CRITICAL AREAS FOR IMPROVEMENT IN THE ABILITY OF SADC AGRICULTURAL SECTOR TO BENEFIT FROM SEASONAL FORECASTS

Emma Archer, University of Cape Town
Elijah Mukhala, SADC-RRSU, Harare, Zimbabwe
Sue Walker, University of the Free State, Bloemfontein, South Africa
Maxx Dilley, International Research Institute for Climate Prediction

INTRODUCTION

The SADC region faces well-documented challenges in maintaining and, indeed, improving food security in the light of multiple stresses. Climate stress, in particular, has received a great deal of attention as an external stress that can compromise the ability of the region's agricultural sector to sustain production. The USAID project 'Mitigation the Effects of Hydroclimatic Extremes in Southern Africa' has taken as one of its foci the diagnosis of problems relating to dissemination and interpretation of climate information in the SADC region. This paper discusses the application of climate information by the agricultural sector, using a targeted multi-stakeholder analysis to identify gaps and present recommendations.

In undertaking such a task, it is recognized that production is merely one component of the continuing challenge in achieving sustainable food security levels for the majority of the population in the SADC region. Several key elements of early warning (specifically, the application of climate information to improve resilience of the agricultural sector) are chosen as a focus in the hope that attention to these areas will form part of the current action to improve preparedness of the agricultural sector in a multi-scale response to the multiple stressors (SAVI, 2003).

METHOD

The SADC Regional Remote Sensing Unit (RRSU) convened an annual Agrometeorology Workshop from the 11th to the 15th November 2002 in Harare. The workshop was entitled "Application of Climate Information to Sustain Agricultural Production and Food Security in the SADC Region" and was attended by Agronomy and Agrometeorological representatives (as well as several NMHS representatives) active in the National Early Warning Units (NEWUs) of SADC member states (SADC-RRSU, 2002). As part of the workshop, stakeholders present were interviewed (and requested to prepare detailed responses) assessing the extent to which the climate information system currently served the agricultural sector in their countries. 12 SADC countries responded; namely Angola, Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

Specifically, NEWU participants were asked to answer four overarching questions:

1. *To identify the specific forecast needs for agricultural decision-making, given the specific characteristics of their agricultural sector;*

2. *To identify the extent to which such forecast needs are currently being accommodated in their country's forecast system;*
3. *To identify the specific gaps in their forecast system (as it serves the agricultural sector);*
4. *To recommend three strategies to close these gaps.*

Participants prepared in-depth responses; frequently going beyond the brief laid out (for example, many country representatives developed substantially more than three strategies in response to question 4).

Selected further targeted interviews were undertaken with the representatives, providing a comprehensive gap analysis of the climate information system as it serves agriculture; as well as *NEWU-identified priority strategies* for improvements in the system to support improved agricultural production and food security.

KEY FINDINGS

Participants identified twelve areas of key weakness in their climate information systems, with much commonality. The number of countries identifying different weaknesses is shown in Figure 1. It should be emphasized here that the gap analysis presented was driven by NEWU representatives attending the November 2002 Agrometeorological Workshop, as well as further selected stakeholder interviews and follow-up interviews. It is designed to be complementary to other gap analyses of climate information specifically for the SADC region, and the authors consulted on their findings in a highly collaborative spirit. Many of the findings of past climate information and early warning system reviews are confirmed by the NEWU representative interviews. The gaps could be grouped into two main areas - technical and communication issues.

TECHNICAL ISSUES

Intra-seasonal rainfall distribution

All SADC countries responding asked that measures of intra-seasonal rainfall distribution or 'seasonal quality' be predicted. Other studies of forecast applications and informational needs have shown this to be a climatic parameter of extreme criticality to a number of decision-makers in the agricultural sector (e.g., Usman et al 2003). The NEWU representatives requested, more specifically, an increased research effort into the feasibility of predicting the season onset, dry spell frequency, season cessation, and season length (SADC-RRSU, 2002). For example the response prepared by Mozambique NEWU representatives lists the following – distribution of rainfall during the season, cessation of rainfall season, and forecast too late for planting decisions in parts of southern Mozambique. Their specific strategy to close the gap is the development of technology to forecast rainfall distribution. More specifically, Botswana, for example, also requested:

- "Start, termination of season (temporal & spatial distribution within respective zones & forecast period - OND & JFM) ("whether rains will be on time, early or late")
- Season length ("Will it last for the whole period of the normal season or turn out to be short")

- Need for10 day & monthly updates ("in addition to forecasts for monitoring, short term planning & strategic management decisions; e.g. whether farmer should cut crop for fodder before destroyed by drought & when to sell part of stock & buy feed for the rest") (SADC-RRSU, 2002). Mauritius, Namibia and Zimbabwe requested further emphasis on the provision of monthly forecasts in addition to calling for intra-seasonal rainfall distribution research as a top priority.

+

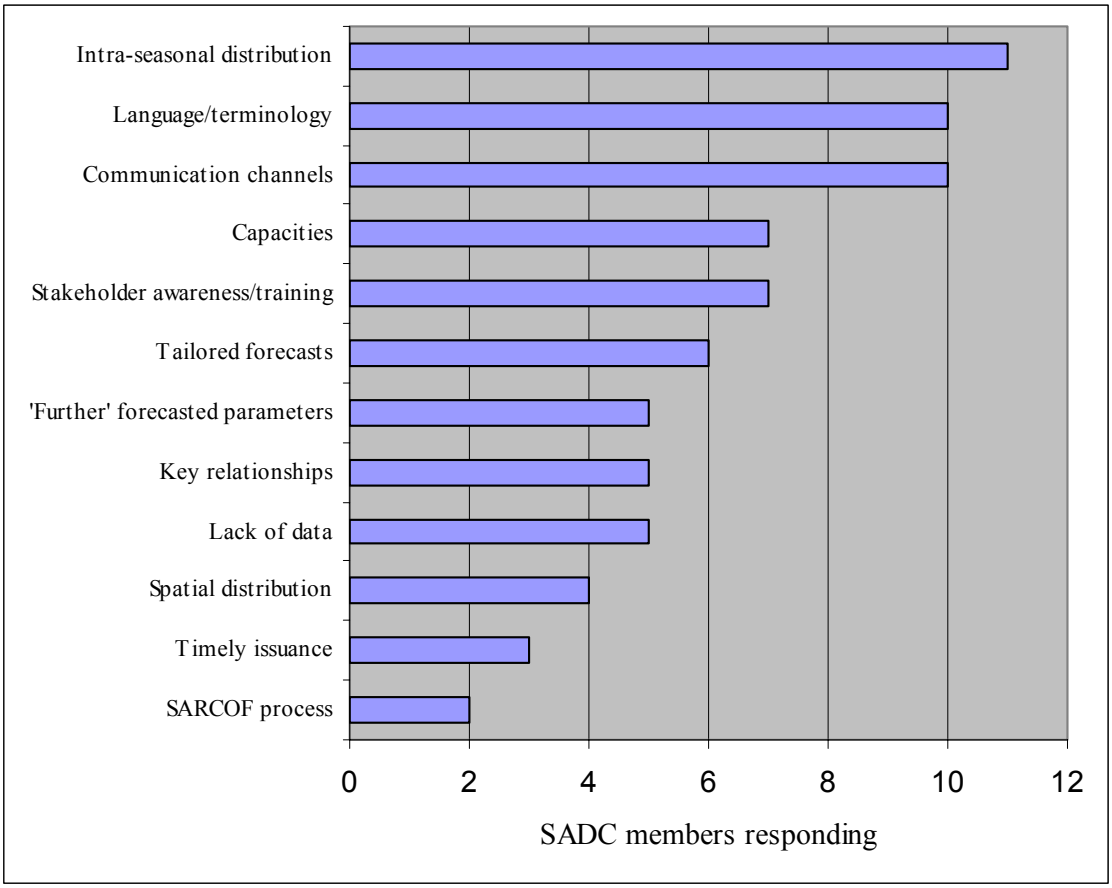

Figure 1: Identified priority weaknesses/gaps in the climate information system

Tailored climate forecasts

A range of countries called for more emphasis on tailoring climate forecasts to specific agricultural sectors and/or commodities. For example, Botswana requested the provision of tailored forecasts at the beginning of the season, together with the development of training workshops for extension officers to learn how to use the tailored forecast and further that tailored forecasts be developed for their commercial farming sector. Both Mauritius and Mozambique requested that forecasts be tailored for particular agro-ecological zones. In a further exercise, countries developed outlines for tailored forecasts of particular relevance to their countries (SADC-RRSU, 2002). The country teams responded with great enthusiasm – in one case, a country went beyond the brief and produced tailored forecast frameworks for two commodities (maize, as a staple crop, and forestry, as a significant agribusiness).

Namibia specifically requested that forecasts be tailored to agricultural commodities, providing the example of livestock. In further interviews, it is clear that the tailoring of forecasts to the livestock sector (or, the emphasis on providing early warning for livestock producers) in the SADC region has received inadequate attention and those NEWUs in countries with a significant livestock sector feel disadvantaged. In the case of Namibia, representatives observed that one factor in this gap was the lack of agrometeorological capacity in the country – at the time there was no dedicated staff member trained in Agrometeorology. This lack of technical capacity was also identified by six other countries.

Spatial distribution of rainfall

Spatial distribution of forecasts is of particular concern to several countries. The request for agro-ecologically specific forecasts is of further interest here (e.g. Lesotho, southern Mozambique, and Mauritius). The Malawi team specifically analyzed forecasts currently provided on different time-scales and critique them as follows:

- Seasonal: provides probability of rainfall amounts BUT doesn't address distribution;
- Monthly: provides probability of rainfall amounts BUT too general & probabilistic;
- Dekadal: addresses rainfall distribution BUT in general, no rainfall amounts or RH;
- Daily: addresses rainfall distribution BUT general, deficient of rainfall amount and relative humidity parameters (SADC-RRSU, 2002).

The fact that forecasts are too general (spatially and other aspects) to be of use to the agricultural sector echoes the previous findings of other assessments of the role of climate information. Lesotho's wish to be able to produce 'split' forecasts for provincial application (assuming this were feasible) echoes the sense that sub-national climate risk variations may be highly significant, yet may be masked by coarse national projections.

Other parameters

Countries also requested 'further' parameters to be forecast, such as relative humidity and temperature. Mauritius and Malawi requested further research into the feasibility of forecasting relative humidity. Mauritius, Malawi and Tanzania also requested that a rainfall amount, that is actually values not 'abstract' ones, be included in forecast output. Namibia requested that the South African Weather Service help Namibia NMHS to improve their temperature forecasting capabilities. Swaziland requested help in developing their ability to monitor soil moisture pre-season and during the curing season, and further, like Namibia, requested technical support in forecasting temperature.

Lack data

Five countries identified lack of data (with specific attention paid to observational networks) as a major concern. Angola, Botswana, Namibia, Swaziland and Zambia all described problems with their (in some cases declining) numbers of reporting meteorological stations. Zambia, for example, has drafted a proposal specifically aimed at improving their network; citing, amongst other factors, the effects of staff turnover, lack of equipment and lack of training on their reporting network. Swaziland requested increased regional collaboration to improve station network coverage.

Technical capacity

Lastly, NMHS and Agrometeorological capacity (e.g. skills, equipment) was cited as a priority concern by more than half the country respondents. Malawi, Mauritius, Namibia, South Africa, Zimbabwe, Swaziland and Zambia all described weak NMHS capacity in detail. For example, in a multi-stakeholder characterization of the South African forecast system undertaken 2002/3, research capacity at the South African Weather Service (that is, the ability to undertake scientific research to produce innovative and improved forecast products) was described as critically weak (Archer & Easterling, 2003). Namibia and South Africa further highlighted the effects of weak Agrometeorological capacity.

A range of strategies were suggested by participants to address capacity concerns. Malawi called explicitly for the building of capacity at the NMHS level, with a particular emphasis on building capacity in equipment (e.g. for short term forecasts; and interpreting existing charts into local forecasts). Malawi further observed that they possess neither the equipment (e.g. weather radar), nor the skills to address the priority issue of rainfall distribution and amount (see above). Swaziland described in detail the extent to which the capacity of their forecast producers is limited (finance, staffing, resources, computer equipment). Malawi proposed the development of a program to build capacity in equipment and skills specifically to address issues of rainfall distribution and amounts. Mauritius emphasized the need to support NMHS capacity to improve forecast accuracy to establish user confidence and trust in the forecast producer. Namibia proposed employing a dedicated Agrometeorologist. South Africa proposed increasing funding for research investigating modes of climate variability beyond ENSO (for example, increase support for work investigating the role of Indian Ocean SSTs).

One gap identified by all countries is the notion of who has responsibility for the forecast amongst all the actors involved in the climate information system. A range of questions were discussed. Is it the responsibility of the NMHS? Or of other Agrometeorology actors in the country? Is it the responsibility of the extension service? What tasks in the climate information system should be the responsibility of which actors? A number of responses were received, including the suggestion that Agrometeorology be tasked with primary responsibilities in forecast dissemination and interpretation, and that it should be teamed with agronomy to translate the forecast for relevant farming systems. Confusion as to roles and responsibilities in the climate information system (even to the point of identifying such roles) was evident and wide-ranging.

COMMUNICATION

Communication channels

Several areas of the weaknesses related to aspects of communication – namely communication channels, stakeholder awareness, key relationships and language and terminology used in forecasts. Ten out of eleven countries highlighted communication as a key weakness in the ability of the climate information system to serve the agricultural sector. This is a weakness that has been well documented in the forecast applications literature (e.g. IRI 2000, 2001), yet remains of critical importance. Zambia, for example, identified key weaknesses in dissemination of climate information to outlying farming

areas. Namibia observed specifically that the communication strategies of their climate information system do not serve the communal farming sector well. Lesotho identified a poor informational flow from their met service through extension to the farmers (e.g. Ziervogel, 2003). The Swaziland team were uncomfortable with too much reliance on radio as a tool of dissemination, and felt that such a 'one-way' device for communication was inadequate for agriculture applications (for example, farmers are not able to ask further questions regarding the information provided). Mauritius observed very dramatic communication and dissemination shortfalls, including restriction on forecast provision. Botswana felt that the current method of dissemination through press release at the season start and Agromet monthly bulletins was inadequate.

Countries presented a number of strategies to improve these types of communication and dissemination weaknesses. For example, Botswana called for increased use of extension staff as tools for communication and dissemination. Zimbabwe prioritized the further development of local radio networks, and the need to improve relations with the print media. Mauritius called for more intensive use of the Mauritian media such that climate information could reach the entire population, while Namibia focused on ways to improve outreach to the communal farming sector. Finally, South Africa described a number of strategies for user outreach, including a focus on their developing agriculture sector.

Several countries (Lesotho, Mozambique and Swaziland) found that timely issuance remains a key weakness in climate information systems. The Mozambique team, for example, observed that at present the forecast is provided too late for planting decisions in parts of southern Mozambique. Zambia states that at present "the meteorological department does not timely get enough information from most of the areas so as to be processed and passed on the National Early Warning Unit (NEWU)".

Key linkages

Countries found that weaknesses in relationships between key partners in climate information systems and NMHSs have critical implications for system effectiveness. Of particular concern to many countries is the weakness of links between NMHSs and the extension service. Malawi, for example, spoke of the importance (and lack) of trust between forecast producer and forecast intermediary. Zambia reiterated the importance of trust in such relationships and suggests that over-complex language used by the met service may be implicated. Namibia identified critical weaknesses in relationships between NMHS and those staff with Agrometeorological responsibilities, *as well as* between NMHS and the agricultural extension service.

As response strategies, Namibia suggested the organization of an annual workshop to train extension officers for commercial farmers union, and to communal farmers. Namibia also called for agronomic and agrometeorological staff to be more proactive in approaching the NMHS. Botswana called for the co-training of extension and NMHS personal – perhaps using rural training centers to address the specific need to include the extension service in the Botswana climate information system (observing that the extension personnel on-the-ground presence far exceeds that of Agromet). Malawi called for the creation of an NMHS-extension service forum to encourage close collaboration.

Language / terminology
Challenges of language and terminology were specifically highlighted by ten of the responding country teams. A range of responding countries called for translation of forecast terms into language understandable to the agricultural user. Zambia, for example, specifically states that the language is too technical.

User / stakeholder awareness / training
A range of countries also consider user/stakeholder training and awareness a critical weakness. A large number of strategies to improve user and stakeholder awareness of climate information and its potential applications were suggested by the representatives. For example, Botswana (also in response to the communication and relationship issues referred to above) highlighted the need for extensions training (using, for example, rural training centers) to include the use of tailored forecasts. Lesotho called for conscientization of farmers regarding the importance of climate information and its distribution. Malawi listed a number of strategies to improve end-user awareness, including the training of extensionists to interpret data and help dissemination, sensitization meetings for policy-makers, inclusion of meteorology in secondary school syllabi and packaging of climate information in a form usable by layman. Reiterating that the current forecast form and dissemination was only really user friendly for commercial farmers, Namibia recommended running an awareness campaign to increase the demand for the forecast in communal areas, as well as an annual workshop to train extensionists. South Africa proposed extending the extensionist training of the National Department of Agriculture's Agricultural Risk Management Directorate, as well as interpretation of the South African Weather Service's training manual specifically for the agricultural sector. Swaziland expressed the need for a comprehensive user education program, while Tanzania called more generally for capacity building and awareness programmes amongst communities.

A WAY FORWARD FOR AGRICULTURAL SEASONAL FORECASTS IN SADC ?

A number of weaknesses and gaps in the ability of the climate information system to serve the agriculture sector have been presented here. The study, as described above, has comprised a very specific and targeted look at a range of issues, led by analysis undertaken with Agrometeorology representatives of 12 SADC country NEWUs.

Sadly, weaknesses and gaps identified by earlier and concurrent diagnoses of forecast, early warning and/or climate information systems persist (and in some cases, are becoming more critical). For example, findings reiterate and emphasize the findings of the RCOF review (IRI, 2000) , where identified weaknesses and gaps persist. Clear follow-up review needed and is underway.

Our study confirms such observations and provides further detail as to where such weaknesses are particularly critical. In addition, NEWU Agrometeorological representatives were provided with the opportunity to design specific strategies – specific to each country – to address the climate informational needs of the agricultural

sector and inform the demand by Mano et al. (2003): "Regional and National Early Warning Systems need to review the nature and utility of the information and analysis they provide to guide critical decision-making in an emergency situation. The REWU should initiate efforts to refocus and build capacity amongst the NEWUs to provide a greater range of food security information and analysis." (pg 21).

In closing, our brief here addresses more effective use of climate information to improve resilience of the SADC region agricultural sector to climate stress. Such an emphasis is, as stated earlier, merely ONE component of the challenge to improve food security in the SADC region. It will receive ongoing attention to enable the country REWU representatives and Agrometeorologists develop viable options together. Such that this effort can integrate well with a broader and more comprehensive assessment of recurrent 'complex crises' in the SADC region, on the road to developing solutions together.

ACKNOWLEDGEMENTS
Thanks are due to USAID, for providing support for the project through which these investigations were undertaken. Thanks also to the WMO and the International Research Institute for Climate Prediction for institutional support. Lastly, we would like to thank the SADC Regional Remote Sensing Unit and SADC Drought Monitoring Centre for multi-faceted support and for remaining central to operations described here.

REFERENCES

Archer, E. & Easterling, W.E., 2003. Mitigating Climate Stress: strengthening the 'end-to-end' climate information system in South Africa. Draft paper to be submitted to Environment.

IRI, 2000. Coping with the Climate: A Way Forward. Summary and proposals for action from a multi-stakeholder review of Regional Climate Outlook Forums. International Workshop, 16-20 October, 2000. Pretoria. 28pp.

IRI, 2001. Communication of Climate Forecast Information Workshop. 6-8 June 2001, Palisades, NY. 74pp.

Mano, R., Isaacson, B. & Dardel, P. 2003. Identifying Policy Determinants of Food Security Response and Recovery in the SADC Region: The Case of the 2002 Food Emergency. FANRPAN Policy Paper, 26th April 2003.

SADC-RRSU, 2002. Procedings of "Application of Climate Information to Sustain Agricultural Production and Food Security in the SADC Region", SADC-RRSU, Harare, 11-15 Nov. 2002.

SAVI, 2003. Southern African Vulnerability Initiative.

Ziervogel , G. & T.E. Downing 2003. Stakeholder networks: Improving seasonal forecasts. Climatic Change (accepted).