsidized the cost of fertilizers and seeds at the start of every season.

"I buy seeds at 500 RFR while others buy at 600 RFR".

Through PICSA, farmers are using climate information services to make decisions. The PICSA training aims to reach up to a million of Rwanda's smallholder farmers.

The training has been very helpful to me. I have gained additional information on the onset and cessation of seasonal rainfall, planning and budgeting for the farming activities and how to keep records. In the future, I would like the training to be continuous and consistent.

Name: Nzamuramba Emmanuel

I love farming as it provides food for my family. I grow beans, potatoes, sorghum and soya beans and keep a cow that

produces 5-8 litres of milk a day. I also work as a mason during the week.

The climate has really changed in the last 5 years. We used to start planting in September, but this has changed to October. Farm production has reduced, I have to work extra hours to put food on the table.

The Twigire Muhinzi (farmers' promoters) and local agronomists have been very beneficial to us. I always receive weather information from them including information on when to plant. Through this training I have learnt more about planning and seasonal forecasts. With this knowledge, I can identify the best crop option under different weather conditions.

From the PICSA Trainees

We also interviewed some of the trainees on the PICSA process:

Donatha Mukamuganga - Nyamagabe District agronomist

The PICSA process is very important for the farmers. The training manuals are detailed and informative and the farmers are now familiar with the weather changes, when and what type of crop to plant, the quantity of rain and when to do irrigation. I feel that some of the training concepts and processes are hard to explain to farmers i.e. some of the graphs are too complex to interpret. I would like to learn how to explain the graphs in a simplified way. Other challenges I foresee include farmers' illiteracy and blindness.

Amos Uwezeye - Data Quality Control Officer, Meteo Rwanda

The PICSA process is good as it provides farmers with climate information to reduce agricultural loss. The farmers have learnt how to prepare action plans and budget, which will improve their way of life and investment. Climate and weather information on its own is not useful but when combined with agro-advisories it is more useful for farmers.

The PICSA process is part of the USAID-funded Rwanda Climate Services for Agriculture project. The 4 year project was launched in 2016 and we look forward to interviewing these farmers and trainees again to share lessons learnt and hopefully, success stories on how localizing climate information services has helped them improve their livelihoods.

CCAFS showcases its Maproom project at the University of Rwanda Scientific Conference Week 2017

It is now feasible to provide climate information services that are actionable at the local scale of agricultural decision-making.

By Tabitha Muchaba

The impact of climate change on Rwanda's agriculture and sustainable development is a continuous challenge. The growing concern has yielded much research on agricultural transformation from subsistence agriculture to intensive, market-oriented agriculture. This was one of the recurring themes of the Scientific Conference Week that was held from 14-16 June 2017 in Kigali, Rwanda. The conference was organized by the University of Rwanda in partnership with University of Rwanda Sweden Program, Rwanda Development Board and the International Institute of Tropical Agriculture (IITA). Under the overall theme 'Rebranding Research for Sustainable Development' the two-day conference brought together various stakeholders from academia and industry to share their knowledge, innovation and expertise.

The conference created a platform to showcase how the Enhancing National Climate Services initiative (ENACTS) implemented by the International Research Institute for Climate and Society (IRI) has filled the 15-year gap in Rwanda's historical meteorological records. Through ENACTS, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) works with International Center for Tropical Agriculture (CIAT) and other partners to support Rwanda's National Meteorological Services (NMS) to fill data gaps and to provide high quality climate information. As a result, it is now feasible to provide climate information services that are actionable at the local scale of agricultural decision-making. The ENACTS approach overcomes data gaps by blending NMS station data with satellite and other proxy data, to produce moderately high-resolution (roughly 4 km grid) historical gridded data (more than 30 years for rainfall, 50 years for temperature) and access to information is improved through the development of online "Maproom" tools derived from the historic data sets, integrated into the NMS web pages.

The Maproom is a collection of maps and other figures that are used to monitor past and present climate and societal conditions. The maps and figures can be manipulated and linked to the original data and users can choose which datasets are particularly useful for monitoring current conditions.

The Maproom also features a Climate Data Library—an online data repository and analysis tool that allows user's to view, analyze, and download hundreds of terabytes of climate-related data. The user can also monitor present climate conditions with maps and analyses and also create visual representations of data, including animations. This data can then be downloaded in a variety of commonly used formats including GIS-compatible formats. All this can be done by the user through a standard web browser for free.

The booth was visited by participants from academia and industry frommore than nineteen countries, keen to learn more about the maproom and the climate data library.

Farmers from Kayonza District, Rwanda review the training materials on climate forecast during a field visit as part of the Building Climate Services Capacity component of the project.

Developing user-centric climate services to enhance drought resilience in Africa

Climate services play a key role in supporting the resilience of communities but continue to be inaccessible to large numbers of climate-vulnerable people.

By Catherine Mungai

*"*A portfolio of user co-designed and co-developed online climate information 'Maprooms' will help decision makers better manage drought risk in three priority areas in East Africa: disaster risk reduction, agriculture and food security, and public health." This was the key conclusion from the workshop on 'Existing and New Tools for Drought Monitoring and Forecasting in Eastern Africa' hosted by the IGAD Climate Prediction & Applications Centre (ICPAC).*

From 23 to 25 August, 2017, 70 participants from national meteorological services, international partners, as well as expert practitioners, policymakers, and researchers from agriculture, health, disaster risk reduction, water resource management, education and finance reviewed current tools and offered recommendations for new climate tools for drought risk management in Eastern Africa. The workshop, which took place immediately after the Forty Seventh Greater Horn of Africa Climate Outlook Forum (GHACOF47), was designed to address two main objectives: (i) make decision-makers in target sectors more aware of the online climate information that is available or under development; (ii) and give these decision-makers a voice in the information that national meteorological services provide in the near future.

"Drought is a slow creeping hazard; how can we predict then prepare for this? We acknowledge that tools and information are available; however, the challenge is awareness among users and also skills on how to use the tools," stated Dr. Ladislaus Chang'a of the Tanzania Meteorological Agency.

The climate change challenge – the perfect storm

This was also emphasized by Dr. Guleid Artan, the director of ICPAC, who pointed out that over 27 million people in the region have been affected by drought over the last four years.

Even though episodic droughts have always been present in East Africa, studies show they have become more frequent in recent decades. There is growing evidence suggesting that the impacts of current and recent droughts in East Africa are likely to have been aggravated by climate change. Poverty, chronic malnutrition, weak governance, conflict, drought and climate change have combined to create a perfect storm.

During the panel session on 'policy and operational needs for drought-related disasters,' panellists from agriculture, livestock, health and disaster risk management sectors agreed that pastoralists and smallholder farmers are most at risk. They lack the skills and resources to cope with the inherent risks of farming, live on harsher lands, and rarely have access to economic safety nets when crops fail and livestock die.

More frequent droughts are making it harder for people to recover between shocks, making them more vulnerable. As such, there is an increasing need and demand for tailored climate information products and services for agriculture and food security, pastoral systems, health, water, and energy resources in Eastern Africa.

There is an increasing demand for tailored climate information products and services to enhance the resilience of farming communities in Africa.

20 million
people have been affected by drought in East Africa in the last 4 years

Tools for developing sector specific responses

To respond to the challenges caused by climate change, research institutions have partnered with regional and national meteorological service providers to create online "Maproom" tools that can be used to inform decision making across sectors. During the workshop, the following Maprooms were shown:

- ICPAC drought risk analysis, monitoring and prediction Maprooms;

- ENACTS Climate Data and Maprooms available from several National Meteorological and Hydrological Services (NMHS);

- WISER-SCIPEA Climate Data Portal at ICPAC, which provides NMHS access to seasonal forecast model output from several international forecasting centers;

- Meteo-Rwanda Agriculture and Food Security Maprooms, under development through the CCAFS-led Rwanda Climate Services for Agriculture project.

This was followed by practical session where participants had the opportunity to use the different tools and give recommendations on improving their usefulness for sector-specific drought management needs.

Participants recognized that climate information tools need to be accompanied by climate-smart response strategies that are sector specific, but also enhance integration across sectors where possible. "One Health"—an approach which seeks to address challenges that threaten human and animal health, food security and poverty and the environments where diseases flourish—is one such integrative approach, presented by Madeleine Thomson, a senior research scientist at the International Research Institute for Climate and Society (IRI).

The future outlook

The workshop showcased a rapidly expanding suite of online climate information tools. New Maproom tools for agricultural and food security decision-makers, some still prototypes or under development, are being rolled out at a national scale in Rwanda, and regionally through ICPAC. CCAFS and IRI are working with ICPAC to increase its ability to assist the NMHS of member countries in East Africa to provide online Maprooms that better serve the needs of their farming populations and agricultural sector. Workshop participants offered several additional recommendations for increasing the use of climate information for managing drought risk:

- Expand sector-specific Maprooms beyond agriculture and health, to include disaster, water, energy and tourism;

- Integrate sectorial and socio-economic data with climate databases, to better inform decision-making;

- Promote sustainability by involving users with national meteorological services in the co-development of tools;

- Enhance access through mobile phone applications, and offline access versions where Internet connectivity is unavailable;

- Encourage continued collaboration across sectors; and among research institutions, line ministries, private sector, and development and humanitarian organizations working directly with communities.

The workshop was organized jointly by ICPAC, CSRD, IRI, CCAFS and UK Met Office; and hosted by the Tanzania Meteorological Agency.

Helping farmers adapt to climate change through climate services

In a world made uncertain by climate variability and change, climate-informed advisory services can help smallholder farmers better manage risks and ensure means of livelihoods.

By Dannie Dinh

It has become common practice for those of us in developed nations to quickly look up local weather forecasts on our computers or smart phones to plan out our day or week ahead.

The readily available and reliable information can help us make better decisions, such as whether it be bringing an umbrella for the day or finding an optimal time for outdoor activities. Smallholder farmers across the developing world, whose livelihoods are intimately tied to the weather, have largely relied on their collective experience and observation. Climate change is altering weather and climate patterns and affecting the reliability of traditional climate knowledge. But climate science has also evolved to produce better predictions. Farmers, too, can be empowered by this knowledge.

This fall, representatives from all nations will gather once again for the United Nations Framework Convention on Climate Change (UNFCCC)'s 23rd Conference of the Parties (COP23). As part of the Paris Climate Agreement, countries have signed on to reduce greenhouse gas emissions and support adaptation to climate change. Agriculture is an important focus—both because of the connection between climate and food security, and because agriculture is an important source and potential solution to greenhouse gas emissions. CGIAR Centers and Research Programs are developing innovations to help countries and communities adapt to the impacts of climate change, while improving productivity and food security, and reducing agriculture's contribution to climate change.

Climate information and advisory services, targeting farmers and the institutions that affect them, are one of the innovations available to make agriculture more resilient to the impacts of a variable and changing climate. Climate information can help farmers better manage risk, making the most of favorable climatic conditions while protecting their livelihoods from extreme events. But the availability of information is not enough; it must be translated into actionable advisories, and supported effective communication processes, training to understand and use the information. Through its research, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Flagship on Climate Services and Safety Nets works with a range of partners to improve the availability and usefulness of climate information and advisories for smallholder farming communities—particularly women and youth—and fill gaps in the knowledge and evidence needed to develop more effective services.

From East Africa to Latin America to South Asia, climate-informed advisory services are evolving and expanding to support more farmers, learning from previous failures and successes. India provides weather-related advisories to tens of millions of farmers through a variety of communication channels. In Senegal, climate information reaches an estimated 7 million farmers through rural radio. In Colombia, producer associations have learned to produce downscaled climate information, which a network of agro-advisory groups translates into management advisories and distributes to member farmers.

Farmers need training to understand and use climate information.

In Rwanda, the Rwanda Climate Services for Agriculture project, funded by the U.S. Agency for International Development (USAID) and led by CCAFS and partners, is developing the capacity of the Rwanda Meteorological Agency (Météo Rwanda) to provide high-resolution climate information tailored to the needs of agriculture, through online "Maprooms." Agricultural extension personnel and other intermediaries are being trained to help rural communities understand and use the new online climate information as well as incorporate it into their farming decisions.

Jim Hansen, CCAFS Flagship Leader on Climate Services and Safety Nets, shares his thoughts:

"I'm excited about Rwanda because it is connecting new, locally-relevant climate information products with participatory communication processes with farming communities. Research innovation, combined with good governance and strong partnership between meteorological and agricultural institutions, have made it possible to make climate-informed advisories work for farmers at a national scale".

Rwanda establishes a national framework for climate services

How to effectively develop and apply climate services in support of agriculture and food security.

By Tabitha Muchaba, Yvonne Munyangeri and Gloriose Nsengiyumva

"Climate services bridge the gap between weather and climate information to meet the users' requirements," said Hon. Dr. Vincent Biruta, Minister of Environment during the official opening of the National Consultative Workshop for Setting Up a National Framework for Climate Services (NFCS) in Rwanda.

The NFCS, which is part of the Global Framework for Climate Services (GFCS) implementation plan and requirement, is a national coordinating mechanism for facilitating the development and delivery of climate services, to better manage climate risks at all levels, through development and incorporation of science-based climate information and prediction services into planning, policy and practice. The workshop, which was the first step towards NFCS, brought together experts and stakeholders from various agencies and institutions, with a goal to improve and sustain the flow, co-production and delivery of user-salient climate information. The Rwanda NFCS will be led by the Rwanda Meteorology Agency (Meteo Rwanda), a government agency under the Rwanda Ministry of Environment (MINIREMA), which already has established link and coordination among stakeholders of the existing initiatives on climate services provision in Rwanda, and will develop new governance structure to fully meet the end users' requirement.

Rwandan farmers have pointed out before that accessibility to relevant information on climate change will help them manage climate risks for better agricultural production. NFCS plans to set out a roadmap for an effective development and application of climate services in support of agriculture and food security and other key climate-sensitive sectors in Rwanda. It proposes recommendations for an elaborative National Action Plan, prioritizing climate risk management actions that can be taken by decision-makers, different sectors' stakeholders in response to plausible climate predictions.

With NFCS, Meteo Rwanda shall position itself to fully contribute to the planning and decision-making processes for the government of Rwanda with a view to attaining Sustainable Development Goals (SDGs), the Rwanda National Strategy for Transformation (NST), and the Rwanda Green Growth and Climate Resilience Strategy.

NFCS Implementation Plan

The implementation will be anchored on the following pillars:

- **User interface platform:** a structured means for users, climate researchers, and climate information providers to interact at all levels;

- **Climate services information system:** the mechanism through which information about climate (past, present, and future) will be routinely collected, stored and processed to generate products and services that inform often complex decision-making across a wide range of climate-sensitive activities and enterprises;

- **Observations and Monitoring:** to ensure that climate observations and other data necessary to meet

Rwanda Minister of Environment, Hon. Dr. Vincent Biruta and Rwanda Climate Services Project Coordinator, Dr. Desire Kagabo at the workshop exhibition area.

the needs of end users are collected, managed and disseminated and are supported by relevant metadata;

- **Research, modelling, and prediction:** to foster research towards continually improving the scientific quality of climate information, providing an evidence base for the impacts of climate change and variability and for the cost-effectiveness of using climate information;

Building climate services capacity in Rwanda

Joint efforts and strategies are being used to ensure that climate services information is downscaled and relevant to smallholder farmers in Rwanda. Meteo Rwanda has been working with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) through the Rwanda Climate Services for Agriculture project funded by the United States Agency for International Development (USAID) to increase its capacity to provide climate information services as well as develop tools tailored to farmers' needs.

The project builds on the Enhancing National Climate Services

(ENACTS) approach, by focusing on the creation of reliable climate information suitable for national and local decision-making. Under this initiative, Meteo Rwanda has merged satellite data with its observations to fill gaps in both space and time and can now provide a range of high-resolution climate information products tailored to agricultural user needs through web-based 'maprooms'. The Maprooms provide an efficient way to access location-specific data and graphs.

The workshop was held between 5 and 6 December 2017 in Nyamata, Busegera District in Rwanda, and brought together partners and experts from agriculture and food security, disaster management, transport safety (air, land and water), health, water resources management, environment, tourism and wildlife management, academic research, project management, leisure sport and public events sectors. The overall budget and funds mobilization for the implementation of the NFCS will be established after the development of the National Action Plan, which will specify projects to be undertaken. The workshop was organized by Meteo Rwanda and sponsored by USAID, WMO/GFCS, CIAT/CCAFS, International Research Institute for Climate and Society, University of Reading, and other partners.

Rwanda Climate Services for Agriculture project awarded the first ever Climate Smart Agriculture Project of the Year 2018

The project transforms Rwanda's rural communities and economy through climate information and historic data reconstruction.

At the inaugural Africa Climate Smart Agriculture Summit 2018 organized by the Aid & International Development Forum (AIDF), the Rwanda Climate Services for Agriculture project was announced as the winner of the first Climate Smart Agriculture Project of the Year Award.

The Climate Smart Agriculture Project of the Year Award 2018 recognizes outstanding projects that bring together multiple stakeholders in the agriculture ecosystem—from governments, donors, and NGOs to the private sector—to form new partnerships that improve productivity, resilience, and efficiency while lowering carbon output. Nominations were judged on a variety of factors, including creative approach to solving real challenges; proven impact and ability to demonstrate environmental, climate, social and economic impact; the longevity of the projects; and potential for self-sufficiency. The panel of judges included members from the Eastern Africa Farmers Federation, International Center for Tropical Agriculture (CIAT), United Nations Environment, and Aid & International Development Forum (AIDF). From more than 50 submissions, only 10 projects were shortlisted, and the list was released earlier in May 2018.

Funded by the United States Agency for International Development (USAID), led by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and implemented by the International Center for Tropical Agriculture (CIAT), the Rwanda Climate Services for Agriculture project seeks to transform Rwanda's rural communities and economy through climate risk management with an overall goal of improving agricultural planning and food security in the face of climate change.

Other project partners include the International Research Institute for Climate and Society (IRI), the International Livestock Research Institute (ILRI), the World Agroforestry Centre (ICRAF), Rwanda Agriculture Board (RAB), Agriculture Information and Communication Program (AICP) of the Ministry of Agriculture and Animal Resources (MINAGRI), Meteo Rwanda, the University of Reading, Radio Huguka, DERN, N-Frnds, and Caritas (Caritas Kibungo, Caritas Butare and Caritas Kibuye).

Photo: Alex Virero (CCAFS)

Project team being interviewed at the award ceremony.

Christine Niragire from Nyanza district sorting her beans after harvest.

"Our collective work benefits from a particularly strong set of government and local and international partners and generous support from USAID at the level needed to strengthen Rwanda's capacity to produce, deliver and use climate services. This investment of human and financial resources, and innovative solutions such as ENACTS and PICSA, have made it possible to make things that have previously only been demonstrated a pilot scale work for farmers on a national scale," says Jim Hansen, leader of the CCAFS Climate Services and Safety Nets Flagship Program.

" It is essential to build on local governance structures. For example, the hybrid of the 'Twigire Muhinzi' homegrown extension service system and PICSA, enables farmer champions in villages to rapidly reach a large number of farmers with weather and climate information to effectively inform farmers' decisions at farm, household and community levels," adds Desire Kagabo, CCAFS Rwanda Climate Services for Agriculture Project Coordinator based at CIAT.

Now about two-thirds of the way through the four-year project, there have already been significant accomplishments on several fronts. Building on the IRI's Enhancing National Climate Services (ENACTS) approach, the project supported Meteo-Rwanda to fill gaps in its historical climate records, and use the new high-resolution data set to produce one of the most advanced suites of online climate information tools and products for agricultural decision-makers available in Sub-Saharan Africa.

The project is working with partners to integrate climate services into Rwanda's national agricultural extension service, by training extension staff and volunteer farmers in a process known as Participatory Integrated Climate Services for Agriculture (PICSA). The trained agricultural extension personnel have led 75,000 farmers through the process of understanding local historical and forecast climate information and incorporating it into their farm and livelihood planning. The project also works with Radio Huguka, a rural radio station covering 75% of the country, to regularly broadcast weather information and innovative programming about its use for agricultural decision-making. Finally, the project has worked with Rwanda's government and the World Meteorological Organization to develop a national climate services framework that will oversee and foster sustained coproduction, assessment and improvement of climate services.

Understanding climate information services for better communication

Training journalists on how to communicate weather and climate information to farmers.

By Yvonne Munyangeri, Desire Kagabo and Gloriose Nsengiyumva

The Rwanda Climate Services for Agriculture (RCSA) project, led by the CGIAR Research Program on Climate Change, Agriculture and Food Security, organized a training workshop between 27 and 28 March 2017 in Kigali for journalists and communication experts from different media outlets to enhance their communication of climate information services to different users and improve their understanding of it.

The two-day training was organized through the Agriculture Information and Communication Program (AICP) of the Rwanda Ministry of Agriculture. The 27 participants included journalists, the AICP staff, the Youth Engagement in Agriculture Network and the Information Technology team from MINAGRI. Three trainers from the International Center for Tropical Agriculture (CIAT), the Rwanda Agriculture Board (RAB) and Meteo Rwanda facilitated the training.

Learning about the use of climate information services

During the workshop, Serge Senyana, the meteorologist in charge of the Weather/Climate Services and Applications Division at Meteo Rwanda, explained the basic concepts of weather and climate information to the participants. Concepts included seasonal forecasts, timescales for prediction, and climate risks, among others.

The RCSA project leader explained why climate information services are important, how climate-related risks affect farmers and through which mechanisms they can benefit from the services. He also explained the partnerships for scaling up climate services for Rwandan farmers, mentioning that climate information like planting dates, length of the season, dry spells, etc., is very useful for farmers and that different communication channels have to be used so that farmers get the appropriate information.

"Farmers value climate information they receive, and journalists are a very important channel to share this information." Michel Kabirigi, Soil Expert, Rwanda Agriculture Board (RAB).

Participants learned about climate information services products in Rwanda and they discussed the needs of farmers in order to learn how to transmit climate information better. Journalists emphasized that farmers need to receive the information in such a way that they can easily understand and apply it.

Production and processing of climate information

Journalists said they found it challenging to communicate climate information since they could not easily understand and interpret the information released by Meteo Rwanda.

A weather radar used for climate information production in Bugesera district, Maranyundo, in Rwanda.

Godfrey Habukuri explaining to journalists the process of climate information production, processing, and communication.

Some of them mentioned that they did not communicate such information, fearing that listeners or readers would ask for clarifications that they were not able to provide.

To address journalists' knowledge gaps, the participants learned how climate information is produced, processed and analyzed before being released. The participants visited the weather radar, the control room and the monitoring room located at Maranyundo, Nyamata sector in Bugesera District.

Godfrey Habukuri from Meteo Rwanda explained the process of information production, processing, and analysis. Ange Soubirous Tambineza, AICP's Manager, called on all journalists to take climate information seriously since it is so important to their listeners and for farmers in particular.

Communication experts appreciated the training received and summarized some of their lessons learnt. They shared that since the climate is changing, farmers need appropriate information to be able to cope with this. They emphasized that media is the primary communication channel for disseminating climate information services. Journalists are trusted by farmers and they can reach many of them. After the training, journalists now better understand the risks arising from ignoring climate information available from Meteo Rwanda.

Trained journalists emphasized that information producers should consider specific farmers' needs before producing and sharing the information. Journalists suggested more collaboration between climate information services producers and media outlets for better dissemination of the information.

Raising awareness of climate information services: experiences during the 13th National Agriculture Show in Rwanda

Sharing successes of our climate services for agriculture project in Rwanda.

By Yvonne Munyangeri, Gloriose Nsengiyumva and Desire Kagabo

At the 13th National Agriculture show that was held at Mulindi showground from 26 June to 3 July 2018, farmers who benefited from trainings on using climate information services provided by the Rwanda Climate Services for Agriculture project (RCSA) shared their success stories with their fellow farmers, farmer cooperatives and different entrepreneurs. At the show, farmers led learning sessions, discussing the use of climate information services to improve farm production and making informed decisions.

The National Agriculture Show is a yearly event organized by the Ministry of Agriculture and Animal Resources for farmers/entrepreneurs to showcase innovations and best practices in the agriculture sector. The event brings together exhibitors and visitors to exchange information and experiences, and is an opportunity for the development of agribusiness. This year's theme was "Invest in Innovations and Agribusiness to Transform Agriculture."

Since Rwandan farmers mostly rely on rain-fed agriculture, climate change-related risks greatly affect their farming activities. The RCSA project invests in transforming rural farming communities through enhanced climate risk management. The project provides climate information, training for farmers on the use of climate information, and advisory services to help them make informed decisions.

Learning from farmers' success stories

During the eight days of the agriculture show, the RCSA project with its local partners and farmers raised awareness on the use of climate services in agriculture. Among people who visited the RCSA stand, 343 people provided feedback in written form regarding climate services products being exhibited. Among the visitors were farmers, farmers' cooperatives, members of the government, private institutions, international and local organizations, agronomists, journalists, local leaders, university lecturers, and students. Some of the feedback gathered included: appreciation of the efforts made by RCSA to improve community members' lives, requests to get the climate information to all farmers, requests for Participatory Integrated Climate Services for Agriculture (PICSA) trainings to be scaled out to more people, requests for partnerships, and requests for teaching materials to be available to most farming communities.

Farmers' testimonies were presented on roll-up banners, and they were used to help visitors read and ask questions. Groups of farmers could sit for 30 minutes to one hour listening and discussing the uses of climate information and its application on the farm with trained farmers.

Farmers trained in the use of climate information services, sharing their success stories with their fellow farmers during the 13th National Agriculture show.

"After appreciating the learning sessions that we are providing, farmers keep on informing their fellows, bringing them to learn from us. It is interesting and I am happy to share my experience," said Wellars Kabalisa, one of the presenting farmers.

These discussions made the RCSA stand a target area for many farmers and the stand was full of visitors almost every day. Farmers enjoyed learning from their peers and RCSA project staff could present when visitors needed detailed information about the project, production of climate information, access, and partnership.

Raising awareness on climate information services through Radio Huguka

Radio Huguka, a partner of the RCSA project in disseminating climate information services, had its own stand hosting groups of people and debates. Groups of farmers, cooperative members and partners invited by the RCSA project debated live about the uses of climate information services in agriculture. These debates were open to listeners

who could call in or text to ask questions which were being answered directly. With this, the radio received the Best Media Exhibitor Award of the 13th National Agriculture show.

"Farmers really understand the importance of using climate information in their farming activities and they are very good at explaining the process to others. For sure, this award is due to their presentations and debates we had on the radio during this agriculture show!" Florentine Mukarubayiza, Journalist and Head of Administration at Radio Huguka.

Towards the end of the agriculture show, many farmers, farmer cooperatives, and entrepreneurs exchanged contacts with the presenters for further communication, and some of them made appointments for more learning sessions. Entrepreneurs including bank owners were interested in the success stories of farmers and were willing to do side meetings with them and discuss access to loans. Based on the requests made by visitors, the project plans to expand awareness of climate information services for agriculture to more farmers and other entrepreneurs, and aims to make climate information accessible to all farmers.

Rwandan farmers share how climate information helps them improve food security

An open field day was organized for farmers to tell their neighbors how using climate information can increase agricultural yields.

By Gloriose Nsengiyumva, Desire Kagabo, Yvonne Munyangeri and Catherine Mungai

In June 2018, the Rwanda Climate Services for Agriculture project staff, partners and donors visited farmers who had been trained on climate services. During the field visit, farmers shared what they learnt from the Participatory Integrated Climate Services for Agriculture (PICSA) trainings and how they applied this learning in their decision-making processes.

Plant on time and follow the forecast!

Athanase Mudenge, a farmer promoter from Ruhuha, Bugesera District, established experimental trials on his farm. One section of the farm is a "PICSA plot" where he applies improved practices learned through the training, and the other is a "farmer's practice plot" for farmer's usual practices. Each section has a size of 10 m^2.

A total of 35 farmers attended the event and conducted an assessment of the practices and technologies applied in the two plots. Through a participatory exercise, farmers identified the following assessment criteria: number of bean plants germinated, the height of the bean plant, the vigor of the stem, pest and disease infestation, number of pods, width (size) of the pods, and number of pods without grains.

Similarly, farming practices and technologies were assessed, and farmers agreed that timely planting based on weather forecasting, application of inorganic fertilizer, use of certified seeds, crop rotation, use of soil and water conservation (e.g. ridges and mulching), and row planting and optimum spacing are all practices that contribute to higher productivity.

Following the visual assessment of the two plots, the next step was to harvest the plots and weigh the biomass and grain yield that came from each plot.

Results from the exercise (Figure 1) showed that the yield had tripled for the "PICSA plot" compared to the "Farmer's plot".
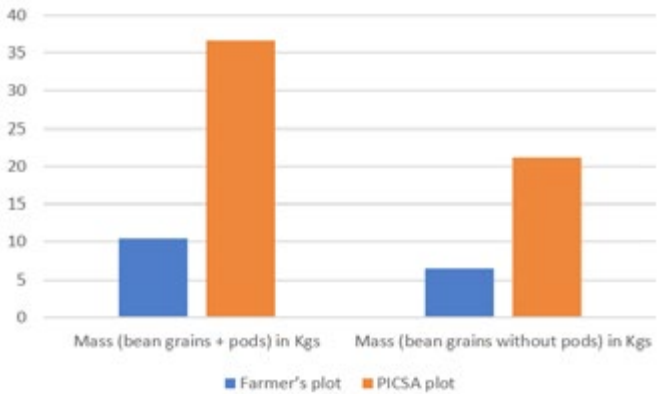

Figure 1. Mass weight in kgs on the farmer's plot vs. the PICSA plot

Open field day in Bugesera District, Rwanda. The event was organized for farmer promoters (trained farmers) to share with their fellow farmers the lessons and practices learned from climate services training.
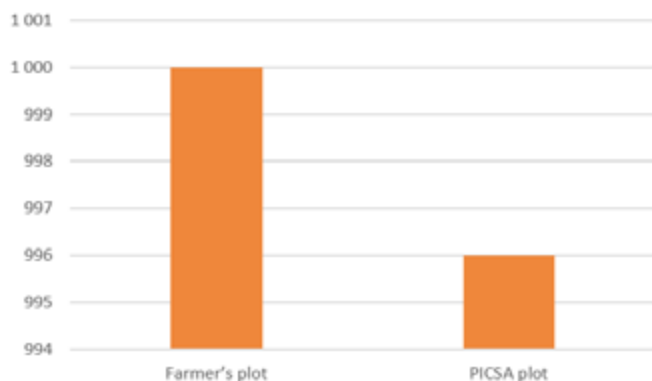

Figure 2. Number of harvested plants.

"Planting on time is the best starting point in the use of improved agronomic practices," said Mudenge. "To achieve this, you need to prepare the land early, look for all inputs and get ready for the season to start," he continued.

Additionally, the seasonal and daily forecasts should be strictly followed. Mudenge encouraged his fellow farmers to adhere to this guidance, emphasizing that when the season does not go as well as expected, smart agricultural techniques are available to address that challenge. He also mentioned some of the smart techniques, which include those that he used in his trial plots like mulching, planting early maturing crop varieties, water harvesting, efficient fertilizer application, and others.

The Project's Agreement Officer Representative (AOR) from USAID Rwanda who was part of the visit emphasized that the difference is obvious from the two sets of trial plots and that farmers should see the variable climate challenge as an opportunity to utilize smart farming techniques.

Ranking practices to implement for increasing yields

Ngendahimana Jean Paul, a farmer promoter in Ntarama Sector of Bugesera District, attended a training on PICSA where he learnt how to manage both the household and the farm using climate information to inform his activities. Following the training, he decided to dedicate a small portion of his land to a trial where he applied what he learnt through the training.

During the first season, he planted maize and observed an increase in yield. This motivated him to grow beans during the following season and he observed an increase in yield once again. He is now more than confident that the practices he implemented are the primary cause of the increased yield for both maize and beans.

"I now adhere to the planting time once I get the seasonal forecast and I always look for improved seeds. I plan to expand my farming activities using these practices because I am sure that I will get higher production. The difference with applying climate information and agronomic advisories that came with PICSA training is obvious in my plots and I urge all my neighbors to follow my example."

Following the visit, farmers ranked the practices in order of importance according to their perceptions and based on affordability. The 20 farmers were split into two equal groups of women and men.

Results are shown in the table below starting with the most important and affordable according to each group.

Practice	Men ranking	Women ranking
Planting on time	1	1
Improved seeds	2	4
Inorganic fertilizer	3	6
Organic fertilizer	4	7
Row planting and optimum spacing	5	5
Tied ridges	6	3
Mulching	7	2

Farmers were happy to learn that they could work together and pool resources to implement the different practices.

Ngendahimana's trial plots were then harvested and the biomass and grain yield were weighed. The measurements suggest almost a double yield from the plot with practices learnt through PICSA training compared to the control plot with farmer's usual practices.

Following the field visit, farmers were encouraged to work closely with their local authorities and the Rwanda Climate Services for Agriculture project partners to seek relevant information that will boost farm productivity. It was emphasized that climate information is readily available through the local authorities and the project's local partners.

The PICSA approach is being implemented across the whole country to help farmers in Rwanda increase their agricultural productivity and adapt to a changing climate.

Photo: V.Atakos (CCAFS)

Training from 6 to 10 June 2016, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) organized a training of trainers session on the Participatory Integrated Climate Services for Agriculture (PICSA) approach in Nyamata, in the outskirts of Kigali, Rwanda.

Photo: T.Muchaba (CCAFS)

University of Rwanda Scientific Conference Week with the theme "Rebranding Research for Sustainable Development". The CCAFS Rwanda climate services project in partnership with Meteo Rwanda had an exhibition booth showcasing the Rwanda maproom and the climate data library.

Photo : CCAFS

At the inaugural Africa Climate Smart Agriculture Summit 2018 held by the Aid & International Development Forum (AIDF). The Rwanda Climate Services for Agriculture project was announced as the winner of the first Climate Smart Agriculture Project of the Year Award.

Photo: A. Nyandwi/MINAGRI Rwanda

USAID-Rwanda visit to the Rwanda Climate Services for Agriculture Project . On 21 to 23 March 2017, a team from USAID-Rwanda visited the 4 pilot districts (Kayonza, Burera, Ngororero and Nyanza) where the Rwanda Climate Services for Agriculture Project has been launched.

Photo: T.Muchaba (CCAFS)

Establishment of the Rwanda National Framework for Climate Services (NFCS) held from 5 to 7 December, 2017. The NFCS will enable Rwanda to create and provide authoritative, credible and usable science-based climate information.

Photo: T.Muchaba (CCAFS)

Open Field Day in Bugesera District, Rwanda 19 to 20 June 2018. The Rwanda Climate Services for Agriculture project organized the event for farmer promoters (trained farmers) to share with their fellow farmers on the lessons and practices learned from climate services training.

Publications

CCAFS. 2016. **Building climate services capacity in Rwanda.** Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Clarkson G, Dorward P, Kagabo DM, Nsengiyumva G. 2017. **Climate Services for Agriculture in Rwanda: Initial findings from PICSA monitoring and evaluation.** CCAFS Info Note. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Coulibaly JY, Birachi EA, Kagabo DM, Mutua M, Hansen J. 2017. **Climate services for agriculture in Rwanda: What farmers know about climate information services in Rwanda**. CCAFS Info Note. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

del Corral J. 2016. **ENACTS, Data Library, Maproom and GIS Training at Rwanda Meteorological Agency, Kigali, Rwanda**, July 2016. CCAFS Workshop Report. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

del Corral J, Rose A. 2018. **Training on ENACTS Data Library and Maproom software in Kigali, Rwanda.** CCAFS Workshop Report. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Dorward P, Clarkson G, Stern R. 2015. **Participatory Integrated Climate Services for Agriculture (PICSA): Field Manual**. Walker Institute, University of Reading.

Faniriantsoa, R. 2017. **Training on IRI Climate Data Tools and developing a method for integrating climate data in Kigali, Rwanda.** CCAFS Workshop Report. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Hansen J, Kagabo DM, 2016. **Training on understanding, communicating and using the downscaled seasonal forecast.** CCAFS Workshop Report. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Kagabo MD, Nsengiyumva G, Clarkson G, Dorward P. 2017. **Participatory Integrated Climate Services for Agriculture (PICSA) Intermediary Training in Muhanga, Rwanda.** CCAFS Workshop Report. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Munyangeri YU, Mungai C. 2017. **Stakholders' planning workshop for the Rwanda Climate Services for Agriculture project.** CCAFS Workshop Report. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Nsengiyumva G, Kagabo DM, Birachi E. 2016. **Rwanda Climate Services for Agriculture project workshop with high-level key partners for pilot sites (districts) identification, Kigali, Rwanda, February 2016**. CCAFS Workshop Report. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark.

Nsengiyumva G, Kagabo MD, Birachi E. 2016. **Joint launch of the Enhancing National Climate Services (ENACTS) program of Rwanda Meteorology Agency and the USAID Rwanda Climate Services for Agriculture project, Kigali, Rwanda, March 2016.** CCAFS Workshop Report. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Nsengiyumva G, Kagabo DM, Birachi E, Hansen JW. 2016. **Planning workshop for Rwanda Climate Services for Agriculture project, March 2016**. CCAFS Workshop Report. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Nsengiyumva G, Kagabo MD, Clarkson G, Dorward P. 2017. **Participatory Integrated Climate Services for Agriculture (PICSA) Specialist Intermediary Training in Nyamata, Rwanda**. CCAFS Workshop Report. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Nsengiyumva G, Kagabo DM, Gumucio T. 2018. **Exploring pathways for gender-responsive climate services in Rwanda. Poster presented at the Gender Summit - Africa: Climate change through the gender lens, Kigali, Rwanda, 19-20 March 2018.** Kigali, Rwanda: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Nyasimi M, Radeny M and Hansen JW. 2016. **Review of Climate Service Needs and Opportunities in Rwanda.** CCAFS Working Paper no. 180. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org

Siebert A, Kagabo DM, Vuguziga F. 2016. **Training and Development of Downscaled Seasonal Forecasts for Pilot Districts, Kigali, Rwanda, August 2016**. CCAFS Workshop Report. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

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