FACING UNCERTAINTY: the value of climate information for adaptation, risk reduction and resilience in Africa

care

A sand storm in Kouggou village, Niger.
Photo by Marie Mornimart, 2014.

ACKNOWLEDGMENTS

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Foreword

Climate variability and change are bringing new and increasing risks and uncertainty about the future. In Sub-Saharan Africa, the impacts are already being felt and are adding another layer of difficulty for achieving productive and secure livelihoods among the most vulnerable people as well as threatening development more broadly. However, climate change also presents opportunities which are rarely recognized and taken advantage of. This is because climate change is not just about hazards and risks, but changes can also be positive, for example areas that were too cold for most common crops to be grown now getting warm enough to grow more. It is for people to explore what opportunities the change brings.

A major challenge for assessing climate risks, opportunities and impacts is the poor or lack of access to and understanding of climate information. Climate information from meteorological services is often viewed as overly scientific and uncertain, whereas information from local knowledge is not widely appreciated. While uncertainty of the future will always exist, and is recognized and worked with in sectors such as business and insurance, uncertainty in climate information is not well understood and as such people tend to push climate science aside with the assumption that it tends to be wrong. Yet uncertainty is not a problem to be solved; it can be understood, managed and used to inform decisions and plans.

This learning paper presents insights into why climate information is a valuable resource for effective decision-making and planning for disaster risk reduction, adaptation and resilience in the face of uncertainty. The paper also offers practical ways in which climate information and communication can be integrated into planning processes, projects and programmes, with a strong focus on working with meteorological services. As a member of the Kenya Meteorological Service (KMS), integration of climate information services in adaptation has created an avenue for directly interacting with users and improving the presentation and understanding of climate information generated by KMS. This has significantly increased our profile at subnational (county) level and contributed to the integration of adaptation into government services in the agriculture and livestock sectors. It is my hope that actors concerned with climate change across Africa will benefit from the information presented in this document and use it to catalyse effective adaptation and resilience to climate variability and change, especially for the most vulnerable populations.

August, 2014

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THE ADAPTATION LEARNING PROGRAMME FOR AFRICA

The Adaptation Learning Programme for Africa (ALP), implemented by CARE International, is a five year programme operational in Ghana, Kenya, Mozambique and Niger. The Programme aims to increase the capacity of vulnerable households in Sub-Saharan Africa to adapt to climate variability and change, through incorporating community-based adaptation (CBA) approaches for vulnerable communities into development policies and programmes in its countries of operation, with plans in place to replicate across Africa.

Facing uncertainty: The value of climate information for adaptation, risk reduction and resilience in Africa

Climate change is not only a concern for the future. Ongoing and visible changes in temperature and rainfall patterns and increased frequency, severity and unpredictability of extremes in weather and climate are already having devastating impacts on productivity, economies and above all, on the livelihoods of the world's poorest and most vulnerable. Added to these, longer term, slow onset impacts from rising temperatures and sea levels threaten development and economic growth at local, national, regional and international levels. In response, efforts to support adaptation to climate change, disaster risk reduction and a focus on resilience have become mainstream features of development assistance. Demand for and investment in adaptation programmes and policies are increasing across Africa, where some of the worst climate induced impacts are felt. Climate scientists are responding to the new demands with development of more information products on the past, current and future climate and with greater openness about the limitations and associated uncertainties in the climate information they produce.

This document explains why and how climate information is a valuable resource for rural communities and those working with them in confronting climate variability and change. It is based on lessons from the Adaptation Learning Programme (ALP), implemented by CARE International, together with the national meteorological services in Ghana, Kenya and Niger. The document will help those working in adaptation, agriculture, sustainable development, disaster risk reduction (DRR), resilience and other climate-sensitive sectors to connect with and use meteorological services and other sources of climate information. It demonstrates how climate information can inform decision making, planning and policy development in these areas and ensure results are climate resilient.

KEY MESSAGES

Climate information is a valuable resource for **decision-making** and **planning** for **adaptation** and **resilience**

Uncertainty is not a problem to be solved; it can be understood, managed and used to inform **adaptation** decisions, **early warning** and **risk management**

Climate information is useful when **different knowledge sources** are **combined** and **'translated'** to relate to local livelihoods, contexts and experiences

Long-term **resilient development** will depend on **climate information services** that are **accessible** and **relevant** to those who need it

Effective communication is essential is **making climate information useable** in different contexts

Enabling national and local **plans, policies** and **investment** are needed to support the realization of effective **climate information services**

WHAT IS CLIMATE INFORMATION?

Climate information is information about past, present and future climate conditions from both local and scientific sources, and the resultant implications on development, people's livelihoods and the environment.

'Past' or 'historical' climate information from meteorologists refers to data on weather elements collected using instruments such as rain gauges, thermometers and barometers among other instruments. The data is analysed to create a picture of patterns and trends in weather and climate at different time scales such as year-to-year rainfall variations and temperature trends (see figure 1 and 2).

'Past' climate information from local sources is based on memories of previous seasonal patterns and changes observed by different groups and communities. The combination of both meteorological and local sources of information helps us to draw a picture of past climate variability patterns and possible trends in the variations. This analysis also shows past instances of climate extremes and can identify trends in frequency of occurrence of climate extremes.

'Present' climate information is data on weather elements – such as millimetres of rainfall – recorded in real time.

'Future' climate information gives predictions of the possible future state of the weather and climate at different time scales. Forecasts predict the state of weather and climate variables such as rainfall, clouds, winds, and temperature over a day to several seasons and years into the future. These forecasts are generated from global indicators such as sea surface temperatures (SSTs; see figure 3) and presented by meteorological services over different spatial scales such as sub-national, national (see figure 4) to regional scales.

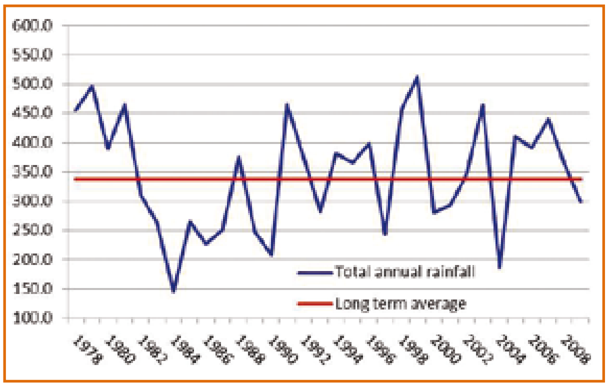


FIGURE 1: Year-to-year variation of total annual rainfall from the long term average in Maradi, Niger.

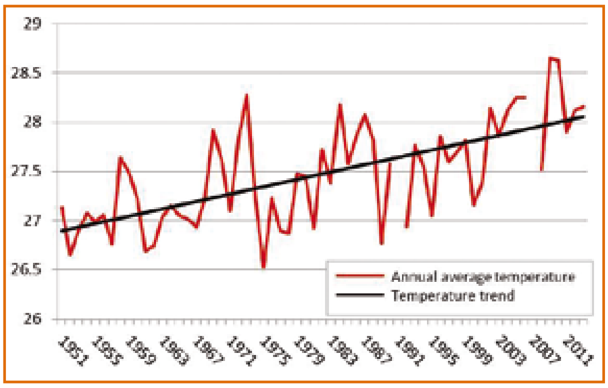


FIGURE 2: Trend of annual average temperature in Maradi, Niger.

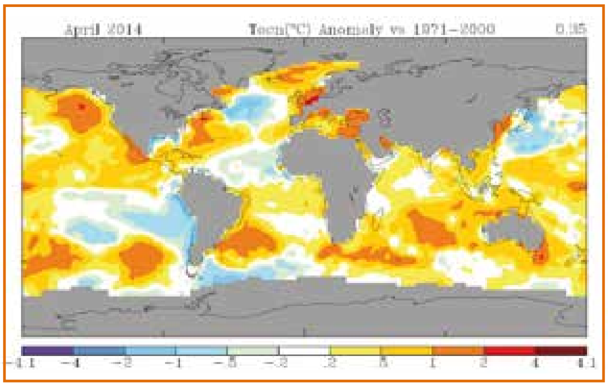


FIGURE 3: A map showing the difference from average conditions of sea surface temperature (SST) in June 2014. *Source: The NASA Goddard Institute for Space Studies (GISS)*[i]

SSTs give the water temperature for the upper few meters of the oceans. Ocean temperatures vary slowly such that significant differences from average ocean temperature (i.e. anomalies) are likely to persist into several months, during which they influence variations in the climate of large regions such as Eastern and West Africa. SSTs therefore provide a measurable indicator that is used in forecasting how regional climates may vary from average conditions in a month, a season to years in the future.

Climate projections give longer term predictions of how the climate may change in the near term (out to about 2035) and long term (out to 2100 and beyond) across countries, regions, continents and the world. Climate projections are developed by considering different scenarios of greenhouse gas (GHG) emissions. GHG emissions are linked to human activities such as burning of petroleum products, activities which the IPCC Fifth Assessment Report states are the "extremely likely" cause of the observed warming from 1951 to 2010. When projecting future climate change, consideration of different GHG emission scenarios is important because it is uncertain how much will be emitted in the future due to uncertainty in future population sizes, technology development and uptake, economic development, emission mitigation policies and strategies, among other factors. The response of the climate to GHG emissions is then simulated by running several climate models under each emissions scenario, producing multiple projections of change into the future (see figure 5). These projections explore a wide range of possible future climate changes and therefore allow the consideration of a wider scope of potential impacts.

'Future' climate information also refers to local knowledge which gives forecasts from a season to a few years ahead, often at village or ward level. Local forecasters use a range of observable environmental indicators – such as the behaviour of trees, animals and wind patterns – and make judgments based on tradition, experience and comparison of indicators with historical memory of climatic occurrences.

Climate forecasts and projections are useful in giving an indication of what the future climate may look like but as they are about the future, they must be understood together with information on the uncertainty and probability of whether they will happen.

Climate information is most useful when it is produced and understood as a result of dialogue between climate scientists, local expert forecasters, intermediaries who provide related support services and users such as farmers, pastoralists, project and programme staff, government planners, businesses and others who benefit from climate information.

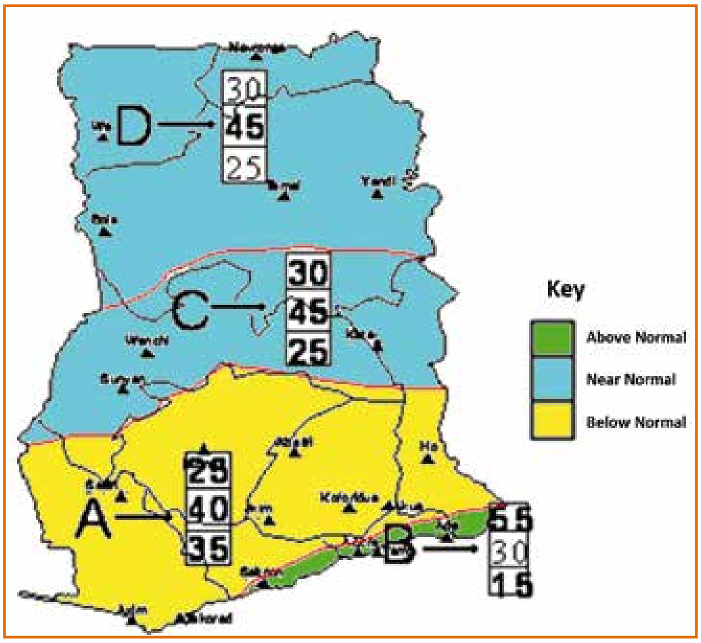


FIGURE 4: An example of a seasonal rainfall forecast map produced by the Ghana Meteorological Agency (GMET) for the 2013 rainfall season in Ghana. The map presents probabilities for different areas getting more than average, average and less than average rainfall in the season.

WEATHER: is the day-to-day state of atmospheric variables such as temperature, rainfall, wind, cloudiness and humidity in a given place. Weather is what is happening now, or is likely to happen tomorrow or in the very near future (i.e. from minutes to days ahead).

CLIMATE: is "what you expect and weather is what you get". Climate is the average weather for a given place. It defines typical weather conditions for an area based on averages over at least 30 years in the past. For example, Northern Kenya is expected to be hot and dry in January and February while cold in June, July and August; however, there may be year-to-year deviations from this.

CLIMATE VARIABILITY: is the deviation of a climatic variable, such as rainfall and temperature, from its long-term average in a specific location.

FIGURE 5: An example of temperature projections for Africa. *Source: IPCC (2013). Climate Change 2013: The Physical Science Basis*[ii]

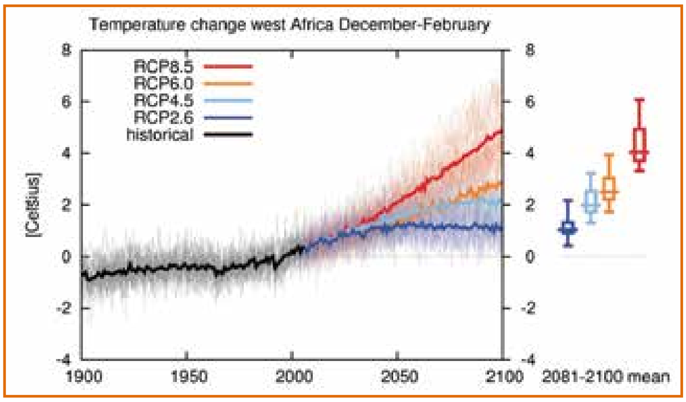


FIGURE 5A: The graph presents temperature change during December to February in West Africa. The thick black line shows temperature change that has been observed between 1901 and 2012. The thin coloured lines are temperature projections between 2013 and 2100 from different climate models under different GHG emission scenarios. The thick coloured lines present the projected temperature change as an average of all climate model outputs in each GHG emission scenario.

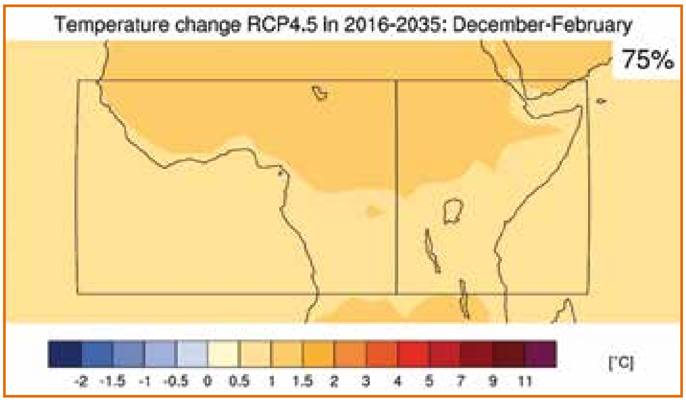


FIGURE 5B: The map presents the projected temperature change over West and East Africa. It shows that between 2016 and 2035, temperature may increase by 0.5° to 1°C in the southern parts and 1° to 1.5°C in the northern parts of the two regions during December to February.

WHY DO WE NEED CLIMATE INFORMATION?

Climate information is a valuable resource for decision-making and planning for adaptation and resilience.

Climate information is key to understanding climate as a major influence on lives, livelihoods, resources, ecosystems and development. It provides a way of analysing the nature and scale of impacts due to past and current climate and the potential future impacts as the climate continues to vary and change. Actors can then make informed and appropriate decisions and plans to deal with climate-related impacts through adaptation, risk reduction and development actions.

Climate information is also a valuable resource for confronting and living with an increasingly uncertain future. It provides a basis on which people whose livelihoods are affected by climate can make forward-looking and flexible plans that are adapted to a range of climate possibilities. Consequently, climate information allows us to move from strategies which react to conditions as or after they occur, to those which seek to build resilience under all possible conditions and ultimately, to proactive strategies informed by forecasts and forecast probabilities. Effective adaptation involves developing a range of adaptation options with flexibility to switch from one strategy to another or to combine options as a way of spreading climate risk. Climate information supports decision making on which option to invest in, when and how much to invest. Flexible and proactive planning enabled by climate information helps vulnerable communities, service providers and intermediaries to continuously adjust their plans as climatic stresses and shocks unfold, as well as to maximise on opportunities. This capacity results in resilience to a continually variable and changing climate.

INTERMEDIARIES: are people who link producers and users of climate information. They work directly with users and are in a position to effectively communicate climate information to them.

Piku reading a rain gauge in Farfar community, Northern Ghana. Photo by Erin Hall, 2012.

BOX 1: COMMUNITY GENERATED CLIMATE INFORMATION SUPPORTING CLIMATE RESILIENT LIVELIHOODS AND DISASTER RISK REDUCTION IN NIGER

In Dakoro district, Niger, the district meteorological services installed rain gauges in locations where ALP is implementing Community-Based Adaptation. As soon as it rains, trained community monitors record the previous 24 hours' rainfall and use mobile phones to communicate the data to the Dakoro district meteorological services and their community. The meteorological services then analyse the rainfall data and transmit the resultant information to community radio stations as well as national radio for wider dissemination.

In an area that gets just one rainfall season a year – averaging only 330mm – and which communities depend on to sustain their livelihoods, a local record and timeliness of rainfall information is especially critical. Through the rainfall monitoring and communication system, communities can now know the amount of rainfall immediately after downpours and also have an opportunity to ask for the specific climate information they need. This allows for communication of rainfall information at a time when it is needed for decision-making. The information has given communities confidence in choosing when best to plant and which crops and varieties, depending on whether a certain rainfall threshold has been reached. These thresholds are determined by agriculture experts together with the communities; an exercise which also raises awareness of the interaction between rainfall amount and people's livelihoods. This is resulting in a reduced rate of seed loss (due to multiple replanting) and improved harvests.

Local rainfall data recorded by communities in Dakoro also supports community systems for early warning and emergency response. The data aids in determining and monitoring 4 levels of alert (i.e. normal, warning, alarm and emergency) and in developing appropriate responses for each alert level. The information feeds into the sub-regional committee on prevention and management of food crises - through vulnerability monitoring observatories located at community level - to support DRR and early warning at local, regional and national levels.

Rainfall information collected through community monitored rain gauges complements local weather and climate knowledge. By comparing rain gauge data with information presented by local forecasting experts – such as good rainfall as described in the local context and the amount of rainfall in millimetres – a better understanding of both sets of information is gained. This in turn provides a wider range of information that is useful for decision-making and planning.

Over the long term, the rainfall information will provide a historical record that can help downscale national forecasts to local levels. Given that producing an entirely accurate forecast is a challenge, there is much potential for the use of historical and daily rainfall data. Continuous real-time climate monitoring coupled with effective communication, can help communities in Dakoro identify changes in: climate and weather patterns, timing and magnitudes of high impact weather-related events and provide information on which to base their adaptation strategies.

MAKING CLIMATE INFORMATION USEFUL

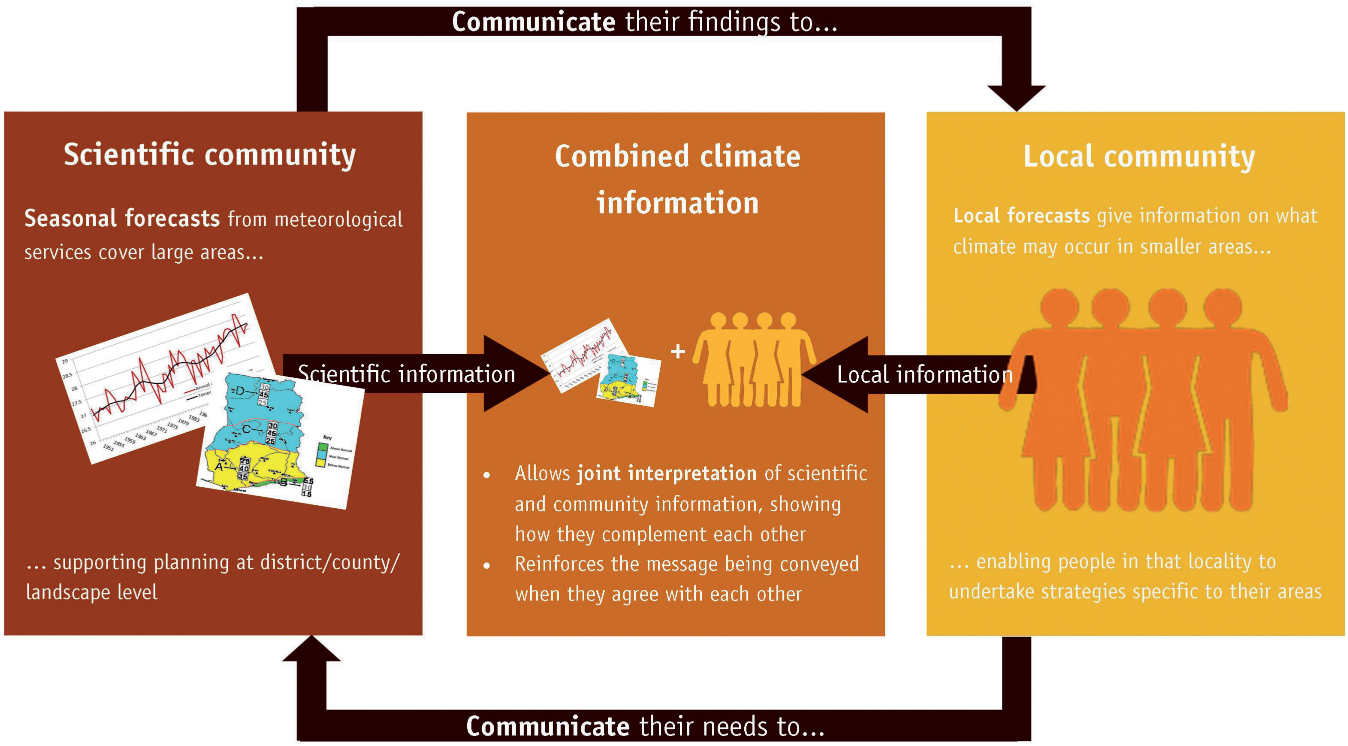
Climate information is useful when different knowledge sources are combined and 'translated' to relate to local livelihoods, contexts and experience.

Scientific climate information is produced by a range of sources such as meteorological services, universities and scientific research programs. Climate products from meteorological services can be accessed through their websites, radio and television. Users can also request for specific information, which may be available depending on the capacity of meteorological services and usually at cost. A big challenge with scientific climate information in Africa is the inadequate number of stations for data recording. This affects the historical analysis of climate in many places and the ability to develop forecasts at local levels.

Local knowledge is equally broad, with community members of different ages, genders, social roles and responsibilities bringing different knowledge and experience to the table, adding to information from local expert forecasters. Local knowledge provides greater understanding of the environment by adding a local spatial scale and presenting information at a time scale that is closer to the present, while contributing to the body of knowledge on past and future climate in a local context. However, there are concerns that its actual application is limited, it is often inappropriately applied and the baselines used may be changing in the context of climate change, expanding populations and other environmental pressures.

Translation of past, present and future information from the different sources into a form which can be understood is critical to creating climate information that is useful for decision making and planning at a given time and spatial scales. Translation works best when it involves the climate affected communities, the different service and support providers who work with them (intermediaries) – such as in agriculture, water, livestock etc. – local forecasters and meteorological services. Time spent collectively interpreting and combining climate information from both scientific and local sources is the first step in participatory translation or downscaling of the information. Combining the information involves co-exploration to find out and understand what is available from different sources, highlighting any existing gaps in the information and barriers to understanding and using the information (see table 1 for an example of exploring and understanding scientific climate information).

FIGURE 6: Benefits of combining local and scientific climate information.



> "The tragic irony is that Africa uses less rainfall data than almost anywhere else in the world and African climate data is much more difficult to get than anywhere else in the world, but…climate change, climate variability, population dynamics, changing land use patterns all make it imperative for Africa to find ways of using more climate information as a basis for informed decision making and climate change adaptation."
> **From the Rainwatch - AfClix Early Warning Workshop in Ghana, June 2014**

TABLE 1: Disconnect between climate science and decision-makers (reproduced from Boyd and Cornforth, 2013)

CLIMATE SCIENCE PRODUCES	GAP	DECISION-MAKERS NEED
Research findings without making the tools used accessible to others	Technology transfer	Tools and frameworks to quantify the impacts of climate change on specific local development projects in metrics relevant to specific sectors e.g. crop production, cost of disasters, risks for infrastructure
General climate publications normally written for the research community or policy-makers with little guidance about which sources are credible	Language gap	Targeted information for specific projects or development sectors from recognized climate experts
Output at global or regional scale	Spatial scales	Local climate information – development projects generally have a spatial scale of a few kilometres in location, and have microclimates
Long-term projections of climate or current/historical climate analysis	Mismatched temporal scales	Many communities need help to cope with current climate variability before they can adapt to future climate
Research often independent of social science research exploring perceptions and societal impact	Interpretation	Ability to evaluate local knowledge relative to local climate analysis of data
Simplified assumptions of non-climatic contexts in many climate impact studies	Limited practical application	Context-specific (e.g. culture, markets, natural resources, politics, community choice) comparison of the climatic impact of different management strategies
Specialized findings in specific fields of research across many different research centres	Multidisciplinary and cross-sectorial research	Advice on current climate variability, long-term climate change, societal impact of climate perceptions, local sectorial impact (e.g. agriculture, health, infrastructure)

Source: Internal discussion at the Walker Institute for Climate System Research with Carlos Barahona, Peter Cooper, Helen Greatrex and Maria Noguer, November 2011.

The process of combining the two sets of climate information (as presented in figure 6) helps to foster understanding and trust between science and local knowledge, builds local capacity to interpret scientific climate information and is essential for arriving at a common understanding. It also creates an environment where both sources of information are valued and both have respect for others' way of looking at things. Developing a combined forecast is a process of co-generation of information by different stakeholders and enabling better local relevance, acceptance and confidence to use the forecast.

The next step in translation is to relate climate information to the local context so that it can be communicated in a language and style that is familiar to users and relates directly to people's livelihoods and decision-making. As explained by Noor Jelle – a member of an agro-pastoral community in Garissa County, Kenya, "When we receive temperature and rainfall information in degrees and millimetres, for most of us it makes no sense as we do not really know what it means. It would be better if the information was more focused on letting the community know the options of what we could grow and when". Hence terminology such as 'normal', 'above

TABLE 2: An example of translating a seasonal forecast produced by the Kenya Meteorological Services. It presents options for pastoral communities in Garissa County, Kenya, to deal with the March to May 2013 seasonal rainfall.

BELOW NORMAL RAINFALL SCENARIO	NORMAL RAINFALL SCENARIO	ABOVE NORMAL RAINFALL SCENARIO
• Revive wet and dry season grazing patterns • Livestock off-take • Herd separation and migration • Engage in alternative livelihoods • Mass vaccination and deworming • Strengthen peace committees at local level	• Rangeland reseeding • Establish and promote pasture conservation • Breed improvement and combinations • Value addition of livestock products • Disease surveillance and communication to the relevant authority	• Develop and activate flood evacuation plans • Undertake baling of hay for conservation • Expansion and de-silting of water pans for water conservation • Activate disease reporting committees • Herd management like selective breeding

normal' and 'below normal' rainfall, as presented in a meteorological seasonal forecast, need to be clarified and related to concrete examples of what it means in terms of options. For example, options for planting choices and timing, likely harvests of different crops and varieties, expected pasture quality over the months to come and risk reduction and management strategies to be implemented (see table 2).

While forecasts presented at the beginning of a season are useful in strategic planning – like which crops to plant, the usefulness of climate information presented at least 3 months in advance is enhanced by the use of forecast updates covering a day to a month thereafter together with an analysis of climate variables recorded from the start of the season (see figure 7). These updates inform operational decisions like time for weeding or when to trigger DRR actions such as moving irrigation equipment from near riverbanks. Mid-season updates also enable users to adjust their decisions depending on how the season is progressing.

> **"If an image is worth a thousand words, a graph about a seasonal rainfall forecast is worth a thousand incomprehensible ones".**
> **From a humanitarian practitioner in Suarez, P. & Tall, A. (2010)[iii]**

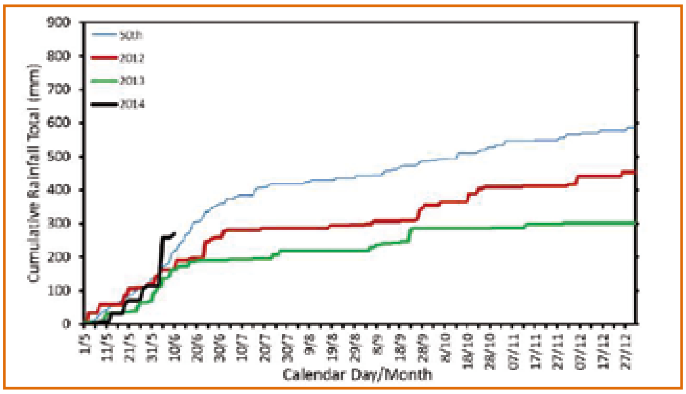


FIGURE 7: Rainwatch-AfClix Monsoon Monitoring over Ghana from 1 May to 10 June 2014, presenting cumulative Rainfall for Accra plotted against other extreme years and the 50th percentile (i.e. the value below which 50 percent of the observations may be found) over a 50 year base period (1960-2012).

A focus on collective interpretation enables meteorological services to know the different information needs of different user groups to ensure that they get the most out of climate information. For example, pastoralists, farmers, women and men in rural contexts often have different roles in crop and livestock farming, different decisions to make and access different spaces at different times of day. This leaves meteorological services with a responsibility to produce and share audience-led climate information products which meet specific information needs and uses. This collaboration slowly increases the uptake of climate information services by different users through building confidence in the use of the information.

BOX 2: TRANSLATION OF CLIMATE INFORMATION THROUGH PARTICIPATORY SCENARIO PLANNING (PSP)

PSP workshops are multi-stakeholder forums that bringing together meteorological services, local forecasting experts, community members, officers from key government ministries, researchers and local NGOs to share their weather and climate knowledge and translate it into actionable and locally relevant information. Figure 8 presents the process followed during the workshop to translate seasonal forecasts for the local context.

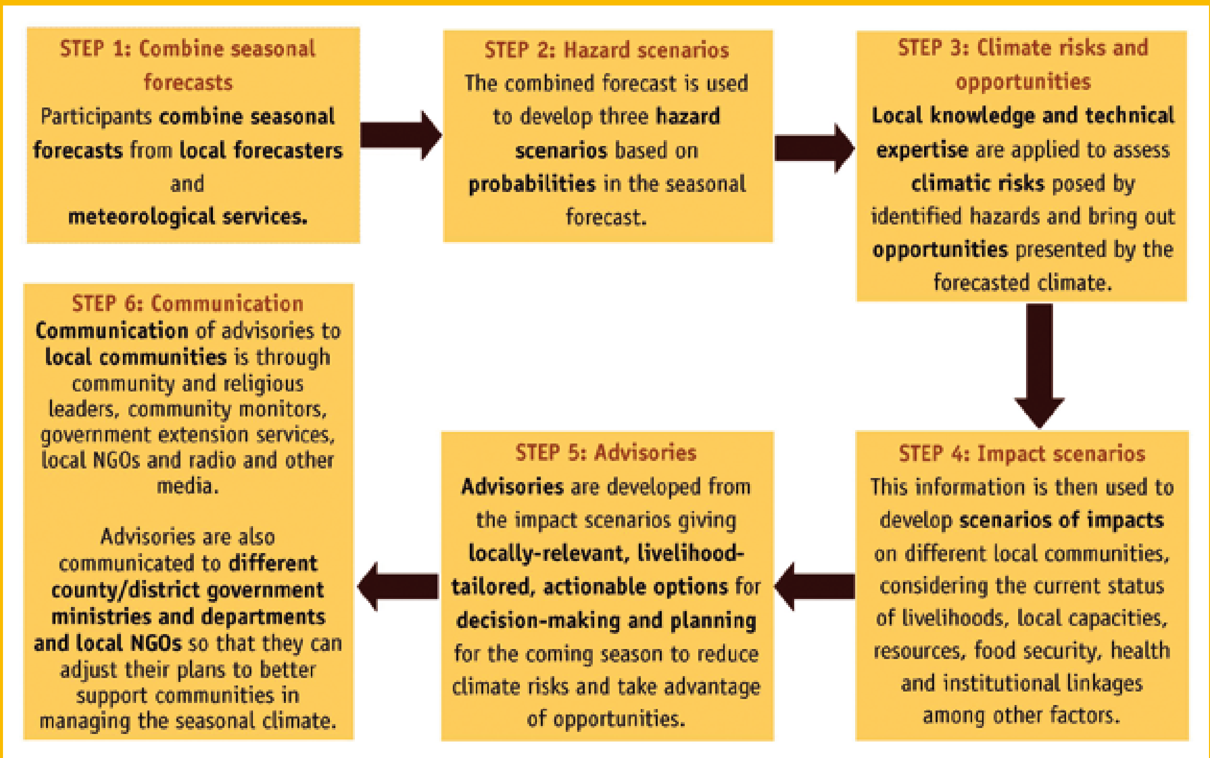


Figure 8: Steps for translating a seasonal forecast in a PSP workshop.

The multi-stakeholder forums created through PSP foster continued dialogue, linkage and mutual or 'social' learning between diverse actors. Through these forums, meteorological, government sectors and other service providers are enabled to better respond to the specific needs of different user groups. This facilitates effective climate information services and broader risk management, bringing together relevant sectorial expertise to support decision-making and planning at local, district and national levels. By creating a new platform for interaction, PSP also recognizes and accommodates users with different needs and timeframes, helping to link different timelines like the immediacy of farmer's seasonal priorities and responses with longer-term capacity to plan and respond to climate[iv].

This integrated approach allows for more coordinated, timely and targeted support to communities, avoiding duplication and contradictory efforts and thus creating a concerted environment for resilient development.

WHY IS COMMUNICATING CLIMATE INFORMATION SO IMPORTANT?

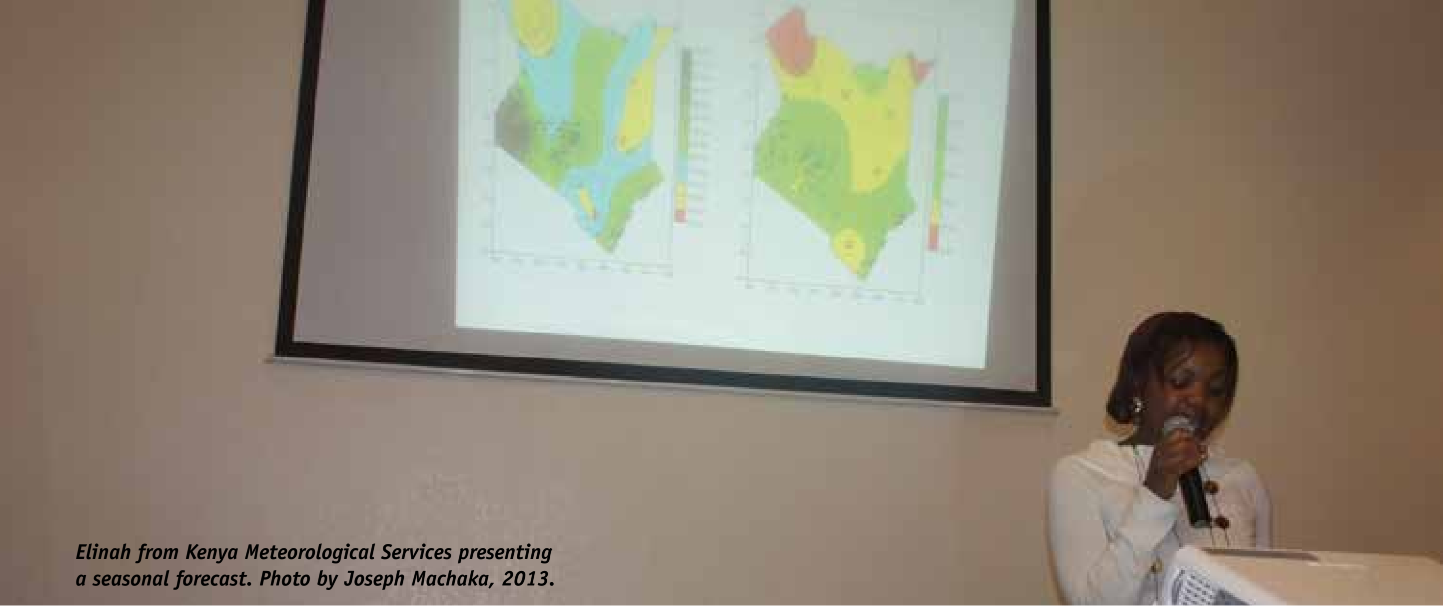
Effective communication is essential in making climate information usable in different contexts.

In order for climate information to be actionable, communication channels between producers and users need to be accessible, effective, timely and bi-directional. Access to useful climate communication helps communities, vulnerable groups and individuals to develop greater capacity for adaptive planning, avoiding predetermined solutions which may not be appropriate and continuing to build resilience against future climate variability and changes.

The language, style and channel through which communication is done are important factors that make climate information useable. Due to people's different social roles in communities, inequalities in social status and different levels of literacy, numeracy, and fluency in a given language, the ability to obtain or make use of climate information can vary significantly. Packaging of climate information tailored to specific users' capacities and needs is therefore essential to effective communication. Other than the issue of language (that is, using clear rather than technical language and use of local languages), the style and visual packaging of translated climate information also contributes to understanding, even by those who are not literate. This serves to extend the reach of climate information to a wider audience, supporting informed decision-making and planning for all stakeholders.

Social status, social networks, cultural norms and available communication resources are all factors affecting access to climate information. Before choosing or developing effective ways to communicate climate information in different contexts, it is vital to understand the communication systems that already exist at local level. Face-to-face communication in local languages is generally the preferred channel. Building on traditional communication mechanisms such as community festivals – like those in Niger that bring together pastoralists or the fire festival in northern Ghana – enables people engaged in different livelihoods to gain access to climate information. Incorporating communication into sectorial events like farmers' field days or structures like local DRR committees helps to integrate climate information into planning processes in different sectors. While effective, such face-to-face mechanisms are expensive and can be limited in their reach. Information communication technologies such as community radio and mobile phones should be fully-utilized for an even wider reach. Use of community radio allows climate information to be disseminated in local languages and facilitates engagement through, for example, programmes that allow people to call in and contribute to discussions, ask questions and share their needs. Mobile phones allow for a real time exchange of information between meteorological services and users whilst enabling rapid release of alerts as part of early warning systems. Finding and using the right communication mechanisms will determine whether those who most need the information actually access it, and whether their information needs are heard. For this to happen, who has access to what must be known and considered. For example, in rural areas, men may have better access to radio than women, while women are more reachable through local gatherings.

Women proudly presenting their community adaptation action plan in Niger. Photo by Harouna Hama, 2013.



Elinah from Kenya Meteorological Services presenting a seasonal forecast. Photo by Joseph Machaka, 2013.

BOX 3: CAPACITY BUILDING FOR EFFECTIVE CLIMATE COMMUNICATION

Interactions between meteorologists and communities during PSP workshops highlighted the need to build the capacity of Kenyan County Directors of Meteorological Services (CDMS) for more effective communication of climate information. Partnering with a communications specialist, ALP conducted training on communication in August 2013 for the 47 CDMS. The training sought to build the capacity of meteorologists for better interactions with different government sectors, civil society organizations (CSO), community groups and organizations working in different sectors such as DRR, water, peace, livelihoods, adaptation and development. These interactions will enable more effective and coordinated planning that is continuously informed and updated by climate information. To realise this, African Meteorological Services need to move beyond traditional modes of operation. The meteorologists require skills to communicate effectively with non-scientists so that users understand the intended messages. The training aimed to enhance the meteorologists' abilities to:

- Effectively prepare and present climate information. This included respecting and listening to local knowledge and information needs, basic communication skills, providing climate information based on demand, feedback and the target audience and explaining content including how to understand probabilities and uncertainties of forecasts. Discussions encouraged meteorologists to appreciate the limitations of science and participate in translating scientific information for practical action.

- Understand the roles of meteorological officers before, during and after disseminating climate information. This covered a range of topics including strengthening systems for the generation of climate information, developing relationships with local actors in all sectors and dissemination of information including use of preferred channels and feedback channels. There was a focus on sensitivity and flexibility around user needs and gathering feedback on changing information needs.

- Plan for climate communication forums such as PSP workshops in their counties in collaboration with other government ministries, communities, CSOs, media and private sector.

From the training, the CDMS gained an appreciation of the value of facilitating interaction and collaborative generation of climate information with key stakeholders, as well as the importance of dissemination and feedback. From the March to May 2014 rainfall season, Kenya Meteorological Services has worked with the Agricultural Sector Development Support Programme in the Kenyan Ministry of Agriculture, Livestock and Fisheries to conduct PSP in all counties across Kenya. This has ensured climate information's continued contribution to resilient development in agriculture and other sectors, and the different parts of the country. Such governance systems enable recognition of meteorologists as not only generating climate information but also providing necessary climate information services that are a useful input for planning across all sectors.

UNCERTAINTY: WHY DOES IT EXIST AND HOW CAN WE MANAGE IT?

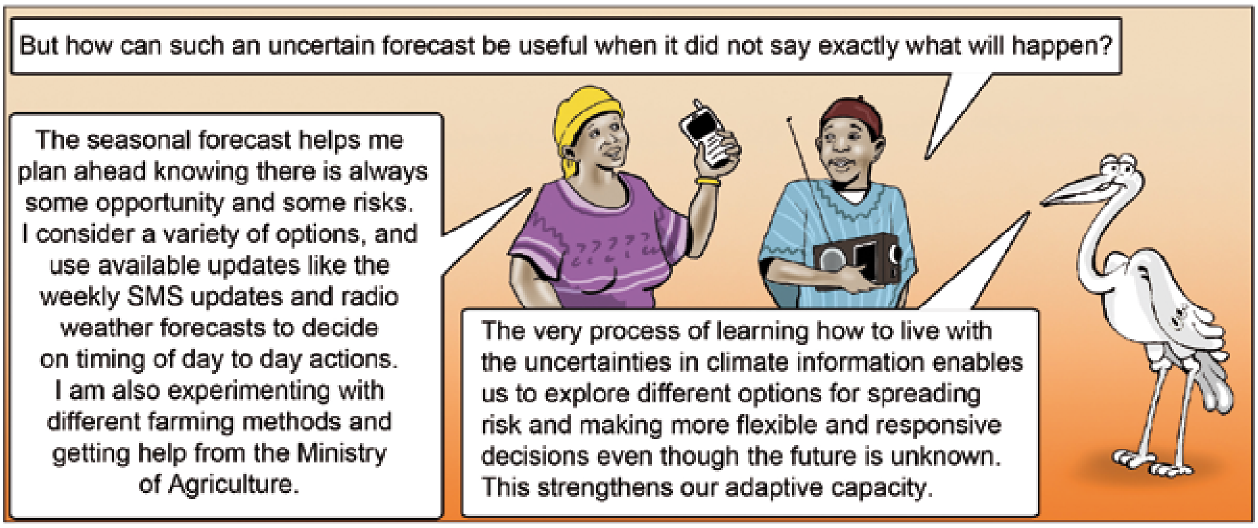
Uncertainty is not a problem to be solved; it can be understood, managed and used to inform adaptation decisions, early warning and risk management.

The evolution and behaviour of the future climate is uncertain, as observed and experienced from erratic patterns and more extreme weather and climate related events in the recent past. Besides the climate, people also face uncertainties in future economics, politics, demographics, jobs and other areas of life where risk on a daily basis is accepted. Increasing uncertainty has become the new "normal". Yet these uncertain domains all form an environment in which people must live and continually adjust so as to remain on a positive development path. Consideration, understanding and interpretation of uncertainty aids the development of proactive plans and actions to contend with a range of possibilities so that shocks do not come as surprises and risks can be anticipated, reduced, managed or turned into opportunities. Just as private entrepreneurs thrive on analysing risk and taking chances, embracing and managing uncertainty as an ongoing fact of life can become a powerful adaptation tool.

Uncertainty is equally inherent in 'future' scientific climate information simply because it is about things which are yet to happen. The climate is chaotic in nature and experiences natural variability making it difficult for the science behind climate processes to be completely understood. For development to be sustainable and resilient, any information relating to uncertain futures is more useful than no information at all. Rather than dismissing climate information as not useful because it does not say exactly what will happen, it makes more sense to get out of it as much information as is available. A picture of possible climatic futures can be developed by considering the levels of uncertainty, and used to make decisions and plans for adaptation and resilience to climate. For example, uncertainty in seasonal rainfall forecasts from meteorological services is typically presented in terms of probabilities, with a percentage likelihood of having rainfall that is below average, average and above average. Translation of a probable seasonal rainfall forecast helps us understand the way the percentages are spread, the level of certainty of the spread and what that means in practice.

In the context of high uncertainty, it is inadvisable to seek 'perfect' forecasts, and instead, current forecast capabilities should be integrated with a broad range of other knowledge. Analysis of graphs generated from past seasonal rainfall records can provide information that is useful in understanding the spread of probabilities. When a probabilistic forecast is combined with historical analyses and local knowledge, future scenarios of climatic impacts on livelihoods, development and DRR can be created, allowing a range of proactive options to be developed at different timescales. This allows the spread of risks across multiple options, and helps actors to maximise on potential opportunities.

FIGURE 9: Befriending uncertainty; taken from the 'stork story' in Joto Afrika magazine, special issue 12



BOX 4: INFORMING DECISIONS ON WHEN TO PLANT IN NORTHERN GHANA

Every year, farmers in East Mamprusi and Garu Tempane districts of Northern Ghana are faced with the decision of when to plant. During the PSP workshop for the 2013 rainfall season, GMET shared the probabilistic season forecast, also giving the expected dates for the start of the rains and possible dry spells between May and August (see table 3). Translation of the forecast involved key local stakeholders including district officers from the Ministry of Food and Agriculture (MoFA). Based on the forecast and using their technical expertise, MoFA advised farmers to decide on planting dates not only based on the start of the rains, but also considering the period in the season when rainfall would be sufficient for their seeds to germinate and crops to mature. The advice helped farmers to avoid the risk of seed loss during prolonged dry spells and increased their chances of reaping a harvest.

TABLE 3: Expected onset (start date of rains), cessation (end date of rains) and periods of dry spells for some areas in Northern Ghana, based on the 2013 seasonal forecast from GMET.

AREA	ONSET DATES FOR 2013 (+/– 5 DAYS)	DRY SPELLS (7-14 DAYS)	CESSATION DATES FOR 2013 (+/– 5 DAYS)
Bimbilla	19th April	July	21st October
Walewale	13th April	August	21st October
Yendi	16th April	May/August	23rd October
Bolgatanga	28th April	May	2nd November
Zabzungu	29th April	July/August	29th October
Tamale	8th April	May/ August	16th October

A DRY SPELL: is a period when several consecutive days received 1mm of rainfall or none. The number of consecutive dry days required to define a dry spell depends on the context. For example, in paddy cultivation, it is reasonable to consider dry spell of about 7 days while when growing coconuts the corresponding value would be about 30 days. When considering the effect of a drought, longer dry spells – of more than 40 days – would be more effective.

WHAT ROLE DOES UNCERTAINTY PLAY IN FUTURE PLANNING?

Communicating information on uncertainty encourages forward-looking, anticipatory and flexible decision-making and planning. It promotes innovation, reflection, experimentation and leveraging of needed support and systems towards development. It provides useful information for risk assessment which can help to coordinate and integrate early warning, risk reduction, safety nets, emergency response and development planning. This strengthens people's adaptive capacity and resilience to live with a variable and changing climate.

> "A resilient system is one where disturbances are used as an opportunity to transform into more desired states. The challenge is to accept uncertainty, be prepared for change and and surprise, and enhance the adaptive capacity to deal with disturbances."
> **From Folke, C., Hahn, T., Olsson, P. & Norberg, J. (2005)[v]**

Impact scenarios are a useful way of communicating uncertainty and assessing climate risk, which can be used at a seasonal (such as during PSPs) or long term timescale connecting future climate projections with potential future development, livelihood, economic or other scenarios. They provide a way to explore a range of possible hazards and disaster risks caused by climate and potential responses. Impact scenario development can draw on existing risk, vulnerability and capacity monitoring data and analysis and inform contingency planning as well as systems for early warning. With the increasing frequency of extreme events anticipatory tools such as scenarios, linked to climate information, are essential to improve DRR, early action and preparedness plans which can reduce the escalation of a climate hazard into a disaster. Alerting actors to a range of possible future risks encourages flexible planning in development, DRR and humanitarian work and supports scaling responses up or down[vi] or to shift from one action to another as appropriate.

Presenting uncertainty in terms of probability in seasonal rainfall forecasts and using it to develop scenarios enables risk management decisions. For example, based on the spread of probabilities, farmers can make better decisions on which mixture of crops to plant (e.g. early maturing and drought tolerant varieties), when to plant them and how much of each to plant to avoid total crop loss due to climate related hazards. Scenarios are also enabling pastoralists to appreciate the value of engaging in other risk management and protection strategies. This can mean rearing different types of livestock, improved or local breeds, better livestock management practices, integrating economic trees which also provide protection against violent winds and involvement in other non-farm income generating activities. This prompts livelihood diversification and environmental management as effective adaptation strategies. Furthermore, communities are becoming more driven to access and make use of information on other uncertainties such as markets and prices. As adaptation options for different impact scenarios are developed, local innovation is fostered. Farmers, pastoralists and researchers are trying out new or modified strategies, recognising that new solutions will be needed on a continuous basis as the climate and its uncertainties keep changing.

BOX 5: MANAGING UNCERTAINTY THROUGH CONTINGENCY PLANNING, EARLY WARNING AND EARLY ACTION

During the PSP workshop for the March to May 2013 rainy season in Garissa County, Kenya, the forecast showed that normal to below normal rainfall was most probable. In addition to discussing what was most probable, participating stakeholders also developed an impacts scenario and action plan for if above normal rains occurred. As the season progressed, part of the county experienced flooding similar to that caused by above normal rainfall, though the flooding was due to an overflow of River Tana as a result of heavy rainfall in counties upstream of the river. Based on actions developed for an above normal rainfall scenario, Officers from the Ministry of Agriculture monitored the River Tana and through mobile phones, alerted farmers living along the river banks of the fast rising water levels. Losses were minimized as community members used their contingency plans to quickly act on the information by removing all their assets from the river banks. Working with information on uncertainty is therefore useful in DRR with regard to preparedness, monitoring, early warning and early action.

THE VALUE OF CLIMATE INFORMATION SERVICES

Long term resilient development will depend on climate information services (CIS) that are accessible and relevant to those who need it.

Climate science is constantly evolving and improving. There is increasing understanding of how climate works with improvements in forecasting at sub-seasonal to seasonal time scales and more climate projections being produced for the long-term. More location specific climate information is being generated for places where information was previously not available. For example, the Coordinated Regional Downscaling Experiment (CORDEX)[vii] and the Climate System Analysis Group (CSAG)[viii] are developing downscaled climate change projections for different locations across Africa.

There is increasing work by different institutions to make climate information more accessible in the public domain, with new information products developed for application in different sectors. For example, Agrhymet[ix] is an institution which assists 13 countries in the Sahel and West Africa in using climate information for improved food security, increased agricultural production and improved management of natural resources. Climate centres in Africa – like the African Center of Meteorological Applications for Development (ACMAD)[x] and the IGAD Climate Prediction and Applications Centre (ICPAC)[xi] – are developing continent-wide and regional climate information products to support climate informed planning and activities across Africa. These climate centres organize Regional Climate Outlook Forums to share seasonal forecasts in the regions where they operate e.g. ICPAC for the Greater Horn of Africa. National meteorological services are seeking ways to downscale climate information and reach local communities through a range of media, for example, using radio services like RANET (Radio and Internet) which spans several countries in Africa – Chad, Kenya, Mozambique, Niger, Senegal, Zambia and Uganda – and is providing access to weather, climate, and related information in local languages. In addition, regional boundary organizations and programmes are enabling increased utility of historical climate information in decision making and early warning. For example, the Rainwatch-AfClix[xii] programme – operating in Senegal, Mali, Niger, Burkina Faso and Ghana – helps to match ground- based needs with climate informed solutions to tackle vulnerability associated with uncertainty, and demonstrate the benefits of historical climate information to in-country policymakers.

All these systems for generating, translating and communicating climate information are referred to as climate information services (CIS). There are many new opportunities for better coordination, further development of responsive products, links to user information needs and improved communication between climate science and users. PSP and Rainwatch – AfClix are examples of the potential for CIS when mainstreamed into risk reduction, development, resilience and adaptation planning. Such integrated governance structures are demonstrating alternative ways to bridge bottom-up and top-down strategies and informal-versus-formal institutions to provide short-term and long-term action on climate change in ways that are meaningful to peoples' lives.

On the other hand, changes in climate mean changes for livelihoods, vulnerabilities, capacities, technology, development, socioeconomics and policies too. As access to and understanding, translation and use of climate information improve so the information needs of different users will also continually change. Effective two-way communication will enable new climate information products to be developed which respond specifically to the changing needs. In addition, policymakers are increasingly demanding insights into 'what works' in practice. This creates the need to enhance understanding of the science-policy-user interface. Scientists must

"The most important thing about PSP is the value it has added to my work. Before this I used to do needs-based trainings with no consideration of how the climate would look like. Thanks to PSP, I am now able to use climate information to plan for community trainings and field assessments that are relevant to the probable impact scenarios. I allow for flexibility in my planning since I know that each season is different."
Joel Okal, Ladgera Sub-County Livestock Production Officer, Garissa County, Kenya

An agro-pastoralist in Garissa, Kenya, reading climate advisories. Photo by Eric Aduma, 2014.

BOX 6: MAKING CHOICES USING CLIMATE INFORMATION

During the March to May rainy season in 2012, the seasonal climate forecast showed low rainfall over Garissa County. Members of Alalaf farmers group received a translation of the seasonal forecast (advisories) and subsequently, one of the members chose to plant green grams rather than maize, the popular crop in the area. He chose green grams because they mature in two and a half months and do not need supplementary irrigation like maize, making the crop more likely to survive the forecasted season. This resulted in better yields, allowing the farmer to meet household food needs as well as generate some income from sale of the crop. The advisories also included some details on markets which guided the farmer's decision to sell his harvest at the local market instead of at his homestead as he had previously. Consequently, he was able to sell his crops at almost double the price. Translating forecasts into options for dealing with the seasonal climate enables actors to decide for themselves on appropriate actions to take. This implies a continuous learning process between farmers and service providers, which requires actors to continually access, translate and use climate information.

take on the job of enabling clear understanding of the information they are providing and relate this to real life experiences of users to demonstrate the benefit of provisioning relevant climate information services.

The use of climate information is putting more emphasis on an integrated approach to the development of climate resilient plans and actions. An integrated approach draws on all economic sectors, contexts, levels and actors, from government officials to climate scientists to communities themselves, and recognizes the contribution of the different knowledge, capacities and experiences of each. Effective climate information services can support links across sectors and across adaptation, DRR, development and humanitarian work. These links are essential for addressing the scale and magnitude of the challenge that climate change presents and for enabling resilient development.

CREATING AN ENABLING ENVIRONMENT

Enabling national and local plans, policies and investments are needed to support effective climate information services.

An enabling environment is needed for climate information services to effectively contribute to adaptation, DRR and resilient development. This means that other systems and processes, from local to national and international levels, must have more active engagement with CIS. Key processes that can make CIS a reality are national climate change adaptation policies including the National Adaptation Plans (NAPs). The NAP technical guidelines already encourage the use of climate information in assessing current and future climate risks. This feeds into assessing climate vulnerabilities and identifying adaptation options at sector, subnational and national levels (among others). Climate information is also useful in reviewing adaptation options as set out in the NAP technical guidelines, by conducting costs and benefits analyses that consider how best different adaptation options can manage climatic risks and supporting flexible budgeting and contingency planning at local to national level.

NAPs can support the establishment of effective CIS systems and strengthen the integration of climate information into national development planning. This gives CIS greater influence in contributing to adaptation and development planning processes. Policies in different sectors that support the use of climate information will further enable its integration into planning processes and implementation. Agriculture policies and plans have a particular opportunity through the new global emphasis on climate-resilient or climate-smart agriculture. Integration of climate information in policies and planning processes will facilitate budget allocation for CIS to actively and continually support climate resilience in different sectors, linked to budget allocation for implementation of the adaptation actions decided using climate and other information. Sufficient financing from adaptation finance and national development and sectorial budgets is needed for CIS to enhance its capacity (in equipment and human resources), information and systems for effective climate communication.

Lessons learned from Rainwatch – AfClix show that even in the absence of coherent national climate strategies, individuals with the appropriate tools, methodologies and connecting networks can link with institutions across scales to access a wider range of climate information and communicate climate risk and uncertainty. Such capacity can help institutions implement practical and tangible innovations to anticipate signals of impending crises and so learn to prepare for future high-impact events (Boyd et al., 2013)

Accessing and translating climate information into locally useful content is made easier when climate information services are included right from the design of projects and programmes. This can be done through climate risk assessment that will bring to light the need for and development of climate related outputs that support wider project and programme goals. Climate risk assessment needs to continue throughout the life cycle of a project or programme. This informs adjustments to outputs to ensure that investments made, interventions implemented and resultant gains remain resilient and sustainable to climate.

"The role of government in development and adaptation should be as partners and facilitators, through participatory and inclusive processes that allow for collective planning, as opposed to imposing prescriptive activities. In this regard, government investment should be based on community priorities and allow for community led and owned processes and initiatives that contribute to their adaptive capacity."
Kenneth Ruteere, County Director of Planning, Garissa County, Kenya

RECOMMENDATIONS

- **Multi-stakeholder dialogue is essential in generating useful climate information.** It enables better interaction between scientists, local forecasters, intermediaries and users for co-production of climate information that is useful for decision making and planning in different contexts. Multi-stakeholder dialogue also allows for feedback loops so that different users can share their experiences in accessing, understanding and using climate information. On the other hand, it can be a platform for science to share on new and improving scientific information as well as progress, opportunities and limitations they face in developing new climate information products. Engagement in multi-stakeholder dialogue is important for developing climate information services that are more effective and responsive to specific and changing climate information needs.
- **Climate information services must be embedded in local, national and regional processes to enable scaled-up support for widespread adaptation activities.** This will facilitate comple¬mentary actions that cut across traditional sectors and disciplines, leading to enhanced results and greater coordination across disaster risk reduction, climate-resilient livelihoods, sustainable natural resource management, humanitarian and development assistance. Integrating climate information services into planning processes ensures that planning goes beyond projects to focus on long-term issues of building adaptive capacity and strengthening resilience to climate.
- **Investment in climate monitoring networks for data collection will go a long way into improving the accuracy of weather and climate forecasts and give a clearer picture of historical climate in different places.** The availability of good quality meteorological data as well as the few and sparsely spread monitoring networks in African countries are the most problematic issues that affect accuracy of weather and climate forecasts. A collaborative effort – involving different government sector ministries, community groups, organizations and institutions and the private sector – to increase monitoring networks will help national meteorological services address this chronic problem in Africa.
- **Harnessing communication opportunities in the 21st century such as smart phones and other ICTs as well as linkages to private sector platforms such as market information systems will enable a wider, targeted and timelier reach of climate information.** These communication systems can allow on-demand access to climate information by different users, while also giving climate information producers a chance to share a wider variety of user driven products.
- **Capacity building of all stakeholders on different aspects is critical for the value of climate information to be realized.** Meteorological services, especially in Africa, need capacity building on technical aspects, packaging of climate science products and communication to a non-scientific audience. Users require capacity building to have a better understanding of information presented by climate science. Intermediaries also need capacity development so that they can better communicate and provide the necessary link between users and producers of climate information.
- **Persistence of effort and longevity of timeframe are essential for scaling-up of needed climate information services.** When developing stakeholder networks and relations, the timeframes can be significant because processes for establishing relationships, learning and generating evidence, building resilience and developing sustainability can take 5 to 20 years or longer.

Further reading

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More reference documents and further information can be found at:
http://www.careclimatechange.org/adaptation-initiatives/alp

Endnotes

[i] Access maps and data from GISS at http://data.giss.nasa.gov/gistemp/maps/

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[vii] More on CORDEX here http://start.org/cordex-africa/about/ and here http://wcrp-cordex.ipsl.jussieu.fr/

[viii] Access CSAG's Climate Information Portal here http://cip.csag.uct.ac.za/webclient2/app/

[ix] AGRHYMET is a specialized agency of the Permanent Inter-State Committee against Drought in the Sahel (CILSS). It operates in thirteen countries: Benin, Burkina Faso, Cape Verde, Chad, Ivory Coast, Gambia, Guinea, Guinea Bissau, Mali, Mauritania, Niger, Senegal and Togo. http://www.agrhymet.ne/eng/

[x] ACMAD's mission is the provision of weather and climate information and for the promotion of sustainable development of Africa (notably within the context of national strategies for poverty eradication), in the fields of agriculture, water resources, health, public safety and renewable energy. It is operational in all African countries. http://www.acmad.net/new/?q=en/pages/about-us

[xi] ICPAC's mission is to provide timely climate early warning information and support specific sector applications to enable the region cope with various risks associated with extreme climate variability and change for poverty alleviation, environment management and sustainable development of the member countries. It is operational in Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan and Uganda as well as Burundi, Rwanda and Tanzania http://www.icpac.net/index.html

[xii] The integrated Rainwatch - AfClix network is building resilience ('here and now') to help mitigate short and medium term climate shocks, providing early warning information and enabling further engagement with an on-going crisis to build adaptive capacity. To receive Rainwatch - AfClix Monitoring Bulletins, please contact ros.cornforth@afclix.org. Visit www.afclix.org

www.careclimatechange.org/adaptation-initiatives/alp

About this Brief

This document explains why and how climate information is a valuable resource for rural communities and those working with them in confronting climate variability and change. It is based on lessons from the Adaptation Learning Programme (ALP), implemented by CARE International, together with the national meteorological services in Ghana, Kenya and Niger. The document will help those working in adaptation, agriculture, sustainable development, disaster risk reduction (DRR), resilience and other climate-sensitive sectors to connect with and use meteorological services and other sources of climate information. It demonstrates how climate information can inform decision making, planning and policy development in these areas and ensure results are climate resilient.

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Front cover: Niger credit: Receiving rainfall information through mobile phones in Kouggou Niger. Photo by Marie Mornimart, 2014.
Kenya credit: Ahmed Rage from Nanighi at his flooded farm. Photo by Stanley Mutuma, 2013.

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