Integrating Local Farmers' Climate Knowledge with Probabilistic Weather Forecasting

"Regional consultation workshop on bridging climate information and communication gaps for effective adaptation decisions"

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By

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INTRODUCTION

- Local Farmers rely on climate information to anticipate the inter-annual variability in the timing and amount of precipitation, since most of them rely on rain-fed agriculture for food production.
- Scientists and local traditional farmers use different methods to forecast weather conditions and predict a likely behavior of climate in the planting season.
- Producing useful forecasts requires an understanding of the needs of specific user groups

Available sources of Climate information

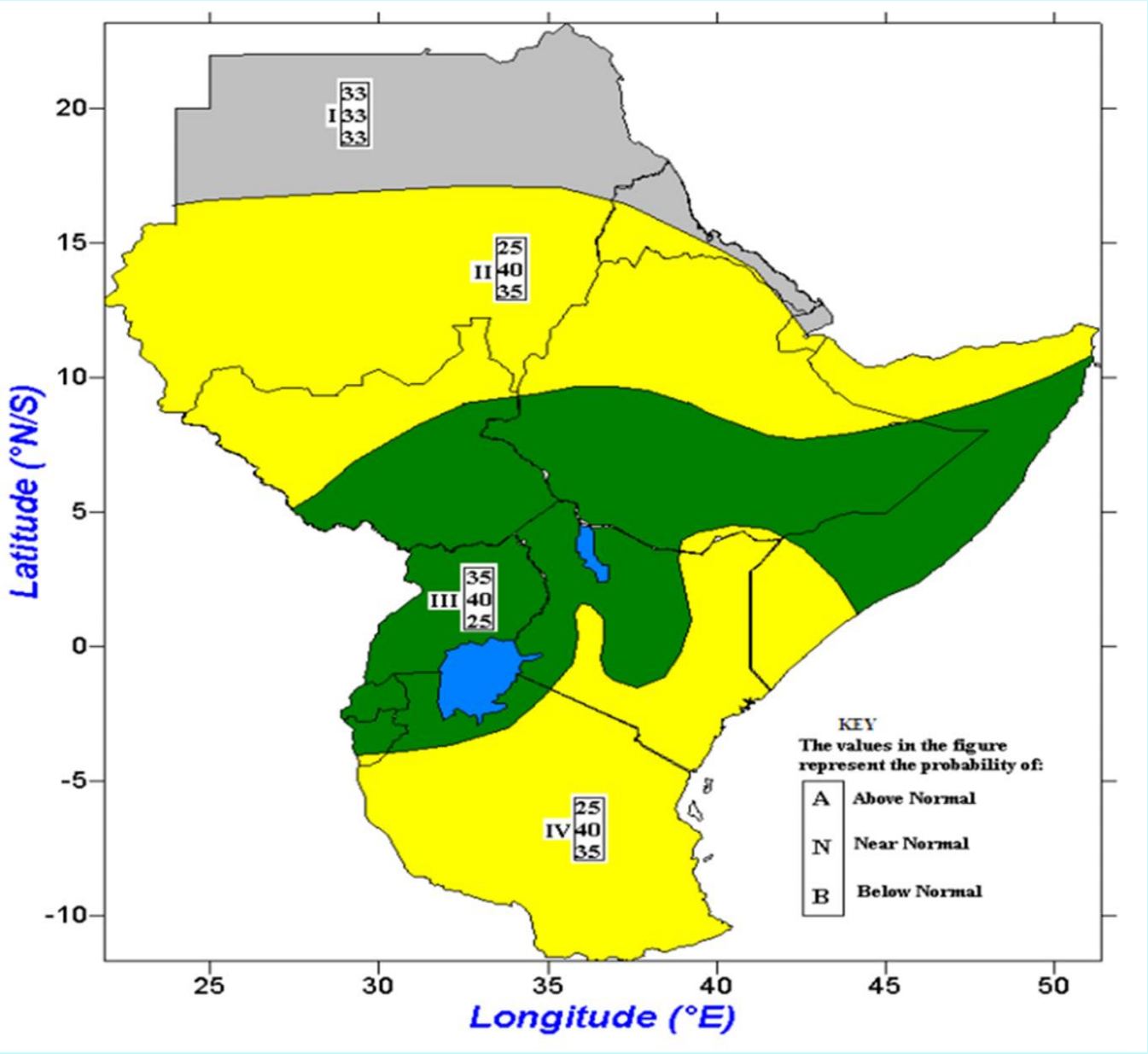
- Climate information for farmers is available from two main sources:
  - ❖ Meteorological Seasonal Climate Forecasts (SCFs)
  - ❖ Indigenous or local Knowledge-based seasonal Forecasts (IKFs).

Meteorological Seasonal Climate Forecasts

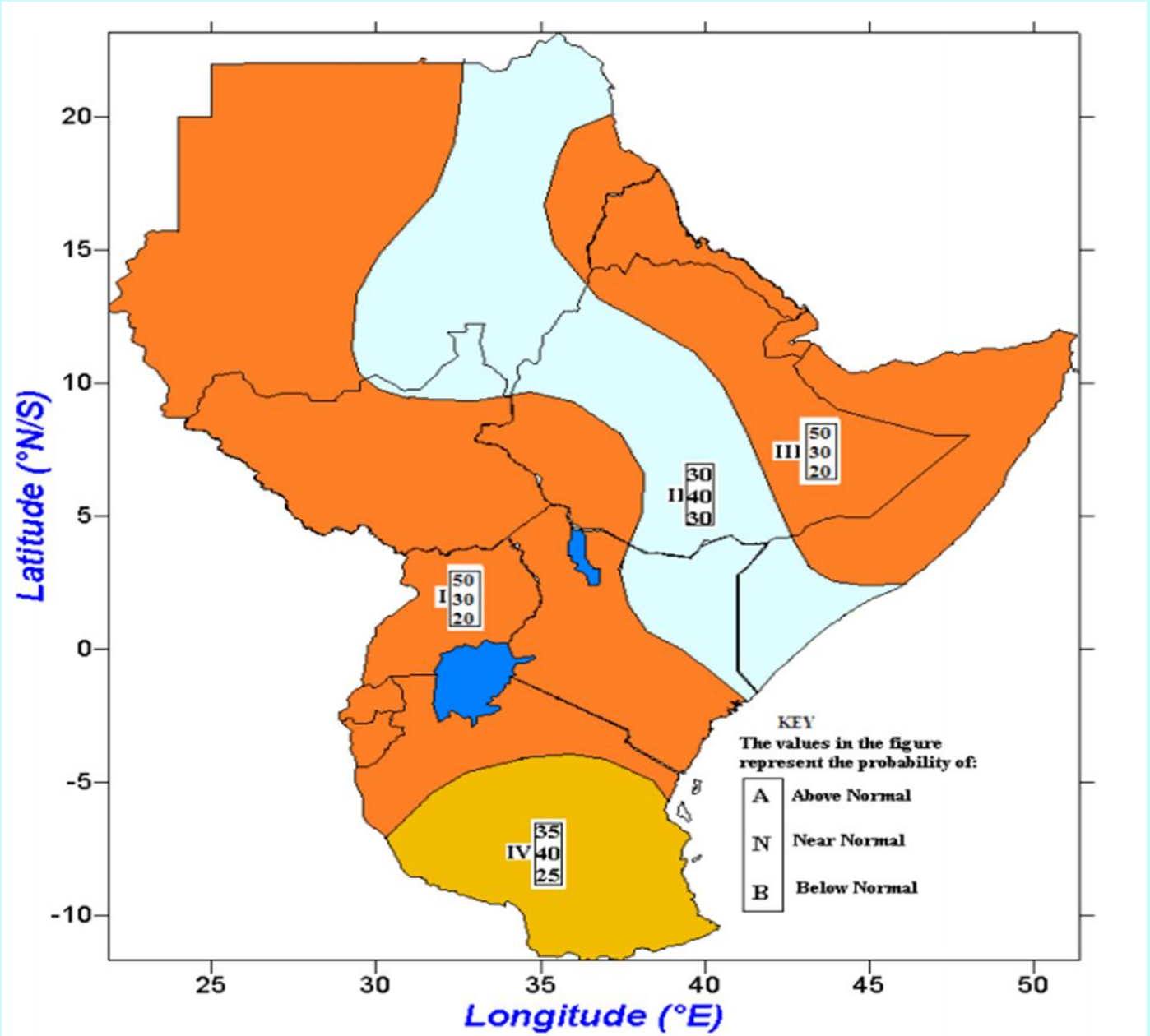
- SCFs are generated by national meteorological and hydrological services using models and empirical data and disseminated at the national level in every country.
- The procedure is usually to divide a country into regions with different probabilities of seasonal rainfall occurrence
- The information on expected rainfall is often given in probabilities, e.g., 40% chance of above normal rainfall, 30% chance of normal, and 30% chance of below-normal rainfall.
- The NHMs are specialized, scientific institutions with a mandate to generate weather and climate-related products under guidelines set by the WMO .

- Their efforts are supplemented by other regional and international climate centres including:
  - The African Centre of Meteorological Applications for Development (ACMAD)
  - The Centre Régional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationelle (AGRHYMET)
  - The IGAD Climate Prediction and Applications Centre (ICPAC),
  - The Climate Systems Analysis Group (University of Cape Town),
  - The United Kingdom Met Office (UK Met Office)
  - The National Oceanic and Atmospheric Administration (NOAA), and others.

Greater Horn of Africa Consensus Rainfall Outlook for the March to May 2016 season (Image courtesy of ICPAC)



Greater Horn of Africa Consensus Mean Temperature Outlook for March to May 2016 season (Image courtesy of ICPAC)



Indigenous or (Local) Knowledge-based seasonal Forecasts (IKFs).

- IKFs, on the other hand, are produced locally by people who live in the area for which the prediction is made.
- The term “indigenous knowledge” is well-established in literature, even though other terms, such as local, traditional, vernacular, or folk knowledge, are also used
- Here, the term is used to refer to the place-based knowledge that is rooted in local cultures and generally associated with long-settled communities which have strong ties to their natural environments.
- Such knowledge tends to be the result of cumulative experience and observation, tested in the context of everyday life, and devolved by oral communication and repetitive engagement rather than through formal instruction

- IKFs differ across communities, cultural background, and environment
- In South-Western Free State and Kwa-Zulu Natal (both in South Africa) as well as Western Kenya, inhabitants use birds, toads, and white ants to predict the summer season and onset of rains as well as temperatures
- While in the North-Eastern Brazil they use the appearance of crickets.
- In Tanzania, they look at the behavioral patterns of birds and mammals.

Farmers' Climate information needs

- Long before the initiation of modern scientific methods for weather forecasting and climate prediction, farming continued successfully, with the exception of regular disasters
- Many farmers already use indigenous forecasts in their farm-level decisions and may only need certain information, such as total rainfall expected in the season, to complement what they already have.
- Similarly, some farmers use SCFs, but the temporal and spatial scale of these is not precise enough; thus, they could benefit from the local details added by IKFs.

Farmers' Climate information needs Cont'

- Although gains have been made in bringing together users and suppliers of climate information, numerous challenges remain associated with its use.
- Among farmers, there is often confusion over terminology (e.g., "seasonal" and "weather" forecasts used interchangeably and what is meant by Above Normal, Near Normal and Below Normal rainfall).
- The most widely available information from the seasonal forecast is total seasonal rainfall.
- However, farmers are often interested in the onset, cessation, and intra-seasonal variations to support decisions about what crops to plant, when to plant, which technologies to use, and when to harvest.

Farmers' Climate information needs Cont'

- It is often hard for most users to interpret these probabilities and know how to respond to them.
- There is also concern because the forecasts cover areas that are often too large for them to have local relevance and inform users decisions
- Farmers, for example, might want to sell their livestock before an imminent drought and restock when conditions become favorable.
- Alternatively, they might move their livestock to localities where more favorable conditions are expected.
- It is therefore, important that the needs and concerns of users, in particular vulnerable groups, inform the content and dissemination of forecasts.

Comparison of IKF and SCF methods

IKFs	SCFs
Use biophysical indicators of the environment as well as spiritual methods	Use weather and climate models of measurable meteorological data
Forecast methods are seldom documented	Forecast methods are more developed and documented
Up-scaling and down-scaling are usually complex	Up-scaling and down-scaling are relatively simple
Indicators are mostly observed	Indicators are usually measurable
Application of forecast output is less developed	Application of forecast output is more developed
Communication is usually oral	Communication is usually written
Explanation is based on spiritual and social values	Explanation is theoretical
Taught by observation and experience	Taught through lectures and readings

Disadvantages of Traditional Weather/Climate Forecasts/Predictions	Disadvantages of Science-Based Weather/Climate Forecasts/Predictions
✓ **They are only momentary but it can work well when combined with scientific forecasts/predictions,**	✓ They are not easily available and accessible for use in agriculture,
✓ **They are culture-based and interpreted differently for different areas,**	✓ Their advantages are not documented in ways that farmers can understand,
✓ **They do not provide predictions on the not immediate future, some seasonal indications apart,**	✓ They are difficult to interpret and it is not easy to make decisions based on the probabilistic information given,
✓ **They cannot predict mid-season dry spells or their probabilities,**	✓ They are not point specific and there is a need for trustable downscaled weather/climate forecasts/predictions.
✓ **They do not indicate rainfall distributions but only when to prepare for the onset and sometimes something on the quality of the season to come,**	
✓ **They are not trusted by some scientific forecast/prediction producers as they incorrectly, perceive it as based on superstition.**	

Integration of IKFs and SCFs

- It is clear that IKFs and SCFs both have strengths and weaknesses. A major challenge is how to bring them together in a way that respects their different values and builds on their strengths.
- This is set against a backdrop of a changing climate, which means that indigenous knowledge indicators might not be as reliable as they were in the past.
- Increasing variability in climate has reduced farmers' confidence in traditional knowledge and has led them to seek out both seasonal and short- term weather forecasts.
- If SCFs can capture the increasingly variable climate, they may be able to provide important information that can create a framework for developing strategies for responding and adapting to climate change.

Integration of IKFs and SCFs Cont'

- Because indigenous knowledge has been used for generations and is part of many rural communities' way of life, it makes sense to explore the role of IKFs in relation to SCFs.
- It is a challenge for disseminators to package the two information types especially if SCFs are seen as external knowledge
- However, an approach that does not prioritize either type of information, but rather finds ways to use both can be of help.

Integration of IKFs and SCFs in the IK in Western Kenya project (2008)

- Twice a year, ICPAC convenes a Climate Outlook Forum for the Greater Horn of Africa which produces a consensus seasonal forecast from modern-day climate scientists.
- The forecast is subsequently downscaled for Kenya by Kenya Meteorological Department (KMD).
- ICPAC brought meteorologists and Nganyi indigenous knowledge forecasters together to produce a further downscaled consensus forecast for the project area.
- The Nganyi clan is locally renowned for its forecasting abilities. For generations, family members have handed down their skill and knowledge in interpreting local indicators, including plant and animal behavior, night sky phenomena and a host of other signs that many consider mystical rather than scientific.

- The method for arriving at a consensus began with presentation of the meteorological forecasts for the region and the consensus indigenous forecast (11 groups from within the Nganyi clan met to agree on a common forecast).
- This was followed by a facilitated discussion of the two forecasts by all.
- The points of departure were thoroughly considered and reasons for the differences explored.
- Agreement was then reached on a harmonized forecast.
- The indigenous knowledge practitioners were very useful in this process, as they are familiar with the local features that would modify the large-scale systems considered by the meteorological methods.

- Representatives of government departments (e.g., health, agriculture, education, security, water) were then invited to assume the role of change agent in communicating the risks arising from the forecast.
- The officials produced advisories for the public regarding activities in their area of responsibility in anticipation of the forecast conditions.
- The integrated forecast and advisories were then disseminated to the larger community.
- An evaluation of the season's forecast, validated by information from the community revealed surprisingly good results
  - ✓ the community concurred that the forecast was accurate.

SCF meets IKF: Meteorologists working with members of the Nganyi clan of western Kenya to develop a harmonized forecast that bridges between their systems of interpretation. (source: IDRC and DFID, CCAA project)

Comparison of IKFs, SCFs, and an integrated forecast for selected seasons and locations Kenya

Season and location	**IKF summary re-port and indicators**	**SCF report**	**Integrated report**	**Performance of integrated forecast**
SOND 2009 Nganyi community (IK in Wes-tern Kenya projects)	**Stars and bubbles in water pots in shrines suggest rains will start in the 2nd week of August. Mid-August to end of September: light rain. October to early December: increased rainfall intensity. 2nd week of December to mid-January: light rain. Rains will be acco-mpanied by heavy storms, but not as severe as those in the previous season (March–May 2009). Early rains will be polluted. The overall distribution of rains over the season will be good.**	**August to Sep-tember: low-intensity rainfall. October to Nov-ember: more intense rainfall. Rains to continue Into January 2010. Good overall distribution of rain throughout the season with no ex-tended dry spells. There will be heavy storms and high winds.**	**The Nganyi forecast provided a more Detailed version of the KMD forecast and was there-fore adopted as follows: 2nd week August: onset of the rainy season. Mid-August to end of Sep-tember: light rains. October to early December: increased rainfall intensity. 2nd week December to mid-January 2010: light rains.**	**Reported as "very good" meaning al-most all predicted events for the season came to pass.**

Comparison of IKFs, SCFs, and an integrated forecast for selected seasons and locations Tanzania				
Season and location	IKF summary report and indicators	SCF report	Integrated report	Performance of integrated forecast
MAM 2010 Same, Tanzania (Managing Risk in the GHA project site)	Frogs making a lot of noise, ants moving and spreading across roads, signifying that the Masika (rainy) sea-son is about to start. IKF indicators show that rains during the Masika season will decrease especially in May.	Seasonal rainfall will be normal. The main indicators include sea Surface temperatures of the Indian and Pacific Oceans and wind strength.	The IKFs and TMA forecasts indicate normal rains, expected to decrease as the season progresses.	Reported as "very good" meaning al-most all predicted events came to pass.

CONCLUSION

- Climate information is usually too “coarse” for crop planning, but integrating indigenous forecasts with those provided by the meteorological departments can bridge this gap.
- The integration of indigenous knowledge is very important as it is highly localized, and often comes with practical advice on measures to take in light of the forecast conditions.
- To integrate the different forecasts, detailed information about both types must be available, even though this is a challenge in many nations where the information based on indigenous knowledge is not easily available

CONCLUSION Cont'

- Climatologists are often uncertain what role indigenous knowledge might play and indigenous knowledge forecasters are suspicious of external people telling them about their environment.
- However, if understanding and trust is developed between both groups through participatory projects, opportunities for working together can be realized
- There is consensus that IKFs should be used alongside meteorological SCFs to increase reliability and acceptability of overall forecasts.

- Thank you for Listening