Training on the Application of Climate Foresight Data in Enhancing Agricultural Policy Implementation and Decision-Making in Eastern and Central Africa

Julian Barungi | John Recha | Teferi Demissie

Workshop Report

CGIAR | AICCRA
Accelerating Impacts of CGIAR Climate Research for Africa

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ASARECA
Transforming Agriculture for Improved Livelihoods

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About AICCRA reports

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

About AICCRA

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RELEVANCE OF CLIMATE FORESIGHT IN AGRICULTURAL DECISION-MAKING AND POLICY IMPLEMENTATION

Background

A paradigm shift is required in policies to make food systems sustainable.

The climate foresight workshop highlights the critical role of collaborations between farmers and corporate, governmental, and entities involved in extension and training services as well as research and development. The workshop demonstrates that stakeholders (Fig. 2) at different dimensions of the climate service value chain and across different industries may collaborate to achieve shared, synergistic aims.

Figure 1: Targeted stakeholders for partnerships and collaborations

Foresight is a description of approaches that try to investigate what the future may hold. Most foresight approaches focus on the use of many potential scenarios of future directions of food systems that may be influenced by different change factors. Climate foresight is a strategic planning technique that enhances decision-making. It helps to speed the flow of information among food system stakeholders. It lends validity to suggested strategies and aids in the development of future-proof policies.

Using a forward-thinking outlook to policymaking has been shown to improve governments' capacity to plan for uncertainty and the unknown. Climate prediction has been utilized in farming to justify the necessity for new or altered agricultural policies that assure holistic development paths that tackle a wide variety of climatic events over several fields, including future-resilient agricultural policies.

Objectives

- The overall objective of the training is to enhance capacity in the application of foresight data in agricultural policy implementation and decision-making.

The **specific objectives** are:

- To raise awareness on the relevance of climate foresight data in Agri decision-making on making and policy implementation
- To enhance capacity in interpretation and analysis of climate foresight data
- To facilitate sharing of lessons, experiences and challenges on access to and use of climate foresight data in agricultural policy implementation and decision making
- To link farmer groups with sources of climate agro-advisories

Expected Outputs

- Awareness was raised on the relevance of climate foresight data in agriculture decision-making and policy implementation.
- Capacity in interpretation and analysis of climate foresight data enhanced.
- Lessons, experiences and challenges on access to and use of climate foresight data in agricultural policy implementation and decision-making documented.
- Farmer groups linked to sources of climate agro-advisories.
- A Training report including training materials.
- Narrative of the training through blogging.

Expected from the farmers:

1) To get more experiences to become better farmers by using the climate change information
2) To learn new policies
3) Farmers in climate change focusing on the climate change
4) Application of climate data information

Workshop organization

ASARECA, farmer representatives from Kenya and Ethiopia, and Lersha gave brief speeches to kick off the event. This was followed by a reflection on the methods, lessons learned, obstacles encountered, and possibilities presented. The brainstorming session compelled participants to develop and agree on a plan for an effective climate foresight platform to improve information exchange among key stakeholders along the climate service value chain.

Figure 1. Participants pose for a group photo in Nairobi, Kenya

SESSION 1: OFFICIAL OPENING AND WELCOME REMARKS

Role of ASARECA: ASARECA Executive Director

"This is a good forum to meet once again with experts, farmers and stakeholders to discuss these important issues on climate change information. We are working closely with ILRI in accelerating climate change data."

Crop Monitor, Forage and Desert Locust Prediction

Crop monitor analyzes various crop conditions at different times of the cropping season. The forage forecast helps pastoralists and governments in guiding livestock management in the region to avoid conflicts and cattle rustling. Additionally, the tool helps in desert locust prediction. This contributes to planning resources allocation for control measures and control damage to crops. For instance, climate monitoring and performance assessment of the Eastern Africa region were predicted to receive below-average-to-average rainfall. Between March and May 2022, most of the region experienced a drier climate with a few areas having received average rainfall.

East Africa Hazards Watch System

The East Africa Drought Watch is a drought monitoring tool and is an early warning system for Food Security. It is a Satellite-based Crop and Rangeland Monitoring System. The web-GIS environment relies on weather and earth observation (EO) indicators that generate automatic warnings regarding poor or delayed vegetation performance every 10 days.

A statistics dashboard uses indicators that are presented as statistical data that has been aggregated at the sub-national level. The dashboard has additional information such as crop calendars, warnings time series, and progress of the season

East Africa Agriculture Hotspots is a platform that explores and analyzes EO-derived data for agriculture monitoring

CLIMATE FORESIGHT DATA

Importance in agricultural decision-making at the farm level:

Climate change has led to new diseases and pests, droughts, seasonal shifts, high temperatures and extreme temperatures, land degradation, short seasons, and loss of crops. Approximately 13 million farmers in Ethiopia are vulnerable to climate change due to increased climate variability. These farmers own small plot sizes (around 85% are smallholder and 70% are women). Furthermore, they have poor access to markets, credits, and labour. Thus, the farmers are mostly risk-averse by applying low inputs and in return get low outputs. Managing climate variability and change will enable the farmer to exploit opportunities during good years.

Climate foresight is a solution used to address the mentioned challenges. It is an all-time-scale weather and climate information that is relevant for agriculture. The information needed depends on decisions that are detail-oriented and factor-specific. With increasing lead time information is more uncertain and complex thus decision makers need technical assistance to understand and use the information.

What are Climate Services

Climate services entail four pillars namely production, translation, transfer, and use of climate knowledge and information in climate-informed decision-making and climate-smart policy and planning. Climate services need to strengthen all aspects of climate foresight by working with the most relevant institutions (Fig 3).

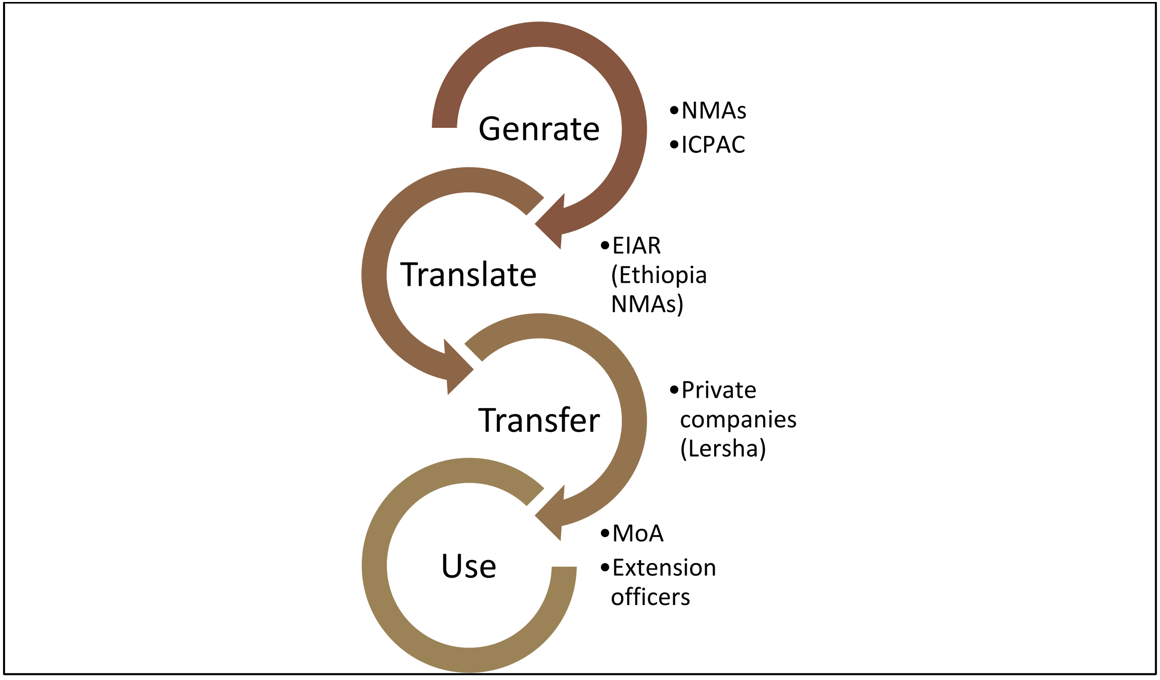


Figure 2: Climate service pillars and responsible institution.

Challenges of climate services

Farmers' capacity to access, understand and act on climate information

- Gaps in the capacity to access, understand and act on information
- Gaps in capacity to provide actionable information
- Gaps in information relevance
- Institutional, governance arrangements to sustain the co-production of service and actionable information to the private sector.

Possible interventions:

- Building capacity to communicate, understand and act on information.
- Process the combined communication and capacity-building
- Participatory processes for understanding climate variability and trends, pre-season planning
- ICT for short-led weather forecasts and advisories
- Media for weather information and advisories
- Women and other disadvantaged groups need special attention.

Regional climate and National Meteorological canters' capacity to provide tailored local information

Institutional capacities in delivering high-quality, decision-relevant, timely, reliable, and suitable forecasts:

- Lack of understanding of stakeholders' needs.
- Human and financial limitations to address the needs of the stakeholders.
- Gaps in the historical dataset in the raise

Possible interventions to support NMS to provide actionable local climate information

- Farmers need identification and assessment
- Enable NMS to customize, generate, and disseminate locally relevant information (e.g., Via co-production)
- Strengthen the forecasting systems of NMS in collaboration with regional and international climate centres (e.g., ILRI, ICPAC) via projects like AICCRA
- Expanding the scope of the NMS existing Maproom (developed by ILRI) products to meet the known needs of farmers and other agricultural decision-makers.
- Support NMS human capacity building plan/program.

Translating raw climate information into agriculturally relevant terms

The climate information from the service providers lacks the following

- The need of the different stakeholders not identified
- The information is more general and not specific to Value Chain
- Language lacks simplicity
- Uncertainty in climate forecast is not well addressed in the translation for different stakeholders

The proposed interventions for raw climate information relevant to farmers

- Identification of farmers' decision-making based on climate information.
- Develop methods using decision support tools (DSTs) to translate and downscale the climate information for the agricultural decision-making process
- Develop a framework for the translation of climate information – by coproduction
- Strengthen co-production of value-chain-specific c climate services and linkage among stakeholders in the chain.
- Awareness creation and continuous training for stakeholders (particularly at the local level) on the nature and application of weather forecasts and climate predictions

Examples of softwares translating raw climate information that is friendly to the end user include ENACTS Maprooms, SIMAGRI, and ASIS.

Institutional and governance arrangements to sustain co-production

- Limitations of supply-driven climate services.
- Has limited boundary thus deficient in agricultural research and development.
- Doesn't revolve around farmers thus their needs are not met.

Possible interventions to sustain co-production include:

- The endorsement of NFCS in Ethiopia (5 institutions signed the agreement)
- Consultative Workshop on the Development and Implementation of the National Framework for Climate Services in IGAD and SADC Countries
- Expand the boundary to agricultural research and development
- Expand the boundaries to give farmers an effective voice

Take away messages

- Develop effective partnerships and dialogue between climate service and agriculture users at all levels to enhance the climate resiliency of the agriculture sector
- Monitor and respond to the evolving needs of the agriculture sector by developing and working to mainstream climate services into core agriculture functions
- Support agriculture decision-makers with appropriate and timely information and services to integrate climate factors into agriculture planning strategies and practice processes at the national, regional, and local levels

Importance of utilizing feedback loops for forecasts

- To identify the information that is relevant to the users (e.g. strong winds, crop pests or dry periods).
- To determine useful spatial scales.
- To assess the accuracy.
- To identify other influential factors (e.g. changes in land use, the market, and value and supply chains.

How feedback loops can increase users' understanding of forecasts

- Determining which languages are most appropriate for the communication of forecast information

- Identifying effective methods for communicating forecast information (e.g. use of images, percentages)
- Identifying which formats (written, verbal) and platforms (radio, SMS, fliers) effectively reach users.
- Building trust between user groups and producers of seasonal forecast information.

Table 1: The approach to Climate services

Impacts	Information	Objectives
How does weather or climate affect your activities?	*What information would provide the greatest benefit?*	*What outcomes do you desire from the conversation?*
Severe droughts can destroy farmers' crops and kill livestock.	Knowing the most likely rainfall amounts this season may help communities manage reservoir levels.	to ensure farmers at the district level have the best available information for planning information
High rainfall during a season can increase the cases of cholera	Utilize early action efforts if there is a significant risk of floods or droughts	to make decisions on whether or not to plan a vaccination campaign in a region

farmers get climate information at different levels at different times scales from the County Director of Metrology. The information is disseminated through media, leaflets/bulletins Chief Barazas, weather advisories, and local administrators. The information advises farmers on when to expect the rains hence preparing their lands, and seed varieties to plant.

REGIONAL SEASONAL BASED ON THE RECENTLY RELEASED JJAS 2022 SEASONAL OUTLOOK

Forecasting: Reproducible, traceable, verifiable, calibrated, digital products

the State of Global Climate Drivers

The Indian Ocean Dipole is one of the key drivers of Eastern Africa's short rainy season in the months of October, November, and December. The amount of precipitation throughout this season is influenced by the fluctuation of the adjacent Indian Ocean Dipole mode. Rainfall performance during the long rains in June, July, August, and September and the short rains in October, November, and December are significantly influenced by the El Niño-Southern Oscillation (ENSO). In 2019, the region had an extremely wet short rainy season. The rains experienced in February 2022 were associated with a positive phase. The neutral phase (-ve index), is expected to turn to the Negative phase by July 2022. The neutral phase of IOD is insignificant but it is still monitored as it is anticipated to influence the short rainy season in 2022.

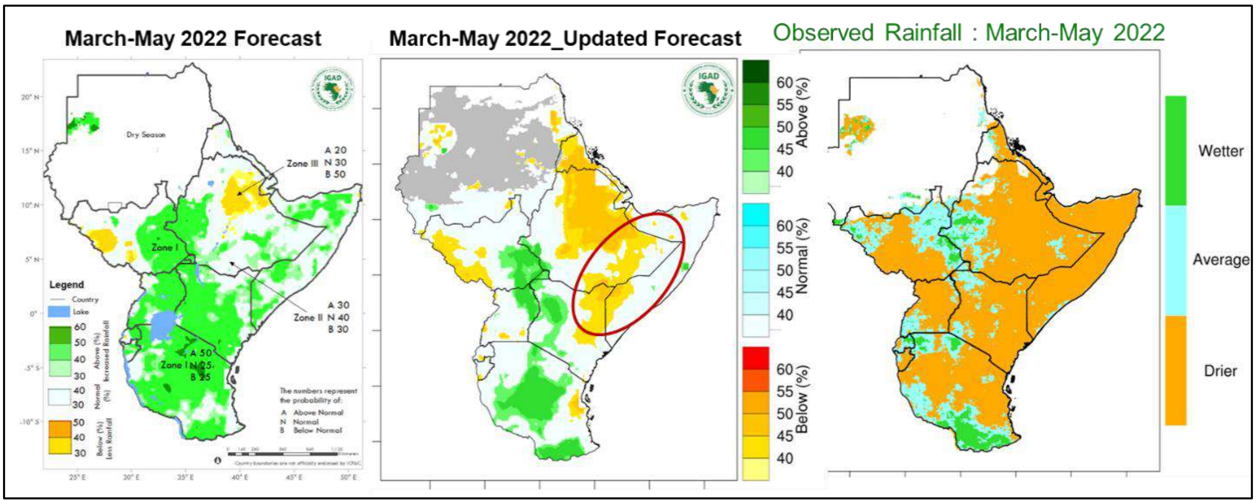


Figure 3: Weather forecast of Eastern Africa region between March and May 2022.

Active La Nina is anticipated to continue into the short rains season in 2022 and has influenced rainfall in the northern region of GHA. Most parts of northern GHA are predicted to have a wetter-than-average rainfall season. No dominant categories are indicated for coastal areas of Kenya and Somalia, Southeastern Ethiopia, and cross-border regions of Sudan and South Sudan. Isolated areas in north coast Kenya to adjacent areas of Somalia are likely to record depressed rainfall. In June, July, August, and September 2022, it was Warmer than the average temperatures predicted over the eastern parts of the region and northern areas of Sudan. Near-average temperatures have been predicted in the western and southwestern parts of Tanzania, Burundi, eastern Rwanda, central Ethiopia, and part of northeastern Somalia. Cooler than average temperatures are expected over much of Sudan, Eritrea, Djibouti, western and northern Ethiopia, northern Somalia, South Sudan, Uganda, and western Kenya. Warmer than normal temperature conditions have been forecasted over northern areas of Sudan, central to south-eastern Ethiopia, central to southern Somalia, much of Kenya, and Tanzania. Average temperatures are expected over central Somalia central to western South Sudan, parts of Uganda, Rwanda, and southern Tanzania. Wetter than normal conditions are expected over most parts of the region and low rainfall is expected over coastal Kenya and southern coastal Somalia. The government agents are developing a manual of climate information data that will be devolved to the County Government up to the level of wards. This will assist farmers to make wise decisions.

FARMERS' EXPERIENCES, CHALLENGES, AND NEEDS IN USING CLIMATE FORESIGHT DATA IN AGRICULTURAL DECISION-MAKING AT THE FARM LEVEL

Kenyan Farmer (Mary Samson)

Farmers in Kitui County started using climate information data in 2008. The farmer form groups to attend farmers' field school, and work with extension officers by using their climate data information. The utilization of climate data has boosted crop productivity in the region. For the farmers to accept to try farming using climate data, they had to be assured of compensation in case of poor yields. In earlier years the yields were low thus, they were guided on when to plant. Additionally, the farmers were given rain gauges to be measuring the rainfall. Advisory Officers from the County Agricultural officer also advise farmers on planting early-maturity sorghum varieties. A Delay in planting crops by a day affects crop productivity. The prediction is good because it informs the farmer on what to do and makes the decision on what to plant. Climate information advises farmers on planting different types of seed hybrid when the season is predicted to be good but when it's below, they plant early-maturity crops like sorghum. After harvest, they sell and buy maize. She was asked a question by the facilitator. It is good to continue using this type of climate data information? She answers that climate advisories have to continue with the good information they are providing. She also said that a seasonal forecast helps the farmer to decide on what to plant.

Ethiopian Farmer- Aman (from Farmer cooperative)

The farmer cooperative, consisting of 95,000 members, has been getting climate information from the media and Ethiopian Agricultural extension officers. There are also gaps in timely information on climate information. They have digital information advisories and say it is very important for the farmers. The member of the cooperative disseminates this information to farmers at the grassroots.

How do you get the climate information and how did it help you? They use the climate information to plan for their activities and decision-making on their farms

Farmers get climate information weekly, monthly and seasonal through the agricultural extension officer.

EXPERIENCES, CHALLENGES AND NEEDS OF POLICYMAKERS IN USING CLIMATE FORESIGHT DATA IN AGRICULTURAL POLICY IMPLEMENTATION

Climate foresight One-Stop Digital Services to smallholder farmers: Lersha and Green Agro Solution PLC

Lersha means agriculture in Amharic. It represents the yearning to fulfil the agricultural needs of smallholder farmers and commercial farmers through innovations. Lersha is an Ethiopian-based company that provides agricultural online services to smallholder and commercial farmers. The online services offered to farmers include access to farm inputs (both crop and livestock), hiring mechanization services, and requesting dynamic agro-climate advisory using technology. Farmers can directly access the digital platform or through Lersha Agents' access. The platform combines a mobile application, a call centre, and a Lersha agent to facilitate transactions with farmers.

The current agricultural sector in Ethiopia has significant unprofessional and unorganized farmers with low yields and less organized farmers with average crop production. Access to finance bundled with insurance is critical for the growth of the agricultural sector. Besides, significant investment in the sector will enhance access to lending institutions, market accessibility, farm inputs and services. It is projected that transformation in the Agriculture sector will see a significant number of farmers have access to farm inputs, mechanization services, financial products as well as timely and critical advisory services. This is possible if the smallholder farmers can access IT platforms either directly or through the assistance of extension agents.

To make the Lersha online agricultural services efficient and convince the farmer to use new technologies, e.g mechanization/agro-climate advisory, they have:

- Built a mobile application thus narrowing the digital gap in agriculture
- A call centre
- Agents that are young graduates
- Facilitate the accessibility to get farm inputs at low cost

This makes the approach unique in that:

i. They Understand the local context and have a decade of experience in Agri-business with smallholder farmers
ii. A multi-stakeholder approach involving public, private, ` and development partners
iii. Lersha subscription is based and farmers pay when he/she receive farming services

Lersha has successfully launched its services in most parts of Ethiopia with good and growing market traction.

Gender mainstreaming

Embedding the specific needs of women smallholder farmers by collecting disaggregated data including gender-specific survey tools as well as conducting ongoing gender-specific monitoring and evaluation. Lersha continuously refines its business model to bridge the gender gap in access to inputs, mechanization, advisory and digital services. Lersha ensures that at least 30% of the Lersha Agents are women and aims to serve 50% of women smallholders.

Financial sustainability

Strategy	Rationale
Lersha platform charge 8% of the input's transaction fee and 5% of the mechanization services as a commission that is divided between the Lersha Agent and the platform.	Commercial Banks, e.g. Bank of Abyssinia Ethiopia, are growing and achieved tremendous growth in the last few years becoming leading banks in Ethiopia
A Lersha agent will be assigned between one to three kebeles with an average of 1000 smallholder farmers.	Lersha's partnership with various banks aims to harvest. Broadcasting agency banking, financial inclusion of smallholders in the rural area and allowing wider deposit mobilization efforts
Lersha is striving to respond to the continuous demand of smallholder farmers, the business model is a win-win for all actors including input suppliers, service providers, Lersha agents and commercial banks.	Additional income for Lersha Agents, Cash in/out Services saving time and effort and allow customers from abroad to pay their family's farm input expenses.

Lersha and CIMMYT in 2022 are under the accelerating impacts of the CGIAR climate research for Africa (AICCRA) initiative. Achieving the Sustainable Development Goals targets simply will not be possible without a strong and sustainable agricultural sector.

ACCESS, TRANSLATION AND USE OF CLIMATE INFORMATION TO ENHANCE AGRICULTURAL DECISION-MAKING AND POLICY IMPLEMENTATION

1. **Ways of access to seasonal forecasts**
   a) National media – radio, TV programs
   b) Stakeholder meetings – NCOF – national climate outlook forum.
   c) Electronic media – Phone, Internet, Twitter
   d) NGOs – e.g., CARITAS
   e) Government – e.g., National Food Security Committee; County climate outlook forums; County forums – information on seasonal outlooks
2. **Ways to improve access to seasonal forecasts -** Policy makers and planners; Practitioners
   a) Increased resource allocation at the county level (by the county government) – participatory scenario planning at the County level.
   b) Downscale further to the community level. Now downscaling is done only at the County level
   c) Sensitize politicians through the relevant parliamentary committees – national to county
   d) Increase the channels of communication e.g. multi-stakeholder platforms for value chains (Kenya)
   e) Call for public barazas for dissemination of information e.g. chiefs barazas in Kenya
3. **Challenges accessing seasonal forecasts**
   a) National level
      i) Media channels used and information packaging is limited in reaching the end user
      ii) Limited decentralization of forecasting services – mandate the regions to make forecasts – some autonomy
   b) Sub-national level
      i) The forecast is still too broad to address the needs of the farmer
   c) Community level
      i) Downscaling has not been done at the community level
      ii) Limited resources to organize meetings
      iii) A long time from the supply of seasonal outlook at the national level throughout the county and reach to end-user
4. **Potential areas for improvement**
   a) Effective downscaling to the community level
   b) Effective decentralization of the services to the county
   c) Bundle CIS with related services

d) Mobilize resources for continuous implementation - around CIS

e) Continuous sensitization and capacity building of the population

5. Multi-stakeholder forums for dissemination of early warning and agro-advisories

1. Regional

    a) ASARECA CSA alliance

2. National level

    a) National agricultural shows

    b) National platforms e.g. EDACAP in Ethiopia; Kenya CSA-MSP (multi-stakeholder platform) – public, private, county, CGIAR, research

    c) Societies e.g. Kenya Met Society

3. Sub-national level

    a) Regional agricultural research institutes

    b) Field agricultural shows

    c) County forums

4. Community-level

    a) Farmer field schools

    b) Agricultural field days

    c) Chiefs barazas

    d) Religious organizations

Group 2: Using the seasonal forecasts for decision-making

Used and useful	**Not used**
USE of the forecast for agricultural practices • Planning • Scheduling activities • Seed selection If the forecast is **Normal** • Proceed with normal seed types During Below Normal • Drought-resistant seeds (green gram, millet, cassava, sorghum),	• Lack of awareness and accessibility • Difficulties in understanding the forecast jargon **Recommendation** • Help from the experts is needed • Create awareness • Avail using easy-to-use channels

• Stop weeding and use the crop for other purposes e.g. fodder. During Above **Normal** • Hybrid or high-yield seeds will be selected.	

Key Information/ Triggers that can invoke a decision

- Onset and spells
- Distribution
- Amounts

Triggering information would like to see in the future

- Reliability
- Improve the accuracy
- More capacity outbuildings resources for facilitation of the forecasts.

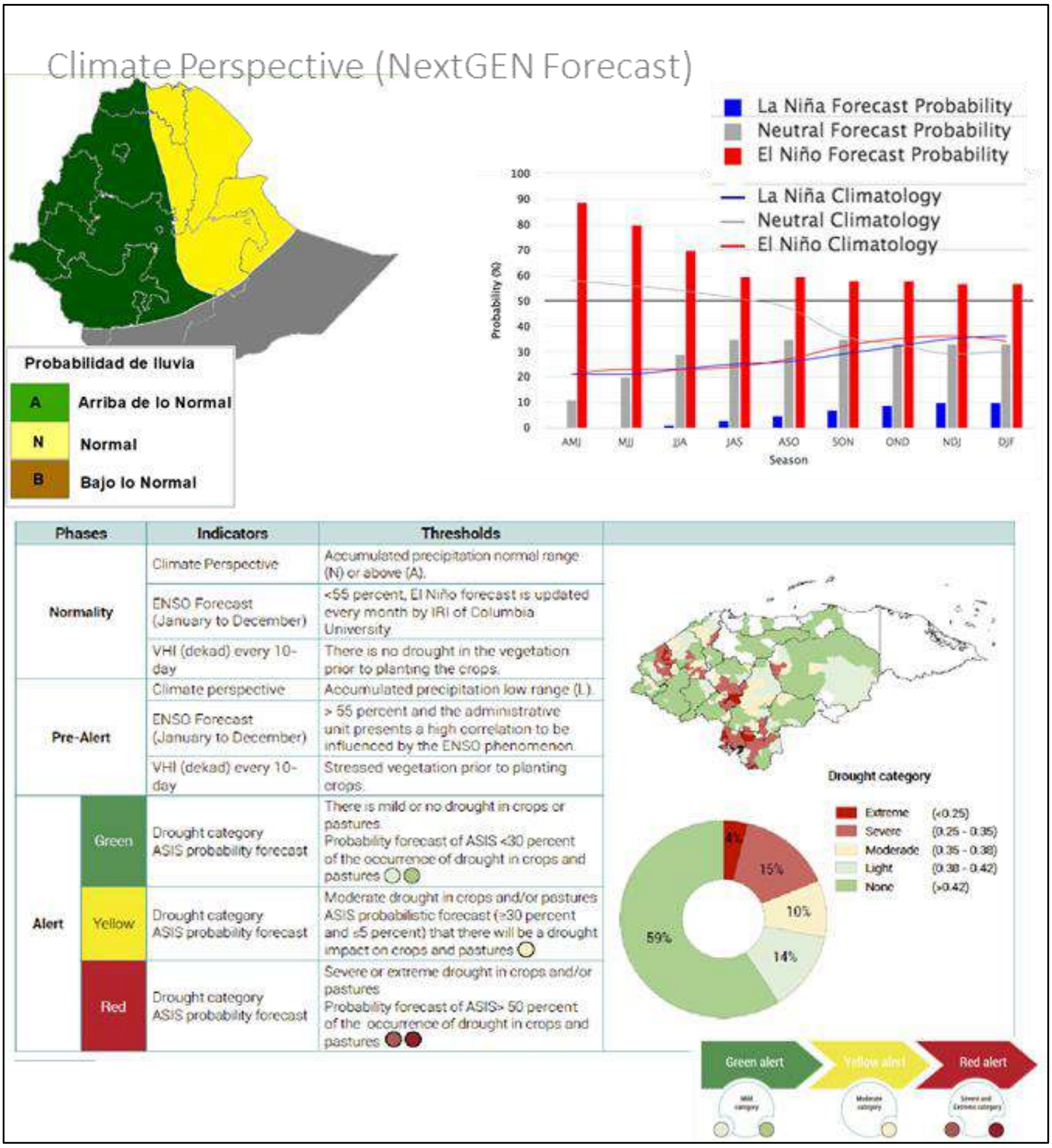
Group 3: Complementing the seasonal forecast by use of other intra-seasonal forecasts and early warnings

1. Methods of complementing seasonal forecast by use of intra-seasonal forecast and early warning,
    - daily forecast,
    - weekly forecast,
    - monthly forecast
2. Importance of provision of feedback on advisory and forecast?
    - it helps in sharing challenges and experiences.
3. Ways of improving feedback mechanism between climate information producers and commodity value chain players
    - Establishing call centres
    - Having regular stakeholder meeting

Use Of Climate Information Services And Digital Agro-Advisories In National Agricultural Extension Systems: Agricultural Advisory Services, Ethiopia

Digital Agro-Climate Systems for better Climate Services

The weekly forecast of extreme rainfall is a valuable indicator for preparedness and early warning actions. Besides, seasonal climate forecasts, (Fig. 5), are a key component of sectoral climate services & useful information for decision-making processes. Monthly updates are useful for the re-adjustment of plans.



Phases		Indicators	Thresholds
Normality		Climate Perspective	Accumulated precipitation normal range (N) or above (A).
		ENSO Forecast (January to December)	<55 percent, El Niño forecast is updated every month by IRI of Columbia University
		VHI (dekad) every 10-day	There is no drought in the vegetation prior to planting the crops.
Pre-Alert		Climate perspective	Accumulated precipitation low range (L).
		ENSO Forecast (January to December)	> 55 percent and the administrative unit presents a high correlation to be influenced by the ENSO phenomenon.
		VHI (dekad) every 10-day	Stressed vegetation prior to planting crops.
Alert	Green	Drought category ASIS probability forecast	There is mild or no drought in crops or pastures Probability forecast of ASIS <30 percent of the occurrence of drought in crops and pastures
	Yellow	Drought category ASIS probability forecast	Moderate drought in crops and/or pastures ASIS probabilistic forecast (≥30 percent and ≤5 percent) that there will be a drought impact on crops and pastures
	Red	Drought category ASIS probability forecast	Severe or extreme drought in crops and/or pastures Probability forecast of ASIS> 50 percent of the occurrence of drought in crops and pastures

Figure 4: Seasonal Forecast, El Niño Forecast and Vegetation Conditions

An Agricultural Drought Monitoring System

The global Agricultural Stress Index System (ASIS) is an agricultural drought monitoring system. It is an early warning system of drought. It uses GIS to strengthen national and regional drought monitoring capacities. In collaboration with FAO, Global Information and Early Warning System on Food and Agriculture (GEWS), the system provides near-real-time images used in the calculation of the Agricultural Stress Index (ASI). The ASI indicator identifies agricultural areas with a high probability of experiencing drought or extreme drought. Ethiopia has developed its drought monitoring system (Fig. 6).

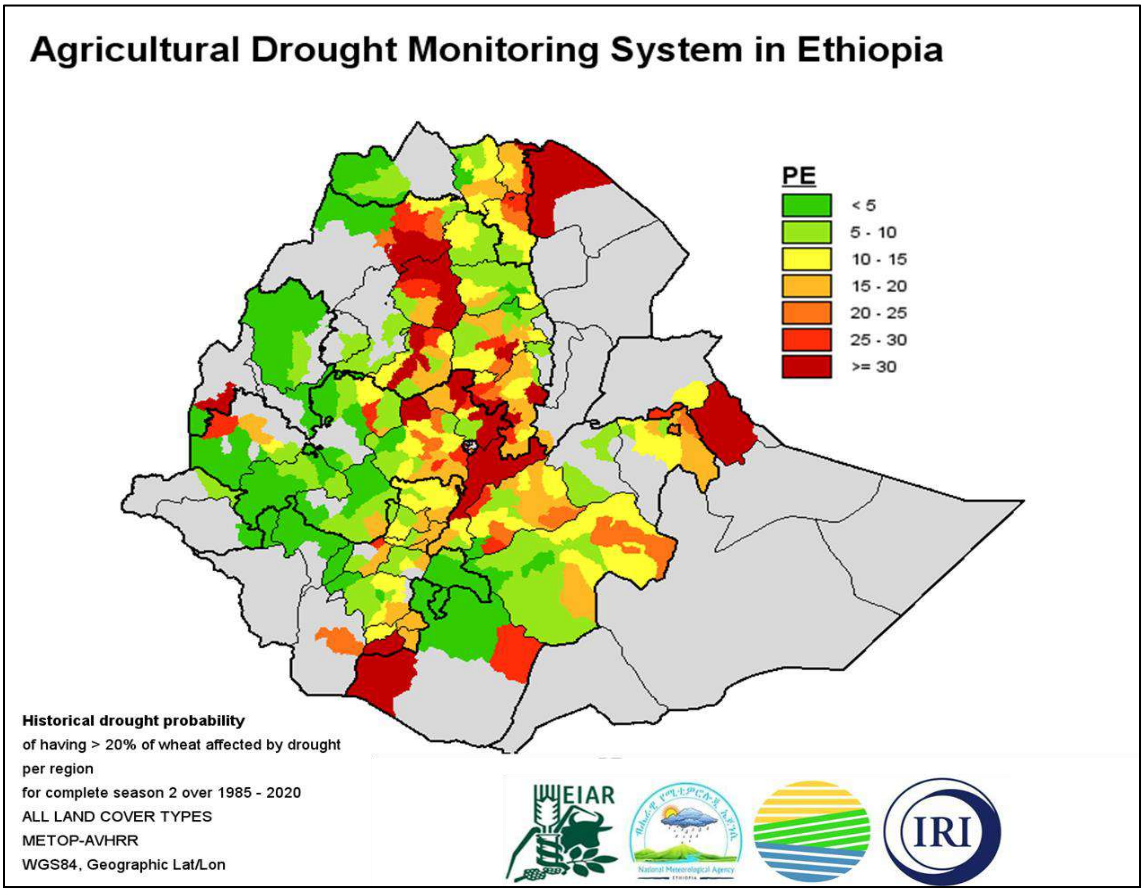


Figure 5: Historical Probability of Drought

Ethiopia's Agricultural Stress Index System (E-ASIS) is a standalone version of this system. It is calibrated to the Ethiopian context and made possible through the collaborative efforts of FAO and the Ethiopian Institute of Agricultural Research (EIAR). Government institutions manage the system. It is completely automated through the ASIS Web Application and monitors drought for agricultural purposes every 10 days at a spatial resolution of 1 km.

Country-level ASIS Applications

- monitoring and early warning system for agricultural droughts.
- trigger for implementation of mitigation activities, to be included in national drought plans.
- trigger for payment of indexed agricultural insurance.
- an independent variable to build yield forecast models.
- a tool for the probabilistic prediction of areas to be affected by drought.
- a tool for carrying out specific studies regarding the El Niño phenomenon, or to guide public investments in infrastructure intended to mitigate the impact that droughts may have on agriculture.

Climate-Agriculture Modelling Decision Support Tool

- SIMAGRI is a DST designed for climate-agriculture modelling. It is a multi-purpose tool used in historical and future modelling. The historical simulation developed scenarios based on:
  - to choose the optimum crop cultivar at a specific location
  - Optimal management options including planting date, fertilizer input use and application time
  - Enterprise budgeting estimation to make the farmer cost-effective-effective

Historical simulation is well suited for DA, Extension officers for training different management for farmers, TVET and Ag University to study the crop climate interaction for different management options.

Forecast simulation predicts location-specific climate forecast scenarios. It translates tercile climate prediction and predicts site-specific agricultural yield (Fig. 7). It is designed to support farm-level planning based on climate prediction, serve as an early warning mechanism, and estimate farm-level budgeting and return

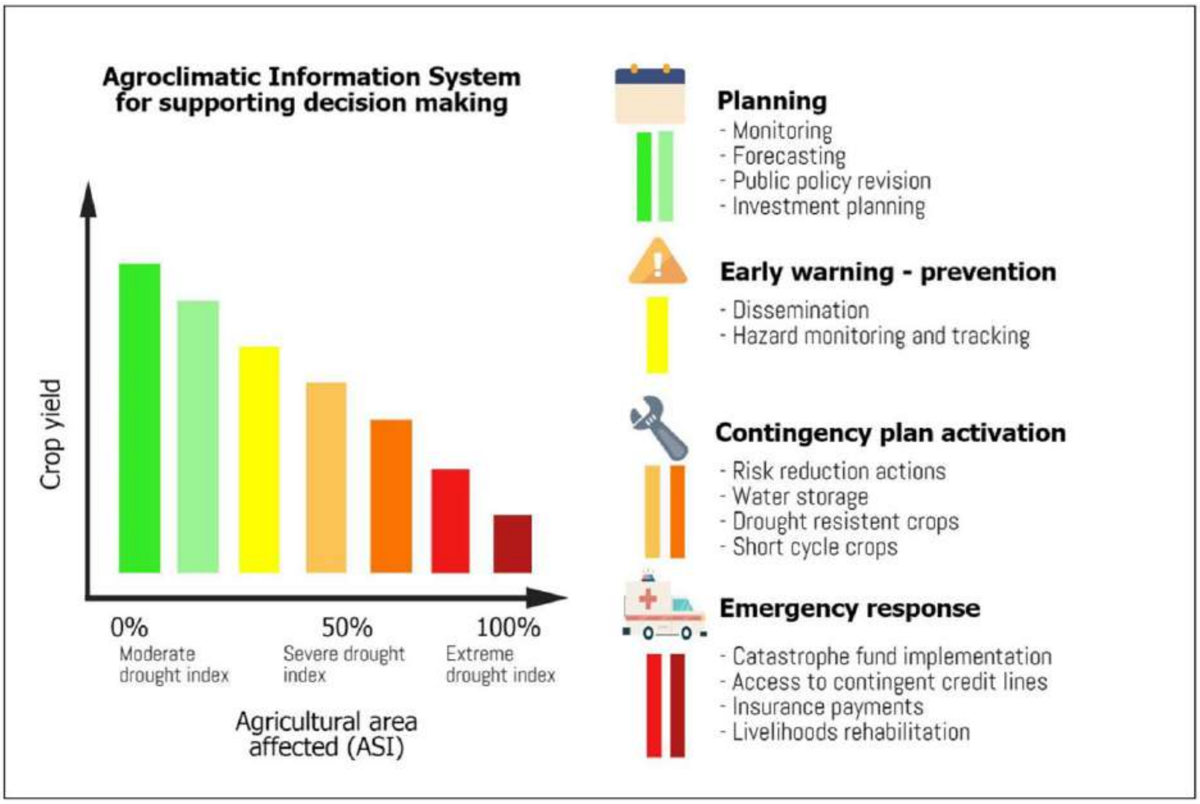


Figure 6: Early warning system for crop yield

The tool supports the decision-making of the producer or technical advisor. This facilitates discussion of optimal production strategies, risks of technology adoption, and evaluation of long-term effects by considering interactions of various variables. It predicts possible scenarios that are location-specific to enhance smart planning of annual crop production. It adopts crop simulation models included in the DSSAT to serve as discussion support tools for DA, Extension officers and farmers.

Integration Of Asis With The National Plan Of Drought: Wheat Rust Early Warning System

Wheat Rust is amongst the most damaging and important crop diseases. The ASIS provides early warning on wheat diseases and it's one of the first to focus on the disease (Fig. 8).

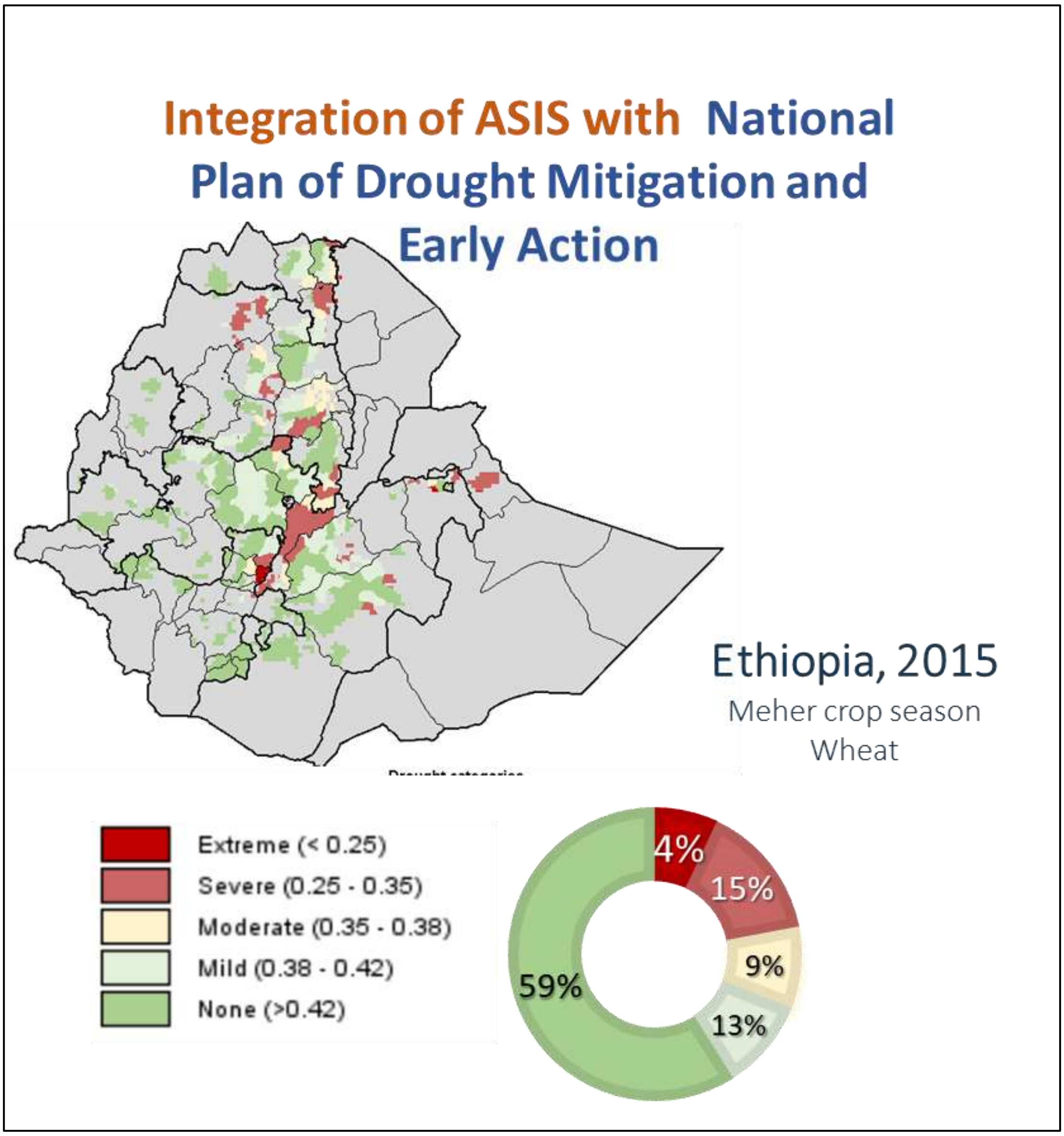


Figure 7

The system is based on the field survey and sampling of wheat rust. The early warning relies on Cambridge spore dispersion models and Met Office forecasts (Fig. 9). The EWS encompasses a sophisticated framework that integrates filed and mobile phone surveillance data, spore dispersal and disease, environmental suitability forecasting, as well as communication to policy-makers, advisors and smallholder farmers. The framework represents one of the first advanced crop diseases EWS implemented in a developing country.

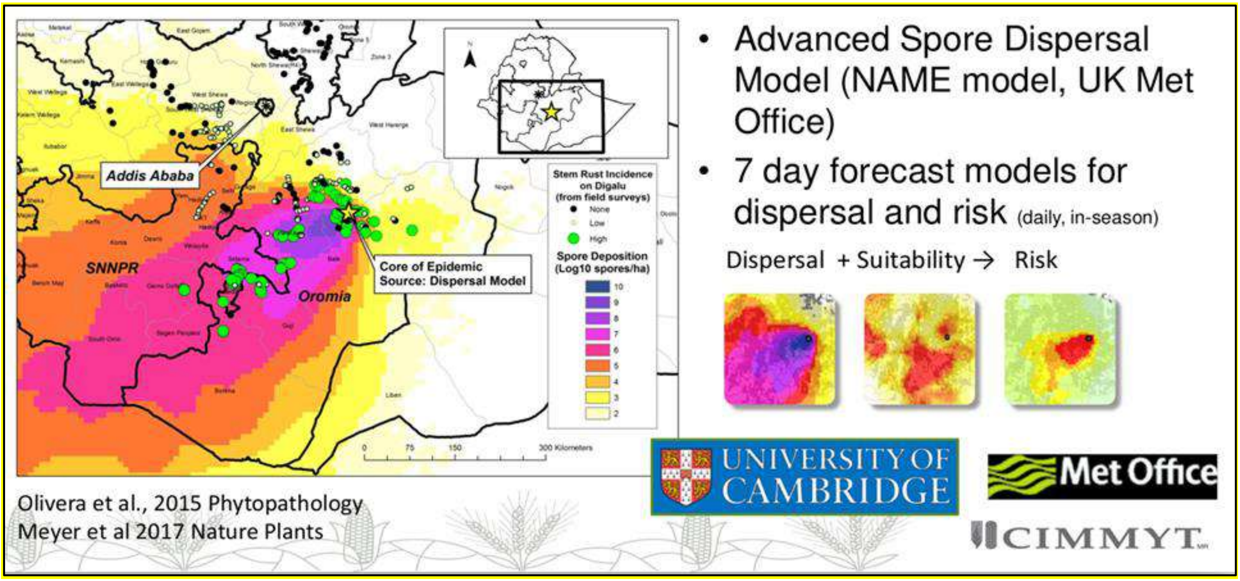


Figure 8: Spore dispersal and disease environmental suitability forecasting

Water Monitoring and Early Warning for pastoral system

EIAR (climate, geospatial, and biometrics research group) in collaboration with CIAT and USGS customized a livestock water monitoring system for Ethiopia. Provides water information to livestock producers and other stakeholders for drought risk planning, implementation, decision making and operational hydrologic model running for the waterholes from the EIAR system. Model output on waterhole water levels compared with the existing USGS outputs give good results. It is hosted locally and is to be published online.

Initially, server configuration and testing are done followed by source code assessment and analysis. This is followed by model initialization and Model calibration with the USGS model. Then the next step is database migration and water point viewer deployment. Develop scripts for automation of the model and RFE download. The system is tested and a field visit of ground-truthing of the water points is done. Further assessment is done before it is published online for the users.

Kenya Agro-Advisory Call Centre

The Kenya Agro-Advisory call centre at KALRO aims at enhancing access to quality climate/agro-weather, advisory, and market information services among farmers/herders for improved decision-making. It is implemented through three sub-components.

- *Improving Agro-meteorological Forecasting and Monitoring*

This sub-component is supporting the strengthening of agro-weather and climate information services, capacity building for agro-weather observation and forecasting, and development of the ability to operate and maintain agro-weather and market information services to help farmer/pastoralists decide on what, when, where, and how to embark on their farm activities.

- *Developing Integrated Weather and Market Information System*

This sub-component is supporting the development of analytical data ('big data') for strengthening market information systems and delivery of integrated weather and market advisory services using ICT as well as existing agricultural extension networks.

- *Building Technical and Institutional Capacity*

This sub-component is supporting institutional and technical capacity building of national and eligible county governments. Relevant autonomous agencies (KMD, KALRO), as well as the Agricultural Statistics Unit and Agricultural Insurance Units in the Ministry of Agriculture Livestock Fisheries and Cooperatives, will be beneficiaries.

Kenya Agro-advisory call centre enquiries revolve around livestock, crops, early warning, pest and diseases control and agro-weather advisory.

There is a need to combine the tools (ASIS, SAMAGRI and ARCE) used by other countries in ECA and share their experiences and if they are useful interaction is very important. Decision tools verse the prediction this has been missing in the analysis. How Ethiopia is like Kenya, but in Kenya, there are no services. Kenyan does not follow up on the information. Ethiopian systems are significant in Kenya because Kenya has devolved agriculture up to the Ward level. There is a need to see successful cases and bring board development partners to facilitate the process of demand-driven and know where to fund.

INTRODUCTION TO CO-PRODUCTION: (ICPAC)

Factors affecting agriculture

- Physical factors: Climate soil, topography
- Economic factors: Transport facilities, labour, capital (machinery, fertilizer, pesticides, high yielding seeds varieties) and policies
- Scientific factors
- Technological factors

Agricultural decisions and key policy concerns

- Agricultural productivity and incomes
- irrigation to reduce over-reliance on rain-fed agriculture
- Encouraging private-sector-led development
- food security and working towards the achievement of SDGs
- diversification into non-traditional agric commodities and value addition
- Ensuring environmental sustainability

Agricultural Decision making and policy implementation in highly variable weather and changing climate environment

PILLAR	QUESTIONS
Value chain	Which value chains will fit in various ecological zones? Will the value chains remain the same with the changing climate change and weather extremes? How can we ensure the resilience of live hoods
Farming practices	Which seed variety am I going to plant in the coming season? When to grow? How to grow? When to weed? When to apply fertilizer and pesticides? When to harvest? When and where to sell?

PILLAR	QUESTIONS
Fish production	Is it safe for me to go to the sea or lake to fish? Will I have enough catch? How is the season, is going to impact the in-land fisheries? With climate change and increased river water temperatures, will the fish continue surviving or breeding? What species are in the water?
Crop production	When to import fertilizer? When is the treasury going to release funds for fertilizers importation and buying farm produce? What are yield projections for this year? Are we going to import or export food? When are desert locusts landing in my country? Which value chains fits in different ecological zones in the face of changing climate? How will I manage production glut and post-harvest losses? How is the regional food security and nutrition? When to take early action or anticipatory action? How am I going to manage food and pasture-related conflicts and insecurity?
Pest management	When is the outbreak of African Armyworms, FMD and RVF? How should I manage Fall Armyworms? When should carry aerial sprays?
Livestock production	Will I have enough pasture and water for my livestock? Am I stock or destock? When are we going to have animal off-take? Am I going to search pasture and water for my animals in another region or country?

Key stakeholders struggle in isolation. When it comes to reducing climate risks, key stakeholders often lack the information to make sound decisions. This is because they are operationally disconnected due to break down of communication among themselves (Fig 10).

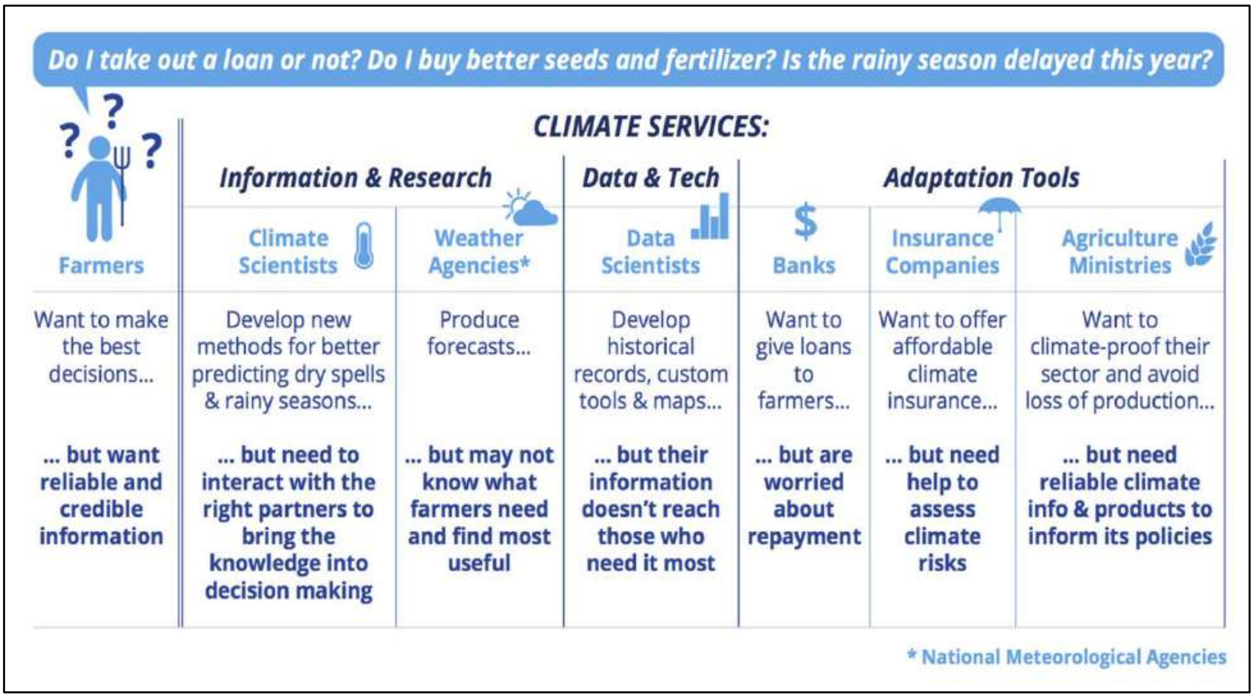


Figure 9: Decision-making and communication breakdown

A detailed schematic of the climate services value chain linking climate knowledge to stakeholders involved is shown below (Fig. 11).

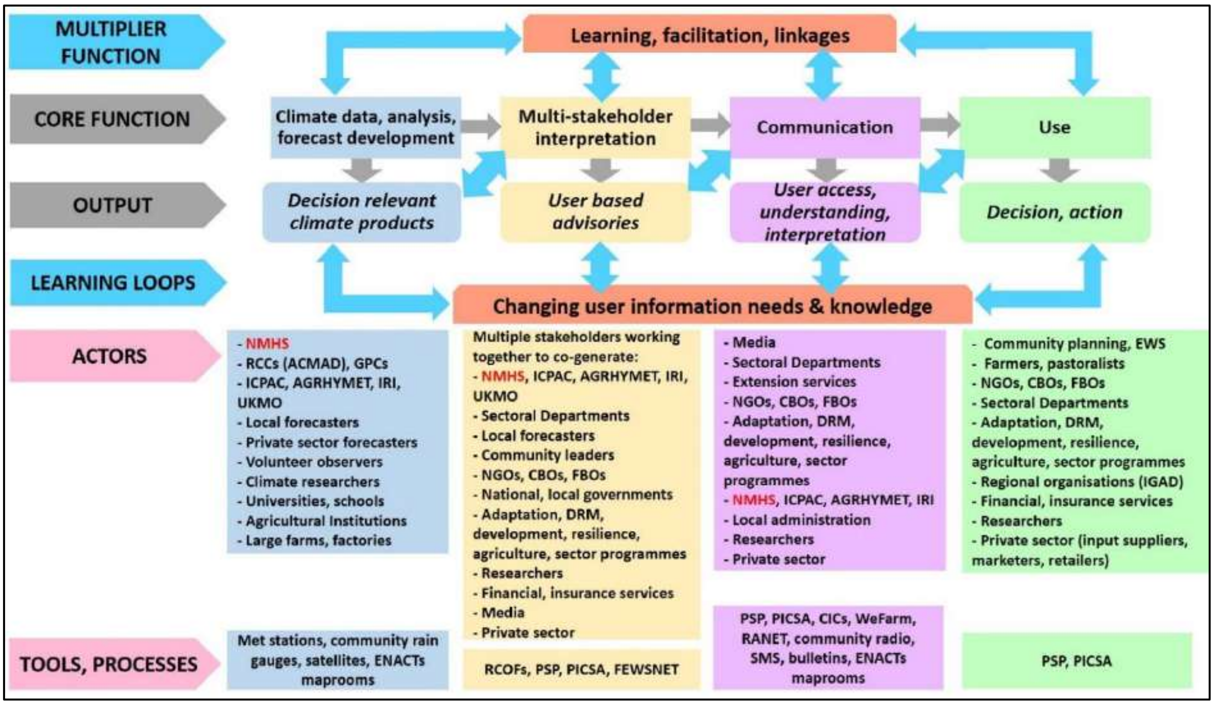


Figure 10: Climate knowledge linked to acting stakeholders

The value of climate information is realized when:

- Translated to scenarios that relate to local livelihoods, knowledge, and experience as well as levels of uncertainty.
- Listens and responds to locally expressed needs.
- Accessible to everyone who needs it (language, communication outreach).
- It recognizes the knowledge and capacity of users to:
  - Understand and adapt to the reality of long-term climate change
  - Understand and use forecasts and probabilities for decision making
  - Generate forecasts from local climate knowledge
  - Record and use climate data that contributes to localized/downscaled information

Trans disciplinarity

Transdisciplinarity is not a single form of knowledge. It is a dialogue of forms. Different disciplines and systems are part of the dialogue, as well as the multiple epistemic of cognition - understanding, conceptualizing, and causal explaining (Klein, 2002). Solving complex problems also requires combining scientific systems knowledge, societal target knowledge, and political transformation knowledge. Conceived as a practice-oriented approach, transdisciplinarity is not

Schematic of the climate services value chain structured around Porter’s value chain (Porter, 1985). Figure from Hewitt and Stone, 2021 confined to a closed circle of academic expertise. It broadens to incorporate stakeholders in the public and private domains

Co-production

In the 1970's social policy analysts recognized that users could make a difference in the quality of services they receive when involved in their design, development and delivery. When a group of people get together can influence the way services are designed, developed and delivered. Co-production is a process that not only concerns the generation of content or substance, but also how individual actors, groups, or organizations collaborate and organize knowledge (Brugnach *et al.* 2014). It can be applied in climate product, service and project design, development and delivery. Hence, the co-production of climate services is a deliberate, collaborative product-development work between climate scientists, or producers of climate data, practitioners, or users who require climate information, including potential or even 'imagined users' (Porter and Dessai, 2017). The approaches used, with guidance from the ten principles (Fig. 12), in co-production include:

- Identifying key actors and building partnerships.
- Building common ground.
- Co-exploring needs.
- Co-developing solutions.
- Co-delivering solutions.
- Evaluation

Ten principles for good co-production

Source: Carter, S., Steynor, A., Waagsaether, K., Vincent, K., and Visman, E. (2019) 'Co-production of African weather and climate services'. Manual, Cape Town: SouthSouthNorth (https://futureclimateafrica.org/coproduction-manual)

Figure 11: Principles of co-production

Co-producing climate services

Definitions

- Climate services are "climate information prepared and delivered to meet users' needs" (WMO, 2011)
- Climate services are "a process of providing climate information in a way that assists decision-making by individuals and organizations (GFCS)

Co-production of climate services is intended to transform climate information into client-tailored services-including forecast-based advisory services and decision-making that clients can make use of it. Climate services provide climate information to assist decision-making. Climate information is being used in decision-making and risk management worldwide. Therefore, there is a need to: respond to user needs, be based on scientifically credible information and expertise, and have appropriate engagement between the users and providers of the service.

User Interface Platforms (UIPs)

UIPs facilitate interactions to enable the climate service actors to come together to develop, deliver and use climate information in support of robust climate-sensitive decision-making. There is not one UIP – the methods and approach for engaging should be determined on a case-by-case basis. The term "platform" does not necessarily mean an application or website. A helpful dictionary definition of platform reads "a means or opportunity to communicate ideas or information to a group of people". Decision-making level and sectoral-based UIPs-CLIMSA are illustrated in Figure 13.

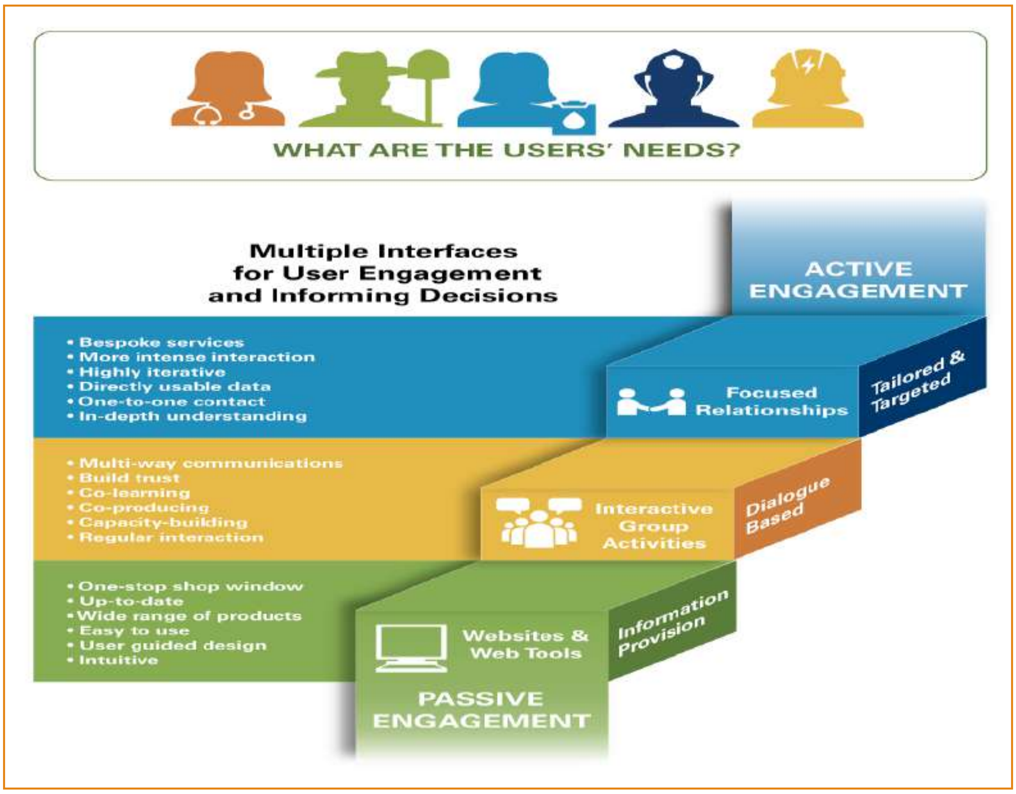


Figure 12: Types of UIPs used in decision making

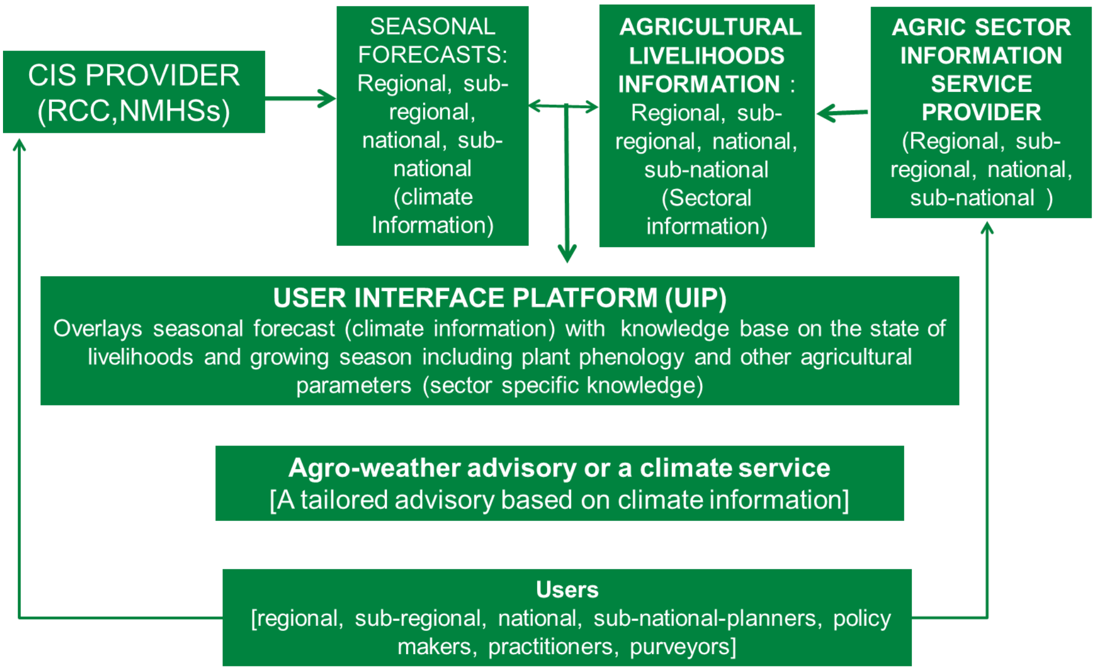
The benefits of UIPs are:

- Improve communication, coordination and collaboration
- Improve climate literacy through capacity building
- Build trust
- Identify and align the capabilities of the climate service providers with the needs of the users of the climate services
- Monitor and evaluate progress in developing and using climate services

Examples of decision-making UIPs

- Regional Climate Outlook Forums (RCOFs)-Great Horn of Africa (GHA) Climate Outlook Forums (GHACOFs)
- National Climate Outlook Forums (NCOFs)-Ethiopia, Kenya, Somalia
- Sub-National Climate Outlook Forums (SNCOFs)-County Climate Outlook Forums or Participatory Scenario Planning (PSP) workshops

Seasonal agro-weather advisory



Global, Regional and National Framework for Climate Services

Vision: enable society to manage better the risks and opportunities arising from climate variability and change, using science-based climate information. The priority areas are:

- Agriculture and food security
- Water management
- Health
- Disaster risk reduction
- Energy

GROUP DISCUSSION ON VARIOUS TOPICS RELATED TO CO-PRODUCTION (ILRI)

Group 1

Do climate information producers understand the decision-making contexts and actions of agricultural and food security value chain actors at all levels of operation? How?

Not necessary

a) The diversity of needs across Counties makes

b) The information producers give is very general perceived impacts on the agricultural sector, especially at the national level. At the County level, the climate information starts taking into account the value chain actors and their needs. The challenge is the lead time

c) Depending on the agro-ecology the information may be interpreted differently. Farmers at the valley bottom may be okay with depressed rains, and soil types matter etc – the need for community downscaling

The shortage of water, food, pasture, and fodder for both humans and livestock over the ASAL areas of the northeastern and parts of northwestern Kenya is expected to worsen owing to the poor performance of the March, April, and May rainfall.

Key next steps for ASARECA/ICPAC/National Governments/AICCRA – organized in collaboration with other stakeholders are:

a. High-level research policy meeting on climate information services – talk data, funding decisions and policy decisions

b. Document best practices of CIS and disseminate widely within the region – create learning platforms

c. Capacity building more stakeholders – on co-production to refine CIS

d. Create a common platform for sharing climate data and information

Group 2

Involving agricultural and food security value chain actors in the co-design, co-development and co-delivery of climate products and services

Kenya case

- The actors are only involved under project arrangements where there is sufficient facilitation

- Under normal circumstances climate services products. No structure engagement or dialogue with value chain actors (they only provide information) this is more supply driven rather than demand elicited
- Where such engagements exist then actors only provide feedback.

Ethiopian case

The climate task force from the Ministry of Agriculture, Ethiopian Meteorological Institute, Ethiopian Institute for Agriculture and Research, and National Disaster and Risk Commission (NRDC) will provide the climate service value chain.

Considerations for ASARECA going forward

- Support development in policy framework (both national and regional) for engagement of value chain actors and the climate service and products support to regional climate outlook forecast
- Establish platform(s) for both national and regional in co-design, co-development and co-delivery of the climate services
- Come up with framework awareness and capacity building for all actors in the generation and utilization of climate products and services
- Facilitate climate data and information among the member countries to enhance the quality of climate products and services (regional-national data integration, sharing and triangulation, casting and decision-making and feedback mechanism.

Group (3)

Breaking institutional and organization silos to transform climate information into climate services for the agriculture and food security sector

Example of Silos

1. KMO and Ethiopian Meteorological Institute (EMI)working on their own
2. KALO and EIAR doing research and reporting to the Ministry of Agriculture

How to Break the silos

1. Writing joint proposals and implementing projects jointly
2. Strengthen agrometeorology units with the NARIS – close linkages between Agroment units in Met-Agencies and NARIS. Note: Some of the NARIS have Agromet Department that needs to be resuscitated.

3. Networking and regular consultative stakeholders meetings. These periodic meetings between the Agromet experts and stakeholders with a focus on different themes
4. Operationalize the National Framework Climate Services(NFCS) like Kenya CSA multi-stakeholder platform
5. Sensitization (awareness creation) using the media (print and electronic)
6. Lobbying respective Directors of Institutions (Met Authorities, Agricultural Research Institutions

Recommendations

- ICPAC more capacity building to the national meteorological knowledge and skills in Ministry of Agriculture: Get more closely involved and strengthen the provision of agro advisories
- National Government s (i) Provide sufficient funding to the Meteorology units and experts at the national and sub-national levels (2) provide enabling policy environment for transforming climate information including quality control
- AICCRA: Continue with strategic networking to raise more donor funds for advancing NFCS.

CONCLUDING REMARKS AND RECOMMENDATIONS

Lessons learnt by the attending stakeholders and way forward:

Farmer stakeholder

1. The workshop has given the farmer hands-on skill that will be utilized in farming.
2. Disseminate knowledge to other farmers on climate information data.
3. Farmers ought to make informed decisions

Ministry of Agriculture

1. The workshop was a good learning session on climate foresight data.
2. Plan with relevant authorities and they make a plan of action toward climate foresight data.
3. There is a need to come out with an institutional framework for climate data information.
4. Capacity building is needed to be catered to the annual work plans and budget
5. Formation of a platform on climate foresight data and linking stakeholders to them.
6. develop guidelines to implement the climate data information

ASARECA Stakeholder

1. Ensuring climate data information is accurate for farmers to make precise decisions on farming activities.
2. The workshop was an informed training on climate information.
3. There should be further training on the agricultural value chain in future.
4. There is a need to think about the future and how to advise the farmers on both livestock and agriculture and mainstream agricultural climate change information.

Recommendations on the application of climate foresight data in enhancing agricultural policy and decision-making

The following recommendations on the application of climate foresight data in enhancing agricultural policy and decision-making were realized.

- **Convene high-level dialogue:** Convene a high-level research policy meeting on climate information to talk about data, funding decisions and policy decisions.

- **Document best practices:** Document best practices on CIS and disseminate them widely within the region
- **Capacity strengthening**: Build a critical mass of experts, suppliers and users of climate-smart information to inform location-specific smart planning at the policy level, provide accurate advice at the simulation level, inform extension support, and accurate decision-making and investments at the farm level for both livestock and crop production. Capacity building of more stakeholders on co-production to refine CIS. Come up with frameworks for awareness and capacity building for all actors in the generation and utilisation of climate products and services
- **Collaboration:** Continue to promote partnership and collaboration through ASARECA as a reputable regional organisation which supports a smooth delivery of international interventions to the national agricultural system. This collaboration should focus on catalysing coordinated and speedy achievement of early warning impacts as well as work towards reducing the accuracy gaps.
- **Integration of and leveraging on existing systems:** Through the ASARECA network, and taking advantage of the AICCRA project, there is a need to continue to integrate already established agro metrological systems developed in Kenya, Ethiopia, and by international institutions to provide better solutions for all countries in Eastern and Central Africa.
- **Investment in downscaling agro-metrological information**: Spatial considerations are important in determining the accuracy of agro-metrological data. It is therefore important for the national systems to continue to prioritize investment in building capacity for downscaling metrological data from regional to national to zonal and to community levels.
- **Private sector role**: Borrowing from Ethiopia, there is a need to mainstream the private sector to support the delivery of agro-metrological data.
- **Investment in feedback mechanisms:** There is a need to invest in feedback mechanisms for agro metrological information to ensure farmers get what they need as well as provide views and information for improvement.
- **Mainstreaming Indigenous knowledge:** Research, extension and simulation experts should continue to mainstream indigenous knowledge to complement the technical simulations and geospatial information to reduce the accuracy gap in grommets information. This calls for the maintenance of databases of indigenous experts who should be consulted at relevant times.
- **Co-production and co-development of interventions and information:** Establish platforms for both national and regional in co-design and co-delivery of climate services. There is a

need to encourage co-production or joint production of metrological and early warning data to ensure it is well-informed by stakeholders and that it addresses the needs of users. Co-production supports decision-makers to be in the know and meets the needs of end users.

- **Promote User Interface Platforms (UIPs):** There is a need to promote the use of User Interface Platforms (UIPs) to facilitate interactions to enable climate service actors to come together, learn, and improve communication, coordination and collaboration. Create CIS platforms for learning and for sharing climate data information
- **Participation in Key Early warning forums**: ASARECA and other regional partners should support key stakeholders including farmers to participate in the Great Horn of Africa Climate Smart Agriculture conference in August in Mombasa, and other such forums.
- **Develop policy framework for CIS:** Promote the development of policy framework both national and regional for engagement of value chain actors and the climatic services and products, support to regional climate outlook forum.
- **Ministries of agriculture:** Get more involved in strengthening the provision of agro advisories.
- **National Governments:** Provide sufficient funding to the metrological units and experts at national and subnational levels; provide enabling policy environment for transforming climate information.
- **AICCRA/ASARECA:** Continue with strategic networking to raise more donor funds for advancing NFCs.

ANNEX 1: WORKSHOP PROGRAM

PROGRAM

TRAINING ON APPLICATION OF CLIMATE FORESIGHT DATA IN ENHANCING AGRICULTURAL POLICY IMPLEMENTATION AND DECISION MAKING IN EASTERN AND CENTRAL AFRICA

Nairobi, Kenya

Date: 23rd – 24th June, 2022

DAY 1: 21/06/2022: RELEVANCE OF CLIMATE FORESIGHT IN AGRICULTURAL DECISION MAKING & POLICY IMPLEMENTATION		
Time (EAT)	Session	Responsible
08:00 – 08:30	Arrival & registration	Ms. Racheal Namuzibwa
08:30 – 09:00	Self introductions	Mr. Ben Ilakut
09:00 – 09:20	Review and adoption of the programme, objectives and expected outputs	Ms. Julian Barungi
09:20 – 09:40	Welcome remarks, statement from ASARECA Executive Director & Official opening	Mr. Moses Odeke (Representative of ASARECA ED)
09:40 – 10:00	Presentation on the AICCRA Project	Dr. Solomon Dawit
10:00 – 10:30	Highlights on climate services in East Africa	ICPAC
10:30 – 11:00	Tea/Coffee Break & Group photo	Hotel
11:00 – 11:30	Presentation on climate foresight, foresight data and its importance in agricultural decision making at farm level	Dr. Teferi Demissie
11:30 – 12:00	Presentation on the regional seasonal forecast based on the recently released JJAS 2022 seasonal outlook	ICPAC/KMD/EMI
12:00 – 12:30	Farmer experiences, challenges and needs in using climate foresight data in agricultural decision making at farm level	Farmer Representative (Kenya) Farmer Representative (Ethiopia)
12:30 – 13:00	Q&A Session	ASARECA

13:00 – 14:00	Lunch Break	**Hotel**
14:00 – 14:30	◎ Presentation on customized agro-climate advisory to smallholder farmers through digital platforms in Ethiopia - Lessons from Lersha	Mr. Abrhame Endrias
14:30 – 15:00	Experiences, challenges and needs of Policy Makers in using climate foresight data in agricultural policy implementation	Director of Agricultural Policy and Planning, Kenya Director of Agricultural Policy and Planning, Ethiopia
15:00-16:00	Group discussion on access, interpretation, communication and useability of the climate foresight data	ILRI
16:00 – 17:00	Presentation of the group discussion	ILRI
16:40 – 17:10	Tea/Coffee	**Hotel**
	End of Day 1	
DAY 2: 22/06/2022: ENHANCING CAPACITY IN INTERPRETATION AND ANALYSIS OF CLIMATE FORESIGHT DATA		
08:00 – 08:30	Arrival & registration	Ms. Racheal Namuzibwa
08:30 – 09:00	RECAP for Day 1	TBD
09:00 – 09:45	Presentation on use of climate information services and digital agro-advisories in National Agricultural Extension Systems	Director of Agricultural Advisory Services, Kenya Directorate of Extension Services, Ministry of Agriculture, Ethiopia
09:45 – 10:30	Introduction to co-production	ICPAC
10:30 – 11:00	Tea/Coffee Break	**Hotel**
11:00 – 12:30	Group discussion on various topics related to co-production	ILRI
12:30 – 13:30	Lunch Break	**Hotel**

13:30 – 14:30	**Presentations from the thematic discussion**	ILRI
14:30 – 15:30	**Wrap up discussions and timelines (next steps)**	Dr. Teferi Demissie
15:30 – 16:00	Concluding remarks	Mr. Moses Odeke
16:00 – 16:30	**Tea/Coffee Break**	**Hotel**
	End of Day 2	

ANNEX 2: WORKSHOP PARTICIPANTS

#	Name	INSTITUTION
1	Abraham Gudini	Addis Ababa
2	Allan Wanyiri	ASARECA
3	Amah Woyema Gemmedo	ETHIOPIA
4	Benjamin Kwinga	Kiwingu Famers- Kitui, Kenya
5	Calistus Wachana	ICPAC
6	Carolyne Minayo	KALRO
7	Dawit Solomon	ILRI
8	Eunice Koech	ICPAC
9	Evans Ilatsia	KALRO
10	Fekadu Tilahun	Addis Ababa
11	Germame Garuma	MoA
12	Gilbert Cheruiyot	Biomet
13	Helena Shilomboneleni	ILRI
14	Ilakut Ben	ASARECA
15	Japheth Otieno Migoro	KMD
16	Joab Osumba	ILRI
17	John Recha	ILRI
18	Josephine Ogosi	MOACF&C

19	Julian Barungi	ASARECA
20	Kizito Kwera	KALRO
21	Lazarus Musyimi	FARMER
22	Leah Seurat	Trans- Nzoia
23	Likumh Gebre	EIHR
24	Liyomn Gebre	EJAF
25	Mary Mueni Samson	FARMER
26	Meshack Makokha	NALFC
27	Michael Okoth	KALRO
28	Moses Odere	ASARECA
29	Nathan M Maweu	KALRO
30	Nicholas Waitathu	People Daily MediaMax
31	Rachael N. Musisi	ASARECA
32	Samuel Chegutu Tirgey	NAROK
33	Stella Makokha	KALRO
34	Stephen Kithuku	ICPAC
35	Teferi Demise	ILRI
36	Tamirat Bekele	ILRI
37	Wangari Ndirangu	Media (WANGARI)
38	Wilbert Akech Cheruiyot	Kenya
39	Willington Mulinge	KALRO